CONTROLLER FOR A MOTOR VEHICLE AND METHOD

TECHNICAL FIELD

The present disclosure relates to a controller for a motor vehicle and method, and particularly, but not exclusively, to a controller for a mirror system and method. Aspects of the invention relate to a controller, a system, a vehicle and a method.

BACKGROUND

Externally mounted motor vehicle rear view sidemirrors, typically mounted to left and right sides of a vehicle, are a legal requirement in many territories. For historical reasons such mirrors are often loosely referred to as wing mirrors even though they are more commonly door mounted in modern vehicles. The mirrors provide a driver with valuable rear view information, enabling a driver to view vehicles in their 'blind spot', permitting safer manoeuvres for example when changing lanes, turning and when reversing. However it is recognised that the presence of sidemirrors causes a not insignificant increase in aerodynamic drag. The mirrors are also vulnerable to damage due to collision with objects when manoeuvring in confined spaces or passing oncoming traffic on narrow roads.

One proposal for overcoming the problems associated with rear view sidemirrors is electronic mirror replacement technology. Such solutions typically involve the mounting of relatively low profile camera devices to the left and right doors of the vehicle, in a similar location to that of current sidemirrors. The camera devices provide a feed to corresponding left and right monitors mounted to left and right sides of a dashboard of the vehicle.

The present applicant has recognised that one problem associated with mirror replacement technology is that a driver is unable to adjust the rearward area presented on the video screen by moving their head, as in the case of conventional mirrors. The driver may therefore be unable to see a rearward area of interest, reducing the information available to the driver to inform a manoeuvre.

It is an aim of the present invention to address disadvantages associated with the prior art.

SUMMARY OF THE INVENTION

Aspects and embodiments of the present invention provide a controller, a vehicle and a method. Embodiments of the invention may be understood with reference to the appended claims.

In one aspect of the invention for which protection is sought there is provided a controller for a motor vehicle rear view camera system comprising means for receiving video information corresponding to a left rearward view and a right rearward view and means for displaying a video image corresponding to the left rearward view on a left video screen visible to a driver and a video image corresponding to the right rearward view on a right video screen visible to the driver. The left and right video screens may comprise respective portions or regions of a single video screen. The controller comprises determining means for determining whether at least one of a set of one or more predetermined conditions is met. The means for displaying the video image is configured to display on the respective video screens video images corresponding to the left and right rearward views having respective first left and first right horizontal angular ranges or respective second left and second right horizontal angular ranges in dependence on whether one or more of the predetermined conditions is met, the second left angular range being greater than the first left angular range and the second right angular range being greater than the first right angular range. The set of one or more predetermined conditions includes ~~one or more of any one or more of the following conditions:~~ (i) a condition that a left turn indicator or a right turn indicator of the vehicle has been activated; ~~(ii) a condition that the vehicle is in a predetermined one or more locations;~~ (iiii) a condition that the vehicle is in a towing condition; (~~iv~~iii) a condition that a lane departure alert has been received by the controller from a lane departure detection system.

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Embodiments of the present invention have the advantage that the horizontal angular range of the images displayed to the driver may be automatically changed in dependence on a predetermined condition being met, such as the occurrence of a predetermined event. Accordingly, a driver may be automatically provided with an image having a horizontal field of view appropriate to a given situation.

It is to be understood that the first left and first right horizontal angular ranges may be substantially the same in some embodiments. Similarly, in some embodiments the second left and second right horizontal angular ranges may be substantially the same.

The means for receiving video information corresponding to a left rearward view and a right rearward view may comprise one or more signal lines arranged to receive the video information.

The means for displaying a video image corresponding to the left rearward view on a left video screen visible to a driver and a video image corresponding to the right rearward view on a right video screen visible to the driver may comprise one or more signal lines arranged to output

video information to respective left and right video screens.

The determining means for determining whether at least one of a set of one or more predetermined conditions is met may comprise a processor for executing computer program code stored in a memory of the controller or other storage device.

Optionally, the means for receiving video information corresponding to a left rearward view and a right rearward view comprises means for receiving a video signal from each of respective left and right video camera devices.

~~Optionally, the~~The controller is configured to display one or both of the video images corresponding to the left and right rearward views having the second left and second right horizontal angular ranges when it is determined that at least one of the set of one or more conditions is met.

The controller may be configured to assume a first configuration in which the controller causes the left and right video screens to display, respectively, the video images corresponding to the left and right rearward views having the respective first left and first right horizontal angular ranges when it is determined that none of the set of one or more conditions is met.

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Optionally, the set of one or more conditions comprises a plurality of the said conditions, the controller being configured to assume a second configuration in which the controller causes the left video screen to display the video image corresponding to the left rearward view having the second left horizontal angular range and the right video screen to display the video image corresponding to the right rearward view having the first right horizontal angular range in dependence on whether a first predetermined one or more of the plurality of conditions is met.

Further optionally, the controller is configured to assume a third configuration in which the controller causes the left video display screen to display the video image corresponding to the left rearward view having the first left horizontal angular range and the right video screen to display the video image corresponding to the right rearward view having the second right horizontal angular range in dependence on whether a second predetermined one or more of the plurality of conditions is met, each of the second predetermined one or more conditions being different from each of the first predetermined one or more conditions.

In one embodiment, the angular range of the horizontal field of view of the images displayed on the left and right video screens may be dependent on whether the left turn indicator or the

right turn indicator has been activated. If the left turn indicator is activated, the field of view of the left screen may be set to the second left horizontal angular range and the field of view of the right screen set to the first right horizontal angular range (the second configuration of the controller). If the right turn indicator is activated, the field of view of the left screen may be set to the first left horizontal angular range and the field of view of the right screen set to the second right horizontal angular range (the third configuration of the controller).

Alternatively the controller may be configured to assume a fourth configuration in which the controller causes the left video display screen to display the video image corresponding to the left rearward view having the second left horizontal angular range and the right video screen to display the video image corresponding to the right rearward view having the second right horizontal angular range if it is determined that at least one of the set of one or more conditions is met.

Optionally, one of the said conditions is that a left or right turn indicator of the vehicle has been activated, the controller being configured to assume the fourth configuration if the left or right turn indicator is activated.

Alternatively, one of the said conditions is that a left turn indicator of the vehicle has been activated, the controller being configured to assume the second configuration if the left turn indicator has been activated. Further optionally, one of the said conditions is that a right turn indicator of the vehicle has been activated, the controller being configured to assume the third configuration if the right turn indicator has been activated.

Thus, in some embodiments, the angular range of the horizontal field of view of the images displayed on the left and right video screens may be dependent on whether the left turn indicator or the right turn indicator has been activated. If the left turn indicator is activated, the field of view of the left screen is set to the second left horizontal angular range and the field of view of the right screen is set to the first right horizontal angular range. If the right turn indicator is activated, the field of view of the left screen is set to the first left horizontal angular range and the field of view of the right screen is set to the second right horizontal angular range.

The controller may be configured to receive a turn indicator signal indicative of whether the left of right turn indicator of the vehicle has been activated by the driver, the controller being configured to determine that the left or right turn indicator of the vehicle has been activated by a driver in dependence on the turn indicator signal.

It is to be understood that the turn indicator of the vehicle may be activated by means of a conventional stalk-type switch device mounted to a steering column of the vehicle. Alternatively or in addition the turn indicator may be activated by means of a voice recognition system. Other arrangements may be useful in some embodiments.

Optionally, one of the said conditions includes the condition that the vehicle is in a predetermined one or more locations.

The predetermined one or more locations may include one or more predetermined traffic junctions.

The controller may be configured to assume the fourth configuration if it is determined that the vehicle is at one of a predetermined one or more traffic junctions.

Thus if the controller determines that the vehicle is at one of the predetermined one or more traffic junctions the controller may cause both the left and right video display screens to display images having the second left and second right angular ranges, respectively.

The predetermined one or more locations may include one or more entry slip roads to a highway.

The controller may be configured to assume the fourth configuration if it is determined that the vehicle is at one of a predetermined one or more entry slip roads to a highway.

The controller may be configured to assume the second configuration if it is determined the vehicle is on a right hand slip road joining a highway to the left of the vehicle.

The controller may be configured to assume the third configuration if it is determined the vehicle is on a left hand slip road joining a highway to the right of the vehicle.

The controller may be configured to receive a location signal indicative of a current geographical location of the vehicle, the controller being configured to determine whether the current geographical location corresponds to the one or more predetermined locations.

The location signal may be received from a global satellite positioning (GPS) system or a global packet radio service (GPRS) system.

Optionally, one of the said predetermined conditions is that the vehicle is in a towing condition.

The controller may be configured to determine that a vehicle is in a towing condition in dependence on at least one selected from amongst whether an electrical connection has been made between the vehicle and the trailer and the status of a driver operated towing selector.

The electrical connection may be between a known vehicle trailer lighting connector and a trailer lighting cable. The driver operated towing selector may comprise a dial or other input means such as a rockerswitch, softkey, touchscreen, voice recognition system or other means by which the driver may provide an indication that the vehicle is towing.

The controller may be configured to receive a signal indicative that a lane departure alert has been issued by a lane departure detection system, wherein one of the said conditions includes the condition (viii) that the controller has received a signal indicating that a lane departure alert has been issued.

In one aspect of the invention for which protection is sought there is provided a controller according to a preceding aspect in combination with a lane departure detection system.

In addition or instead, the controller may be provided in combination with left and right video camera devices and/or left and right video screens.

In another aspect of the invention for which protection is sought there is provided a vehicle comprising a body, a plurality of wheels, a powertrain to drive said wheels, a braking system to brake said wheels, and a controller according to a preceding aspect.

In a further aspect of the invention for which protection is sought there is provided a motor vehicle rear view camera system comprising:

means for receiving video information corresponding to a left rearward view and a right rearward view;

means for displaying a video image corresponding to the left rearward view on a left video screen visible to a driver and a video image corresponding to the right rearward view on a right video screen visible to the driver,

determining means for determining whether at least one of a set of one or more predetermined conditions is met,

wherein the means for displaying the video image is configured to display a video image corresponding to the left and right rearward views having respective first left and first

right horizontal angular ranges or respective second left and second right horizontal angular ranges,

the means for displaying the video image being further configured to display a video image corresponding to at least one of the left and right rearward views having the second left and second right horizontal angular ranges, respectively, in dependence on whether one or more of the predetermined conditions is met, the second left angular range being greater than the first left angular range and the second right angular range being greater than the first right angular range,

wherein the set of one or more predetermined conditions includes ~~one or more of any one or more of the following conditions~~:

(i) a condition that a left turn indicator or a right turn indicator of the vehicle has been activated;

~~(ii) a condition that the vehicle is in a predetermined one or more locations;~~

(iii) a condition that the vehicle is in a towing condition;

(iv) a condition that a lane departure alert has been received by the controller from a lane departure detection system.

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In another aspect of the invention for which protection is sought there is provided a method of controlling a motor vehicle rear view camera system implemented by means of a controller, comprising:

receiving video information corresponding to a left rearward view and a right rearward view;

displaying a video image corresponding to the left rearward view on a left video screen visible to a driver and a video image corresponding to the right rearward view on a right video screen visible to the driver,

determining whether at least one of a set of one or more predetermined conditions is met,

the method comprising displaying on the respective video screens video images corresponding to the left and right rearward views having respective first left and first right horizontal angular ranges or respective second left and second right horizontal angular ranges in dependence on whether one or more of the predetermined conditions is met, the second left angular range being greater than the first left angular range and the second right angular range being greater than the first right angular range,

wherein the set of one or more predetermined conditions includes ~~one or more of any one or more of the following conditions~~:

(i) a condition that a left turn indicator or a right turn indicator of the vehicle has been activated;

~~(ii) a condition that the vehicle is in a predetermined one or more locations;~~

(iiii) a condition that the vehicle is in a towing condition;

(iviii) a condition that a lane departure alert has been received by the controller from a lane departure detection system.

The method ~~may~~ comprises displaying one or both of the video images corresponding to the left and right rearward views having the second left and second right horizontal angular ranges when it is determined that at least one of the set of one or more conditions is met.

The method may comprise causing the controller to assume a first configuration in which the controller causes the left and right video screens to display, respectively, the video images corresponding to the left and right rearward views having the respective first left and first right horizontal angular ranges when it is determined that none of the set of one or more conditions is met.

Optionally, the set of one or more conditions comprises a plurality of the said conditions, the method comprising causing the controller to assume a second configuration in which the controller causes the left video screen to display the video image corresponding to the left rearward view having the second left horizontal angular range and the right video screen to display the video image corresponding to the right rearward view having the first right horizontal angular range in dependence on whether a first predetermined one or more of the plurality of conditions is met.

The method may comprise causing the controller to assume a third configuration in which the controller causes the left video display screen to display the video image corresponding to the left rearward view having the first left horizontal angular range and the right video screen to display the video image corresponding to the right rearward view having the second right horizontal angular range in dependence on whether a second predetermined one or more of the plurality of conditions is met, each of the second predetermined one or more conditions being different from each of the first predetermined one or more conditions.

Optionally, the method comprises causing the controller to assume a fourth configuration in which the controller causes the left video display screen to display the video image corresponding to the left rearward view having the second left horizontal angular range and the right video screen to display the video image corresponding to the right rearward view having the second right horizontal angular range if it is determined that at least one of the set of one or more conditions is met.

Optionally, one of the said conditions is that a left or right turn indicator of the vehicle has been activated, the method comprising causing the controller to assume the fourth configuration if the left or right turn indicator is activated.

Alternatively, one of the said conditions is that a left turn indicator of the vehicle has been activated, the method comprising causing the controller to assume the second configuration if the left turn indicator has been activated. Optionally, one of the said conditions is that a right turn indicator of the vehicle has been activated, the method comprising causing the controller to assume the third configuration if the right turn indicator has been activated

In another aspect of the invention for which protection is sought there is provided a carrier medium carrying computer readable code for controlling a vehicle to carry out the method of a preceding aspect.

In another aspect of the invention for which protection is sought there is provided a computer program product executable on a processor so as to implement the method of a preceding aspect.

In another aspect of the invention for which protection is sought there is provided a computer readable medium loaded with the computer program product of a preceding aspect.

In another aspect of the invention for which protection is sought there is provided a processor arranged to implement the method of a preceding aspect, or the computer program product of a preceding aspect.

It is to be understood that the controller or controllers described herein may comprise a control unit or computational device having one or more electronic processors. The system may comprise a single control unit or electronic controller or alternatively different functions of the controller may be embodied in, or hosted in, different control units or controllers. As used herein the term “control unit” will be understood to include both a single control unit or controller and a plurality of control units or controllers collectively operating to provide the stated control functionality. A set of instructions could be provided which, when executed, cause said computational device to implement the control techniques described herein. The set of instructions could be embedded in said one or more electronic processors. Alternatively, the set of instructions could be provided as software to be executed on said computational device. The controller may be implemented in software run on one or more processors. One or more

other controllers may be implemented in software run on one or more processors, optionally the same one or more processors as the controller. Other arrangements are also useful.

Within the scope of this application it is expressly intended that the various aspects, embodiments, examples and alternatives set out in the preceding paragraphs, in the claims and/or in the following description and drawings, and in particular the individual features thereof, may be taken independently or in any combination. That is, all embodiments and/or features of any embodiment can be combined in any way and/or combination, unless such features are incompatible. It is however to be understood that within the terms of the foregoing the scope of the present invention is as defined by the appended claims. The applicant reserves the right to change any originally filed claim or file any new claim accordingly, including the right to amend any originally filed claim to depend from and/or incorporate any feature of any other claim although not originally claimed in that manner.

BRIEF DESCRIPTION OF THE DRAWINGS

One or more embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

FIGURE 1 is a schematic illustration of a vehicle according to an embodiment of the present invention;

FIGURE 2 is a schematic illustration of the controller of the vehicle of FIG. 1;

FIGURE 3 is a schematic illustration of (a) a field of view of a left rearward facing camera device and (b) a field of view of a right rearward facing camera device;

FIGURE 4 is a flow diagram illustrating a method of controlling a vehicle according to an embodiment of the present invention; and

FIGURE 5 is a schematic illustration of a controller according to a further embodiment of the present invention.

DETAILED DESCRIPTION

FIG. 1 shows a vehicle 100 according to an embodiment of the present invention. The vehicle 100 has an internal combustion engine 110 operable to provide motive torque to a transmission 108. The vehicle 100 has a driveline 109 by means of which the transmission 108 may be coupled to a pair of rear wheels 103, 104 of the vehicle 100 by means of a rear

prop shaft 109RP and rear drive unit 109RDU. The transmission 108 is releasably connectable to a pair of front wheels 101, 102 by means of a power transfer unit (PTU) 109PTU under the control of a driveline controller 109C. The PTU 109PTU has a power transfer clutch (not shown), front prop shaft 109FP and front differential gear box 109FD, which also form part of the driveline 109.

The vehicle 100 has a powertrain controller 110C configured to control the engine 110 in response to actuation of an accelerator pedal 110P, a transmission controller 108C configured to control the transmission 108 and an anti-lock braking system (ABS) controller 140C configured to control a braking system (not shown) in response to actuation of a brake pedal 140P. The transmission controller 108C is configured to cause the transmission 108 to assume an operating mode selected from amongst a park mode P, reverse mode R in which a reverse gear is selected, neutral mode N in which the transmission 108 causes the engine 110 to be disconnected from the driveline 109 by opening a transmission clutch, a drive mode D in which the transmission 108 automatically selects an appropriate forward gear in dependence at least in part on vehicle speed, engine speed and powertrain torque demand, and a sport mode S. In the sport mode S the transmission is controlled in a similar manner to the drive mode D but with certain modifications in order to provide a more sporty driving experience.

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It is to be understood that embodiments of the present invention are not limited to motor vehicles with internal combustion engines but may be used with electric vehicles, hybrid electric vehicles or any other suitable vehicles.

The vehicle 100 has a rear view camera system providing mirror replacement functionality. The camera system includes a controller 150C, left and right rear view cameras 151L, 151R respectively, and left and right video monitors 153L, 153R respectively. The controller 150C that receives left and right video input signals S1, S2 from the left and right rear view cameras 151L, 151R respectively. The controller 150C also receives a signal S5 indicating whether a turn indicator switch 133 mounted to a steering column 131 of the vehicle 100 has been actuated to signal a left or right turn.

The controller 150C processes the left and right video input signals received and outputs left and right video output signals S7, S8 to the left and right video monitors 153L, 153R respectively.

The controller 150C is configured to output left and right video output signals S7, S8 to the

respective monitors 153L, 153R that are either narrow-field signals, being signals carrying images with a relatively narrow lateral (horizontal) field of view, or wide-field signals, being signals carrying images with a relatively wide field of view. In the present embodiment the controller 150C outputs narrow-field left and right video output signals S7, S8 when the turn indicator switch 133 is in a neutral position, not indicating a left or right turn, and wide-field left and right video output signals S7, S8 when the turn indicator switch 133 is in a position indicating a left or right turn.

FIG. 3 illustrates the difference in field of view of images displayed by the monitors 153L, 153R when the vehicle 100 is signalling a turn and when the vehicle is not signalling a turn. The field of view of the left camera device 151L is shown in FIG. 3(a) whilst the field of view of the right camera device 151R is shown in FIG. 3(b). When the vehicle 100 is not signalling a turn, the field of view of the left monitor 153L has a horizontal angular range A1 degrees (FIG. 3(a)) and the field of view of the right monitor 153R has a horizontal angular range B1 degrees (FIG. 3(b)). When the vehicle is signalling a turn the field of view of the left monitor 153L has a horizontal angular range A2 degrees and the field of view of the right monitor 153R has a horizontal angular range B2 degrees, where A2>A1 and B2>B1. In the present embodiment A1=B1=X degrees, A2=B2=Y degrees. It is to be understood that the vertical field of view of the respective narrow field and wide field images may also be different, and determined by the aspect ratio of the monitors so as to give a substantially undistorted rear view. In some embodiments the image may be compressed in one or both of the horizontal and vertical directions. In the present embodiment, the vertical field of view is arranged to scale with the horizontal field of view to give a substantially undistorted image. In the present embodiment X is approximately 25 degrees and Y is approximately 45 degrees. Other values may be useful in some embodiments.

In some embodiments the values of A1 and B1 may be different, and similarly the values of A2 and B2 may be different, provided that A2>A1 and B2>B1.

In the present embodiment, the left and right rear view cameras 151L, 151R are each configured to output to the controller 150C substantially continuously a respective video signal S1, S2 corresponding to the respective left and right wide-field images. The controller receives the signals and processes the signals to generate respective left and right narrow-field signals. The images carried by the left and right narrow-field signals correspond to a predetermined portion of the wide-field images carrying the portion of each wide-field image to which the narrow-field images correspond, enlarged to the dimensions of the image displayed by the monitors 153L, 153R.

The controller 150C is configured to output the wide-field signals received from the left and right rear view cameras 151L, 151R substantially directly to the monitors 153L, 153R as signals S7, S8 respectively when the turn indicator switch 133 indicates a turn is being signalled. When the turn indicator switch 133 does not indicate that a turn is being signalled the controller 150C is configured to output the narrow-field signals to the monitors 153L, 153R as signals S7, S8.

In some alternative embodiments the controller 150C may be configured to output left and right video output signals S7, S8 to the respective monitors 153L, 153R that are narrow-field signals unless the turn indicator switch 133 indicates a left of right turn is being signalled. If a left turn is being signalled, the controller 150C causes the left video output signal to carry the wide-field signal from the left camera 151L and the right video output signal to carry the narrow-field signal based on the right camera 151R. If a right turn is being signalled, the controller 150C causes the left video output signal S7 to carry the narrow-field signal based on the left camera 151L and the right video output signal to carry the wide-field signal from the right camera 151R.

In some embodiments the controller 150C may be configured to receive a signal from a navigation system indicative of whether the vehicle is at one of one or more predetermined locations or types of location. For example, the controller 150C may receive a signal indicative that the vehicle is at a traffic junction or on a slip road to a highway. In some embodiments, the controller 150C may be configured to output left and right video output signals S7, S8 to the respective monitors 153L, 153R that are the wide-field signals in the event the controller 150C receives a signal indicative that the vehicle is at a traffic junction or on a slip road to a highway, and to output the narrow-field signals absent these conditions unless the turn indicator switch is in a position indicative of a left or right turn as described above.

In some embodiments the controller 150C may be configured to determine, if the vehicle is on a slip-road to a highway, whether the highway is to the left or right of the vehicle. The controller 150C may then cause only left or the right video output signal S7, S8 to carry the corresponding wide-field video signal in dependence on whether the highway is to the left or right of the vehicle. If the highway is to the left, the controller 150C may cause the left video output signal S7 to carry the corresponding (left side) wide-field video signal and the right video output signal S8 to carry the corresponding (right side) narrow-field video signal. Conversely, if the highway is to the right, the controller 150C may cause the right video output signal S8 to carry the corresponding (right side) wide-field video signal and the left video output

signal S7 to carry the corresponding (left side) narrow-field video signal.

Other arrangements may be useful in some embodiments.

In some embodiments, the vehicle 100 may be provided with a lane departure warning system. Various types of lane departure warning systems are known and will not be described in detail herein. The lane departure warning system may be configured to monitor, by means of one or more forward (and optionally rear) facing cameras, the road ahead of the vehicle (or behind, in the case of rear facing cameras) and to detect the presence of lane markings on the road. If the vehicle 100 determines that it is travelling along a multilane highway, for example by reference to location information or images of the road ahead of and optionally behind the vehicle, the lane departure warning system may monitor the lateral position of the vehicle 100 with respect to the lanes of the highway. In the event the warning system determines that the vehicle 100 is travelling in a lane but may be about to depart its current lane, or has departed a lane in which it was travelling, the system may issue an audible and/or visual alert. The controller 150C may receive a signal from the lane departure system, optionally via a controller area network (CAN) bus or other communications signal line(s), indicating that the lane departure system has determined that the vehicle is about to depart a lane or has departed a lane. In response to this signal, the controller 150C may cause one or both of the left and right monitors 153L, 153R to receive a respective video signal carrying a wide-field image rather than a narrow-field image.

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In some embodiments, the controller 150C causes both the left and right monitors 153L, 153R to receive a respective video signal carrying a wide-field image in the event the lane departure warning is received. In some alternative embodiments the controller 150C only causes the monitor that is on the side of the vehicle in the direction of lane departure to receive a video signal carrying the respective wide-field image, whilst the other monitor receives a signal carrying the respective narrow-field image.

FIG. 4 illustrates a method of controlling the vehicle of the embodiment of FIG. 1 described above.

At step S101 the method commences.

At step S103 controller 150C receives a wide field video signal from each of left and right video camera devices 151L, 151R.

At step S105 the controller 150C generates left and right narrow-field video signals from the wide-field video signals received at step S103 using known methodologies.

At step S107 the controller 150C determines whether a turn indicator switch 133 is set to a position indicating a left or right turn. If at step S107 the controller 150C determines that the switch 133 is in such a position the controller 150C continues at step S111 else the controller continues at step S109.

At step S109 the controller 150C outputs the left and right narrow-field video signals to the respective left and right monitors 153L, 153R. The method then continues at step S103.

At step S111 the controller 150C outputs the left and right wide-field video signal to the respective left and right monitors 153L, 153R. The method then continues at step S103.

FIG. 5 illustrates a controller 250C of a vehicle according to a further embodiment of the invention. Like features of the controller 250C of FIG. 5 to those of the controller 150C of FIG. 2 are shown with like reference signs.

The controller 250C is configured to receive left and right video input signals S1, S2 from left and right rear view cameras 151L, 151R respectively and to output left and right video output signals S7, S8 to the left and right video monitors 153L, 153R respectively. The video output signals S7, S8 carry either a narrow-field or a wide-field video image in dependence on signal S5 as per the embodiment of FIG. 2. In addition, the controller 250C is configured to receive a signal S6 indicative of the geographical location of the vehicle 100.

The controller 250C is provided with map data of roads in a predetermined geographical region. The controller 250C determines whether the signal S6 indicates that the vehicle 100 is in a location for which map data is available. If map data is available, the controller 250C determines whether the vehicle 100 is located on a road or portion of a road that is contained in a predetermined list of roads or portions of roads for which the controller is required to output wide-field video signals S7, S8 to the left and right video monitors 153L, 153R respectively. If the location is not contained within the list, the controller 250C outputs the narrow-field video signals S7, S8 unless, as described above, the input signal S5 indicates that turn indicator switch 133 is set to a position indicating a left or right turn.

In some alternative embodiments the controller 250C may be configured to receive an input signal S6 indicating whether the vehicle 100 is at a location for which the wide-field images

should be displayed on the monitors 153L, 153R rather than the controller 250C being required to determine whether the current location corresponds to such a location. In this case, if the signal S6 indicates that the vehicle is at such a location, the controller 250C outputs the left and right wide-field video signals S7, S8 to the respective left and right monitors 153L, 153R. If the signal S6 does not indicate that the vehicle is at such a location, the controller 250C outputs the left and right narrow-field video signals S7, S8 to the respective left and right monitors 153L, 153R unless, as described above, the input signal S5 indicates that turn indicator switch 133 is set to a position indicating a left or right turn.

Other arrangements may be useful in addition or instead in some embodiments. For example in some embodiments the controller 250C may only output the wide-field video signals in response to vehicle location if the vehicle speed is above a predetermined threshold value.

In some embodiments the controller 250C may be configured to receive, in addition to or instead of signals S5 and S7, a signal indicative of whether the vehicle 100 is towing. In some embodiments, the controller 250C may be configured to determine that the vehicle 100 is towing if a trailer lighting connector of the vehicle is connected to the trailer. In some alternative embodiments, in addition or instead the controller 250C may be configured to determine that the vehicle 100 is towing if a driver sets a driver operable 'towing' selector to indicate the vehicle is towing. The selector may be provided by means of a touch screen interface, a switchpack, a voice recognition interface or any other suitable means.

In some embodiments the controller 250C may, in addition or instead, be configured to receive a signal indicative that the vehicle is executing a turn independently of the position of the turn indicator switch 133. For example, the controller 250C may receive a signal indicative of an amount of lateral acceleration or rate of change of lateral acceleration that is being experienced by the vehicle 100. The controller 250C may be configured to output left and right video output signals S7, S8 to the left and right video monitors 153L, 153R carrying the wide-field image if the amount of lateral acceleration (or the rate of change of lateral acceleration) exceeds a predetermined value. In some embodiments, the controller 250C may be configured to output left and right video output signals S7, S8 carrying the wide-field image if the amount of lateral acceleration exceeds a predetermined value in further dependence on vehicle speed. In some embodiments the controller may set the output signals S7, S8 to carry the wide-field image only if the amount of lateral acceleration exceeds a predetermined value if vehicle speed is below a predetermined threshold value such as 20kph, 30kph or any other suitable value. The threshold value of lateral acceleration above which output of the wide-field image is made may be set in dependence on vehicle speed. The threshold value may be higher with

higher values of vehicle speed. In some embodiments, in addition or instead the controller 250C may determine that a vehicle is turning in dependence on a signal indicative of steering angle, such as a signal indicative of steering wheel angle. The controller 250C may in some embodiments determine whether the vehicle is turning in dependence on the signal indicative of steering angle and speed. The controller 250C may for example be provided with threshold values of speed for a range of steering wheel angles and set the output signals S7, S8 to carry the wide-field image if the speed exceeds the threshold value for the prevailing steering wheel angle.

Embodiments of the present invention have the advantage that a driver of a vehicle equipped with mirror replacement technology may be provided with an enhanced rearward view when performing a manoeuvre for which enhanced rearward view is desirable, and a standard or default rearward view when such a manoeuvre is not being performed. The default or standard rearward view may be arranged to provide an image having a smaller horizontal field of view and therefore less tiring to a driver to interpret, whilst the enhanced rearward view may provide an image having a larger horizontal field of view. Whilst this will typically result in shrinking of the size of objects with respect to a horizontal axis at least, such a view may alert the driver to the presence of objects otherwise not visible to the driver, enhancing driver awareness of the vehicle's surroundings. Some embodiments of the invention enable a driver to enjoy a field of view that would otherwise only be accessible in a motor vehicle with external rear view mirrors if the driver were to move his or her head whilst viewing the mirror in order to adjust the rearward area viewed. The benefits of conventional rear view mirror technology may therefore be preserved in cars with mirror replacement technology, with the added benefit that a driver does not need to move his or her head, as well as the general benefits associated with mirror replacement technology described above.

Throughout the description and claims of this specification, the words "comprise" and "contain" and variations of the words, for example "comprising" and "comprises", means "including but not limited to", and is not intended to (and does not) exclude other moieties, additives, components, integers or steps.

Throughout the description and claims of this specification, the singular encompasses the plural unless the context otherwise requires. In particular, where the indefinite article is used, the specification is to be understood as contemplating plurality as well as singularity, unless the context requires otherwise.

Features, integers, characteristics, compounds, chemical moieties or groups described in

conjunction with a particular aspect, embodiment or example of the invention are to be understood to be applicable to any other aspect, embodiment or example described herein unless incompatible therewith.

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CLAIMS:

1. A controller for a motor vehicle rear view camera system comprising:

means for receiving video information corresponding to a left rearward view and a right rearward view;

means for displaying a video image corresponding to the left rearward view on a left video screen visible to a driver and a video image corresponding to the right rearward view on a right video screen visible to the driver,

the controller comprising determining means for determining whether at least one of a set of one or more predetermined conditions is met;

wherein the controller is configured to control the displaying means to display on the respective video screens video images corresponding to the left and right rearward views having respective first left and first right horizontal angular ranges or respective second left and second right horizontal angular ranges in dependence on whether one or more of the predetermined conditions is met, the second left angular range being greater than the first left angular range and the second right angular range being greater than the first right angular range, the controller being configured to display one or both of the video images corresponding to the left and right rearward views having the second left and second right horizontal angular ranges when it is determined that at least one of the set of one or more conditions has been met;

and wherein the set of one or more predetermined conditions includes one or more of any one or more of the following conditions:

(i) a condition that a left turn indicator or a right turn indicator of the vehicle has been activated;

~~(ii) a condition that the vehicle is in a predetermined one or more locations;~~

(iiii) a condition that the vehicle is in a towing condition;

(iiiv) a condition that a lane departure alert has been received by the controller from a lane departure detection system.

2. A controller according to claim 1 where the means for receiving video information corresponding to a left rearward view and a right rearward view comprises means for receiving a video signal from each of respective left and right video camera devices.

~~3. A controller according to claim 1 or claim 2 configured to display one or both of the video images corresponding to the left and right rearward views having the second left and~~

~~second right horizontal angular ranges when it is determined that at least one of the set of one or more conditions is met.~~

~~13~~. A controller according to claim ~~3~~ 1 or claim 2 configured to assume a first configuration in which the controller causes the left and right video screens to display, respectively, the video images corresponding to the left and right rearward views having the respective first left and first right horizontal angular ranges when it is determined that none of the set of one or more conditions is met.

~~14~~. A controller according to claim ~~4~~ 3 wherein the set of one or more conditions comprises a plurality of the said conditions, the controller being configured to assume a second configuration in which the controller causes the left video screen to display the video image corresponding to the left rearward view having the second left horizontal angular range and the right video screen to display the video image corresponding to the right rearward view having the first right horizontal angular range in dependence on whether a first predetermined one or more of the plurality of conditions is met.

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~~15~~. A controller according to claim ~~4~~ 3 or claim ~~5~~ 4 configured to assume a third configuration in which the controller causes the left video display screen to display the video image corresponding to the left rearward view having the first left horizontal angular range and the right video screen to display the video image corresponding to the right rearward view having the second right horizontal angular range in dependence on whether a second predetermined one or more of the plurality of conditions is met, each of the second predetermined one or more conditions being different from each of the first predetermined one or more conditions.

~~16~~. A controller according to claim ~~4~~ 3 configured to assume a fourth configuration in which the controller causes the left video display screen to display the video image corresponding to the left rearward view having the second left horizontal angular range and the right video screen to display the video image corresponding to the right rearward view having the second right horizontal angular range if it is determined that at least one of the set of one or more conditions is met.

~~17~~. A controller according to claim ~~7~~ 6 wherein one of the said conditions is a condition (i) that a left or right turn indicator of the vehicle has been activated, and wherein the controller is configured to assume the fourth configuration if the left or right turn indicator is activated.

~~8~~. A controller according to claim ~~5~~ 4 or claim ~~6~~ 5 as dependent on claim ~~5~~ 4 wherein one of the said conditions is that a left turn indicator of the vehicle has been activated, and wherein the controller is configured to assume the second configuration if the left turn indicator has been activated.

~~109~~. A controller according to claim ~~6~~ 5 or claim ~~9~~ 8 as dependent on claim ~~6~~ 5 wherein one of the said conditions is that a right turn indicator of the vehicle has been activated, and wherein the controller is configured to assume the third configuration if the right turn indicator has been activated.

~~1110~~. A controller according to any one of claims ~~8~~ 7 to ~~10~~ 9 configured to receive a turn indicator signal indicative of whether the left of right turn indicator of the vehicle has been activated by the driver, the controller being configured to determine that the left or right turn indicator of the vehicle has been activated by a driver in dependence on the turn indicator signal.

~~12. A controller according to any preceding claim wherein one of the said conditions is a condition (ii) that the vehicle is in a predetermined one or more locations.~~

~~13. A controller according to claim 12 wherein the predetermined one or more locations include one or more predetermined traffic junctions.~~

~~14. A controller according to claim 13 as depending through claim 7 configured to assume the fourth configuration if it is determined that the vehicle is at one of a predetermined one or more traffic junctions.~~

~~15. A controller according to claim 12 wherein the predetermined one or more locations include one or more entry slip roads to a highway.~~

~~16. A controller according to claim 15 configured to assume the fourth configuration if it is determined that the vehicle is at one of a predetermined one or more entry slip roads to a highway.~~

~~17. A controller according to claim 15 as depending through claim 5 configured to assume the second configuration if it is determined the vehicle is on a right hand slip road joining a highway to the left of the vehicle.~~

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~~18. A controller according to claim 15 or 17, each as depending through claim 6, configured to assume the third configuration if it is determined the vehicle is on a left hand slip road joining a highway to the right of the vehicle.~~

~~19. A controller according to any one of claims 12 to 18 configured to receive a location signal indicative of a current geographical location of the vehicle, the controller being configured to determine whether the current geographical location corresponds to the one or more predetermined locations.~~

~~20. A controller according to claim 19 wherein the location signal is received from a global satellite positioning (GPS) system or a global packet radio service (GPRS) system.~~

~~21~~11. A controller according to any preceding claim wherein one of the said conditions is a condition (~~iiii~~) that the vehicle is in a towing condition.

~~22~~12. A controller according to claim ~~21~~ 11 configured to determine that a vehicle is in a towing condition in dependence on at least one selected from amongst whether an electrical connection has been made between the vehicle and the trailer and the status of a driver operated towing selector.

~~23~~13. A controller according to any preceding claim which is configured to receive a signal indicative that a lane departure alert has been issued by a lane departure detection system, wherein one of the said conditions is a condition (~~iviii~~) that the controller has received a signal from the said lane departure detection system indicating that a lane departure alert has been issued.

~~24~~14. A controller according to claim ~~23~~ 13 in combination with a lane departure detection system.

~~25~~15. A controller according to any preceding claim in combination with left and right video camera devices and/or left and right video screens.

~~26~~16. A vehicle comprising a body, a plurality of wheels, a powertrain to drive said wheels, a braking system to brake said wheels, and a controller according to any preceding claim.

~~27~~17. A motor vehicle rear view camera system comprising:

means for receiving video information corresponding to a left rearward view and a right

rearward view;

means for displaying a video image corresponding to the left rearward view on a left video screen visible to a driver and a video image corresponding to the right rearward view on a right video screen visible to the driver,

determining means for determining whether at least one of a set of one or more predetermined conditions is met,

wherein the means for displaying the video image is configured to display a video image corresponding to the left and right rearward views having respective first left and first right horizontal angular ranges or respective second left and second right horizontal angular ranges,

the means for displaying the video image being further configured to display a video image corresponding to at least one of the left and right rearward views having the second left and second right horizontal angular ranges, respectively, in dependence on whether one or more of the predetermined conditions is met, the second left angular range being greater than the first left angular range and the second right angular range being greater than the first right angular range, the means for displaying the video image being configured to display one or both of the video images corresponding to the left and right rearward views having the second left and second right horizontal angular ranges when it is determined that at least one of the set of one or more of conditions has been met;

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wherein the set of one or more predetermined conditions includes one or more of any one or more of the following conditions:

(i) a condition that a left turn indicator or a right turn indicator of the vehicle has been activated;

~~(ii) a condition that the vehicle is in a predetermined one or more locations;~~

(iiii) a condition that the vehicle is in a towing condition;

(iviii) a condition that a lane departure alert has been received by the controller from a lane departure detection system.

2818. A method of controlling a motor vehicle rear view camera system implemented by means of a controller, comprising:

receiving video information corresponding to a left rearward view and a right rearward view;

displaying a video image corresponding to the left rearward view on a left video screen visible to a driver and a video image corresponding to the right rearward view on a right video screen visible to the driver,

determining whether at least one of a set of one or more predetermined conditions is

met,

the method comprising displaying on the respective video screens video images corresponding to the left and right rearward views having respective first left and first right horizontal angular ranges or respective second left and second right horizontal angular ranges in dependence on whether one or more of the predetermined conditions is met, the second left angular range being greater than the first left angular range and the second right angular range being greater than the first right angular range,

the method further comprising displaying one or both of the video images corresponding to the left and right rearward views having the second left and second right horizontal angular ranges when it is determined that at least one of the set of one or more conditions is met,

and wherein the set of one or more predetermined conditions includes one or more of any one or more of the following conditions:

(i) a condition that a left turn indicator or a right turn indicator of the vehicle has been activated;

~~(ii) a condition that the vehicle is in a predetermined one or more locations;~~

(iiii) a condition that the vehicle is in a towing condition;

(iviii) a condition that a lane departure alert has been received by the controller from a lane departure detection system.

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~~29. A method according to claim 28 comprising displaying one or both of the video images corresponding to the left and right rearward views having the second left and second right horizontal angular ranges when it is determined that at least one of the set of one or more conditions is met.~~

3019. A method according to claim 2918 comprising causing the controller to assume a first configuration in which the controller causes the left and right video screens to display, respectively, the video images corresponding to the left and right rearward views having the respective first left and first right horizontal angular ranges when it is determined that none of the set of one or more conditions is met.

3120. A method according to claim 30 19 wherein the set of one or more conditions comprises a plurality of the said conditions, the method comprising causing the controller to assume a second configuration in which the controller causes the left video screen to display the video image corresponding to the left rearward view having the second left horizontal angular range and the right video screen to display the video image corresponding to the right

rearward view having the first right horizontal angular range in dependence on whether a first predetermined one or more of the plurality of conditions is met.

~~32~~21. A method according to claim ~~30~~ 19 or ~~31~~ 20 comprising causing the controller to assume a third configuration in which the controller causes the left video display screen to display the video image corresponding to the left rearward view having the first left horizontal angular range and the right video screen to display the video image corresponding to the right rearward view having the second right horizontal angular range in dependence on whether a second predetermined one or more of the plurality of conditions is met, each of the second predetermined one or more conditions being different from each of the first predetermined one or more conditions.

~~33~~22. A method according to claim ~~30~~ 19 comprising causing the controller to assume a fourth configuration in which the controller causes the left video display screen to display the video image corresponding to the left rearward view having the second left horizontal angular range and the right video screen to display the video image corresponding to the right rearward view having the second right horizontal angular range if it is determined that at least one of the set of one or more conditions is met.

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~~34~~23. A method according to claim ~~33~~ 22 wherein one of the said conditions is a condition (i) that a left or right turn indicator of the vehicle has been activated, the method comprising causing the controller to assume the fourth configuration if the left or right turn indicator is activated.

~~35~~24. A method according to claim ~~31~~ 20 or claim ~~32~~ 21 as dependent on claim ~~31~~ 20 wherein one of the said conditions is that a left turn indicator of the vehicle has been activated, the method comprising causing the controller to assume the second configuration if the left turn indicator has been activated.

~~36~~25. A method according to claim ~~32~~ 21 or claim ~~35~~ 24 as dependent on claim ~~32~~ 21 wherein one of the said conditions is that a right turn indicator of the vehicle has been activated, the method comprising causing the controller to assume the third configuration if the right turn indicator has been activated

~~37~~26. A carrier medium carrying computer readable code for controlling a vehicle to carry out the method of any one of claims ~~28~~ 18 to ~~36~~25.

~~38~~27. A computer program product executable on a processor so as to implement the method of any one of claims ~~28~~-18 to ~~36~~25.

~~39~~28. A computer readable medium loaded with the computer program product of claim ~~38~~27.

~~40~~29. A processor arranged to implement the method of any one of claims ~~28~~-18 to ~~36~~25, or the computer program product of claim ~~38~~27.