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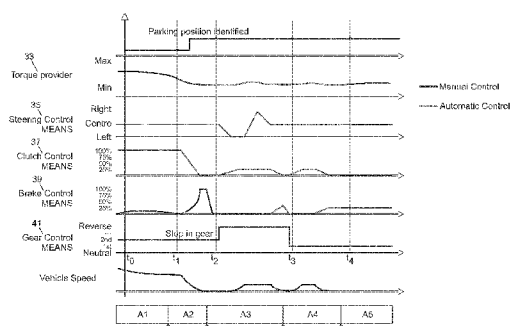
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A VEHICLE

FIG. 5

Key: (A1 to A9)	
A1	Driver drives vehicle
A2	Parking point on identified and vehicle slows down to a stop (or gear)
A3	Vehicle is automatically driven in reverse and is stopped when it gets close to the obstacle behind
A4	Vehicle is automatically driven forward and positioned correctly
A5	Driver has full control
A6	Driver initiates the parking procedure
A7	Outputs message to the driver to release all pedals and shift in reverse
A8	Outputs message to the driver to shift to 'rd gear
A9	Parking successful Driver is free to take over the steering of the vehicle

(57) Abstract: An apparatus (11), method, computer program (27) and non-transitory computer readable medium for providing parking assistance within a vehicle (1), the apparatus (11) comprising means (21) for detecting that parking assistance has been selected; means (21) for controlling the vehicle to be moved into an identified parking space; means (21) for automatically controlling the speed of the vehicle; means (21) for detecting a feedback signal from the driver that the speed of the vehicle should be reduced or increased, and means (21) for changing the speed of the vehicle in response to the detected feedback signal.

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AN APPARATUS, METHOD AND COMPUTER PROGRAM FOR PROVIDING PARKING ASSISTANCE WITHIN A VEHICLE

5 TECHNICAL FIELD

The present disclosure relates to an apparatus, method, computer program and non-transitory computer readable medium for providing parking assistance in a vehicle.

10 Aspects of the invention relate to an apparatus, method, computer program and non-transitory computer readable medium.

BACKGROUND

15 Parking assistance systems enable vehicles to be automatically manoeuvred into parking spaces without requiring the user to steer the vehicle. In vehicles with automatic transmissions the driver does not need to make any inputs while the parking assistance manoeuvres are being carried out. However in vehicles with manual transmissions the driver may still be required to select the gears of the vehicle and control the pedals of the vehicle.
20 For instance the driver may be required to engage and disengage the clutch and may be required to control one or more of the pedals such as the brake.

It is an aim of the present invention to provide improved parking assistance systems.

25 SUMMARY OF THE INVENTION

Aspects and embodiments of the invention provide an apparatus, method, computer program and non-transitory computer readable medium as claimed in the appended claims.

30 According to an aspect of the invention there is provided an apparatus for providing parking assistance within a vehicle, the apparatus comprising: means for detecting that parking assistance has been selected; means for controlling the vehicle to be moved into an identified parking space; means for automatically controlling the speed of the vehicle; means for detecting a feedback signal from the driver that the speed of the vehicle should be

reduced or increased, and means for changing the speed of the vehicle in response to the detected feedback signal.

This may enable the driver to indicate a speed that they are comfortable for the parking process to be carried out at. This may enable an adaptive assisted parking system to be provided. The adaptive assisted parking system may use the feedback signals from the driver to learn the driver's preferences for the movement of the vehicle and use this learned information for future parking manoeuvres.

The apparatus may automatically set a target speed when the apparatus detects that parking assistance has been selected.

The target speed of the vehicle may be changed when a feedback signal from the driver that the speed of the vehicle should be reduced or increased is detected.

The detected feedback signal may comprise the driver actuating one or more of the pedals of the vehicle.

This provides a simple and intuitive way for a driver to indicate if the vehicle is moving too slowly or too fast. The use of existing pedals to provide the feedback signals may also enable the feedback to be provided without needing any extra user input devices within the vehicle.

In response to detected actuation of the brake pedal by the driver the speed of the vehicle may be reduced.

This provides the advantage that it may enable the driver to slow the vehicle down if they feel the vehicle is moving too fast.

The apparatus may be configured such that if the driver presses the brake pedal with a force which is below a threshold, the speed of the vehicle is reduced, but if the driver presses the brake pedal with a force which is above a threshold, the parking assistance is overridden and the vehicle may stop.

This allows the driver to stop the vehicle and override the parking assistance if they feel this is necessary.

5 In response to detected actuation of the accelerator pedal by the driver the speed of the vehicle may be increased.

This provides the advantage that it enables the driver to increase the speed of the vehicle if they feel the vehicle is moving too slowly.

10 The apparatus may comprise means for determining an angle of incline of the vehicle and means for controlling the torque provided in response to the determined angle of incline of the vehicle.

15 This provides the advantage that it makes the vehicle easier to park if it is positioned on a hill or slope. For instance, if the vehicle is facing down a hill then a large amount of torque may be needed to enable the vehicle to move in a reverse gear while a small amount of torque may be need to enable the vehicle to move in a forward gear.

20 The apparatus may comprise means for determining if the vehicle is travelling on at least one of; an uneven surface, snow, sand, wet grass.

25 This provides the advantage that it enables the torque to be controlled in dependence of the road surface. For example, if the vehicle is on an uneven surface such as cobbles a higher torque may be required to keep the vehicle moving.

The apparatus may comprise means for obtaining a control signal indicating a status of one or more components of the vehicle.

30 This may provide the advantage that the control signal may be used to provide information relating to the status of any relevant components of the vehicle such as the temperature of the gears or whether unnecessary wear is taking place. This information could then be used to adjust the control of the respective components of the vehicle and improve the performance of the vehicle.

The apparatus may be for providing parking assistance within a vehicle with manual transmission, the apparatus comprising means for identifying a gear needed by the vehicle to move the vehicle into an identified parking space; means for automatically opening a clutch to enable a gear to be selected; means for enabling an instruction to be provided to the driver of the vehicle where the instruction indicates the gear needed by the vehicle to enable the vehicle to be moved into the identified parking space; and means for controlling the vehicle to be moved into the identified parking space after the driver has selected an appropriate gear.

This provides the advantage that it enables an improved parking assistance system to be provided in a vehicle with a manual clutch. By providing an apparatus that can automatically control the opening and closing of the clutch there is no need to for the driver to control the clutch pedal while the parking manoeuvre is being performed. In order to enable the correct gear to be selected an instruction is provided to the driver to select the appropriate gear. The selection of the appropriate gear may be the only input that is required from the driver while the parking manoeuvre is being performed.

The clutch may be an electronic clutch.

Using an electronic clutch provides the advantage that the clutch can be opened and closed in response to an electrical signal and does not require the driver to operate the pedals. This means that the driver does not have to control the clutch pedal while the parking assist system is being used.

The means for opening a clutch may comprise means for automatically providing a control signal to the clutch.

This provides the advantage that it enables the clutch to be controlled without requiring any further input from the driver. This means that the driver does not need to control the pedals of the vehicle in order to enable the parking assistance to be completed.

The appropriate gear may comprise at least one of; the gear indicated in the instruction, an alternative gear which enables the vehicle to be moved into the identified parking space.

This may provide the advantage that it may enable the instruction to indicate the precise gear that should be selected. It may also enable the parking manoeuvre to be performed even if the driver selects a different gear. For instance, if the instruction indicates that first gear should be selected the vehicle 1 may still be moved into the parking space if the driver
5 selects another forward gear such as second gear.

The apparatus may be providing parking assistance within a vehicle with automatic transmission.

10 This provides the advantage that it enables an improved parking assistance system to be provided in a vehicle with automatic transmission.

The means for controlling the vehicle to be moved may comprise means for automatically controlling the steering of the vehicle.

15

This provides the advantage that it enables the vehicle to be steered automatically without any further input from the driver. This reduces the input needed from the driver to complete the parking manoeuvre.

20 The means for controlling the vehicle to be moved may comprise means for automatically controlling the speed of the vehicle.

This provides the advantage that it enables the vehicle to be moved automatically without any further input from the driver and so reduces the input needed from the driver to complete
25 the parking manoeuvre.

The means for controlling the vehicle to be moved may comprise means for automatically controlling the brakes of the vehicle.

30 This provides the advantage that it enables the speed of the vehicle to be controlled without requiring any input from the driver. This may enable control of the amount of torque provided to the wheels of the vehicle.

The means for controlling the vehicle to be moved may comprise means for automatically controlling a torque provider. The means for controlling the vehicle to be moved may comprise means for automatically controlling a clutch.

- 5 This may provide the advantage that it enables the speed of the vehicle to be controlled as needed without any input from the driver.

The apparatus may comprise means for detecting a feedback signal from the driver and, means for changing the movement of the vehicle in response to the detected feedback
10 signal.

The respective means may be provided by one or more controllers.

According to an aspect of the invention there is provided a vehicle comprising an apparatus
15 as described above.

According to an aspect of the invention there is provided a method for providing parking assistance within a vehicle, the method comprising:

- 20 detecting that parking assistance has been selected;
controlling the vehicle to be moved into an identified parking space;
automatically controlling the speed of the vehicle;
detecting a feedback signal from the driver and changing the speed of the vehicle in response to the detected feedback signal.

25 According to an aspect of the invention there is provided a computer program for providing parking assistance within a vehicle, the computer program comprising instructions that, when executed by one or more processors, cause an apparatus to perform, at least:

- 30 detecting that parking assistance has been selected;
controlling the vehicle to be moved into an identified parking space;
automatically controlling the speed of the vehicle;
detecting a feedback signal from the driver and changing the speed of the vehicle in response to the detected feedback signal.

According to an aspect of the invention there is provided a non-transitory computer readable medium comprising a computer program as described above.

5 According to an aspect of the invention there is provided an apparatus for providing parking assistance within a vehicle, the apparatus comprising: means for identifying a gear needed to complete a manoeuvre and automatically opening a clutch and means for instructing a driver to select an appropriate gear.

10 According to an aspect of the invention there is provided an apparatus for providing parking assistance within a vehicle, the apparatus comprising means for automatically controlling the speed of the vehicle, and means for changing the speed of the vehicle in response to instructions from the driver.

15 According to an aspect of the invention there is provided an apparatus for providing parking assistance within a vehicle, the apparatus comprising: one or more processors arranged to detect that parking assistance has been selected and enable a gear needed by the vehicle to move the vehicle into an identified parking space to be identified; wherein the one or more processors are also arranged to enable a clutch to be opened automatically to allow a gear to be selected and to enable an instruction to be provided to the driver of the vehicle where
20 the instruction indicates the gear needed by the vehicle to enable the vehicle to be moved into the identified parking space; the one or more processors are also arranged to control for the vehicle to be moved into the identified parking space after the driver has selected an appropriate gear.

25 A system for providing parking assistance within a vehicle, the system comprising:
means for receiving one or more signals indicating that parking assistance has been selected and identifying a gear needed by the vehicle to move into the identified parking space; and
means to automatically open a clutch to enable a gear to be selected;
30 means to enable an instruction to be provided to the driver of the vehicle where the instruction indicates the gear needed by the vehicle to enable the vehicle to be moved into the identified parking space; and
means to control the vehicle to be moved into the identified parking space after the driver has selected an appropriate gear.

A system for as described above, wherein:

said means for receiving one or more signals indicating that parking assistance has been selected and identifying a gear needed by the vehicle to move into the identified parking space comprises an electronic processor having an electrical input for receiving said one or more signals; and

an electronic memory device electrically coupled to the electronic processor and having instructions stored therein,

said means to automatically open a clutch to enable a gear to be selected; means to enable an instruction to be provided to the driver of the vehicle where the instruction indicates the gear needed by the vehicle to enable the vehicle to be moved into the identified parking space; and means to control for the vehicle to be moved into the identified parking space after the driver has an appropriate gear comprise the processor being configured to access the memory device and execute the instructions stored therein.

The apparatus may be for enabling parking assistance within a vehicle.

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. 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:

Fig 1 illustrates a vehicle;

Fig 2 illustrates an apparatus;

Fig 3 illustrates a system;

Fig 4 illustrates an example method;

Fig 5 illustrates the status of components of a system during an example parking manoeuvre;

5 Fig 6 illustrates another example method;

Fig 7 illustrates a further apparatus;

Fig 8 illustrates a further system; and

Fig 9 illustrates a further example method.

10 DETAILED DESCRIPTION

The Figures illustrate an apparatus 11, method and computer program 27 for providing parking assistance within a vehicle 1, the apparatus 11 comprising: means 21 for detecting detecting that parking assistance has been selected; means 21 for controlling the vehicle to be moved into an identified parking space; means 21 for automatically controlling the speed of the vehicle; means 21 for detecting a feedback signal from the driver that the speed of the vehicle should be reduced or increased, and means 21 for changing the speed of the vehicle in response to the detected feedback signal.

20 Fig 1 illustrates an example vehicle 1 which may comprise an apparatus 11 according to embodiments of the invention. The vehicle 1 may comprise a manual transmission which requires input from the driver in order to enable the gear of the vehicle to be changed. For example it may require the driver to depress a clutch pedal to disengage the clutch and to control a gear lever or other input device to manually select the correct gear.

25

Fig 2 illustrates an apparatus 11 which may be provided within the vehicle 1. The apparatus 11 may be arranged to provide parking assistance of the vehicle 1.

The apparatus 11 comprises a controller 21. The controller 21 may be a chip or a chip set.

30 The controller 21 may form part of one or more systems comprised in the vehicle 1. The controller 21 may be arranged to control any suitable functions or applications within the vehicle 1. In embodiments of the invention the controller 21 may be arranged to control parking assistance of the vehicle 1.

The controller 21 comprises at least one processor 23, at least one memory 25 and at least one computer program 27.

5 Implementation of a controller 21 may be as controller circuitry. The controller 21 may be implemented in hardware alone, may have certain aspects in software including firmware alone or may be a combination of hardware and software (including firmware).

As illustrated in Fig 2 the controller 21 may be implemented using instructions that enable hardware functionality, for example, by using executable instructions of a computer program 10 27 in a general-purpose or special-purpose processor 23 that may be stored on a computer readable storage medium (disk, memory etc) to be executed by such a processor 23.

The processor 23 may be arranged to read from and write to the memory 25. The processor 23 may also comprise an output interface via which data and/or commands are output by the 15 processor 23 and an input interface via which data and/or commands are input to the processor 23.

The memory 25 may be arranged to store a computer program 27 comprising computer program instructions 29 (computer program code) that controls the operation of the controller 20 21 when loaded into the processor 23. The computer program instructions 29, of the computer program 27, provide the logic and routines that enables the controller 21 to detect that parking assistance has been selected and to implement the parking assistance methods. The processor 23 by reading the memory 25 is able to load and execute the computer program 27.

25

In some examples the controller 21 may be arranged to identify a parking space for the vehicle 1. In other examples the controller 21 may obtain information indicative of an identified parking space from a different controller.

30 The controller 21 may be arranged to identify a gear needed by the vehicle 1 to move the vehicle 1 into the identified parking spaces and may also be arranged to open a clutch to enable a gear to be selected. The controller 21 may be arranged to control a user interface to provide an instruction to the driver of the vehicle 1. The instruction indicates the gear needed by the vehicle 1 to enable the vehicle 1 to be moved into the identified parking

space. The controller 21 may also be arranged to control the vehicle to be moved into the identified parking space once the driver has selected the gear indicated in the instruction.

As illustrated in Fig 2, the computer program 27 may arrive at the controller 21 via any suitable delivery mechanism 31. The delivery mechanism 31 may be, for example, a non-transitory computer-readable storage medium, a computer program product, a memory device, a record medium such as a compact disc read-only memory (CD-ROM) or digital versatile disc (DVD), an article of manufacture that tangibly embodies the computer program 27. The delivery mechanism may be a signal arranged to reliably transfer the computer program 27. The controller 21 may propagate or transmit the computer program 27 as a computer data signal.

Although the memory 25 is illustrated as a single component/circuitry it may be implemented as one or more separate components/circuitry some or all of which may be integrated/removable and/or may provide permanent/semi-permanent, dynamic/cached storage.

Although the processor 23 is illustrated as a single component/circuitry it may be implemented as one or more separate components/circuitry some or all of which may be integrated/removable. The processor 23 may be a single core or multi-core processor.

Fig 3 schematically illustrates an example system 31 which comprises an apparatus 11 as described above. The system 31 may be a parking assistance system which enables the vehicle 1 to be moved into a parking space with minimal input from the driver.

The example system 31 of Fig 3 comprises an apparatus 11, a torque provider 33, steering control means 35, clutch control means 37, brake control means 39, gear control means 41 and notification means 43 for providing a notification to a driver of the vehicle 1.

The apparatus 11 may be as described above in relation to Fig 2. The apparatus 11 may comprise one or more controllers 21. In some examples the controller 21 may be dedicated to the parking assistance system 31 and may solely control functions related to the parking assistance system 31. In other examples the controller 21 may be arranged to control functions of the other systems of the vehicle 1. This may enable the same controller 21 to be

used for different systems. This may reduce the number of controllers 21 needed within the vehicle 1.

The torque provider 33 may comprise any means which may be arranged to provide a torque to the wheels of the vehicle 1. In some examples the torque provider 33 may comprise an engine which may be an internal combustion engine. The internal combustion engine may be a petrol engine, a diesel engine or any other suitable type of engine. In some examples the torque provider 33 may comprise an electric machine or any other suitable type torque provider 33.

The torque provider 33 may be coupled to the wheels of the vehicle by a drive shaft. A transmission may be used to couple the torque provider 33 to the drive shaft and control the power provided to the drive shaft and the wheels of the vehicle 1.

The transmission may comprise a manual transmission. The manual transmission requires input from the driver in order to enable the gear of the vehicle 1 to be changed. The manual transmission may require the driver to depress a clutch pedal to disengage the clutch and to control a gear lever or other input device to manually select the correct gear.

In the example system of Fig 3 the torque provider 33 is coupled to the apparatus 11 so that the torque provider 33 can send an input signal to the apparatus 11 and receive an output signal from the apparatus 11. The input signal 11 that is provided from the torque provider 33 to the apparatus 11 may enable information about the current operating state of the torque provider to be provided to the apparatus 11. For example, it may enable information about the current power output to be provided to the apparatus 11.

The output signal that is provided by the apparatus 11 to the torque provider may enable the apparatus 11 to control the output provided by the torque provider 33. For example it may enable the apparatus 11 to increase or decrease the power provided by the torque provider 33.

The steering control means 35 may comprise any means which enables the steering of the vehicle 1 to be controlled. The steering of the vehicle 1 may control the direction of travel of the vehicle 1 when it is moving. In some examples the steering control means 35 may

comprise a steering wheel and steering column which are coupled to the wheels of the vehicle 1. The steering wheel may be arranged so that it can be operated by the driver of the vehicle 1 to enable manual control of the steering control means 35.

5 The steering control means 35 may also be coupled to the apparatus 11 to enable the steering control means 35 to receive an input signal from the apparatus 11. The input signal from the apparatus 11 may enable the steering control means 35 to be controlled by the apparatus 11. When the steering control means 35 is being controlled by the apparatus 11 this enables automatic control of the steering of the vehicle 1. The automatic control requires
10 no input from the driver.

The automatic control of the steering control means 35 may be enabled when the vehicle 1 is in some modes of operation and disabled when the vehicle 1 is in other modes of operation. For instance, during normal driving the driver may control the steering control
15 means 35. If an assisted mode of driving is selected, for instance if parking assistance is selected, then the apparatus 11 may control the steering control means.

The clutch control means 37 may comprise any means which enables the clutch of the vehicle 1 to be opened and closed as needed. The clutch control means 37 may be
20 arranged so that it can be operated by the driver of the vehicle 1 to enable manual control of the clutch control means 37. For instance the clutch control means 37 may be arranged so that the driver can open the clutch by depressing the clutch pedal of the vehicle 1.

The clutch control means 37 may also be coupled to the apparatus 11 to enable the clutch
25 control means 37 to receive an input signal from the apparatus 11. The input signal from the apparatus 11 may enable the clutch control means 37 to be controlled by the apparatus 11. When the clutch control means 37 is being controlled by the apparatus 11 this enables automatic control of the clutch of the vehicle 1. The automatic control requires no input from the driver.

30 The automatic control of the clutch control means 37 may be enabled when the vehicle 1 is in some modes of operation and disabled when the vehicle 1 is in other modes of operation. For instance, during normal driving the driver may control the clutch control means 37. If an assisted mode of driving is operational, then the apparatus 11 may control the clutch control

means 37. For example if parking assistance is selected or if an anti-stall mode is in operation then the apparatus 11 may control the clutch control means 37.

5 In some examples the clutch of the vehicle 1 may comprise an electronic clutch. This may enable the clutch to be controlled by providing an electric signal to the clutch.

10 The brake control means 39 may comprise any means which may enable the brakes of the vehicle 1 to be controlled. This may enable the speed of the vehicle 1 to be reduced as needed. The brake control means 39 may be arranged so that it can be operated by the driver of the vehicle 1 to enable manual control of the speed of the vehicle 1. For instance the brake control means 39 may be arranged so that the driver can operate the brakes by depressing the brake pedal of the vehicle 1.

15 The brake control means 39 may also be coupled to the apparatus 11 to enable the brake control means 39 to receive an input signal from the apparatus 11. The input signal from the apparatus 11 may enable the brake control means 39 to be controlled by the apparatus 11. When the brake control means 39 is being controlled by the apparatus 11 this enables automatic control of the brakes. The automatic control requires no input from the driver.

20 The automatic control of the brake control means 39 may be enabled when the vehicle 1 is in some modes of operation and disabled when the vehicle 1 is in other modes of operation. For instance, during normal driving the driver may control the brake control means 39. If a parking assistance mode is operational, then the apparatus 11 may control the brake control means 39.

25 In some examples the brake control means 39 may be arranged so that the automatic control of the brake control means 39 may be overridden in response to a manual input from the driver. For instance, if the driver becomes aware of a reason to stop the vehicle 1 they may actuate the brake pedal of the vehicle 1. This may ensure that the vehicle can be
30 stopped even if the parking sensors have failed to detect a reason for stopping.

The gear control means 41 may comprise any means which enables a gear of the vehicle 1 to be selected. The gear control means 41 may be a manual means which requires input from the driver of the vehicle 1 to select the gear. The gear control means 41 may comprise

a gear lever or any other suitable means. In embodiments of the invention the gear control means 41 is not arranged to be controlled by the apparatus 11. The gear control means 41 may be arranged to provide an input signal to the apparatus 11 indicative of the current gear of the vehicle 1. This information may be used by the apparatus 11 to determine whether or not a gear change is needed. However in the parking assistance system 31 of Fig 3 the apparatus 11 is not arranged to control the gear control means 41 to cause the change of gear.

In order to enable the driver to select a gear it may be necessary for the clutch to be opened. The opening of the clutch may disengage the current gear and enable a different gear to be provided.

The notification means 43 may comprise any means which may be arranged to provide a notification to a driver of the vehicle 1. In some examples the notification means 43 may comprise visual means such as a display. The display could be provided in any suitable location within the vehicle 1. In some examples the display could be a heads up display (HUD) or any other suitable type display. In some examples the notification means 43 may comprise an audio means. The audio means may comprise a loudspeaker which may be arranged to provide an audio signal to the driver.

The notification means 43 may be provided as part of a user interface. In such examples the user interface may also be arranged to enable a driver to input information to the vehicle 1 as well as to receive notifications from the vehicle 1.

The notification means 43 may be coupled to the apparatus 11 so that the notification means 43 may be arranged to receive an output signal from the apparatus 11. The output signal from the apparatus 11 may comprise information indicative of a gear needed by the vehicle. The means 43 for providing the notification to the driver may use the information in the output signal to indicate to the driver the gear that needs to be selected.

Fig 4 illustrates an example method according to embodiments of the invention. The method may be implemented using a parking assistance system 31 as described above. The blocks of the method, or at least some of the blocks of the method may be performed by the apparatus 11.

The method comprises, at block 51, detecting that parking assistance has been selected. The parking assistance may be detected by a driver making a user input to select parking assistance. In some examples the driver may stop the vehicle 1 before selecting parking assistance. In other examples the vehicle 1 may be arranged to enable the driver to select parking assistance while the vehicle 1 is still moving.

When the driver selects parking assistance an input signal is provided to the apparatus 11. In response to the input signal the apparatus 11 may enable a parking assist mode of operation. In the parking assist mode of operation the apparatus 11 may take control of the steering control means 35, the clutch control means 37 and the brake control means 39. However the gear control means 41 may remain in a manually controlled state so that they are only responsive to inputs from the driver. In embodiments of the invention the apparatus 11 does not provide any output signal to the gear control means 41.

Once parking assistance has been selected a parking space for the vehicle 1 may be identified. In some examples the parking space may be identified by the apparatus 11. In other examples one or more different controllers may identify the parking space and then provide information indicative of the identified parking space to the apparatus 11. The vehicle 1 may comprise ultrasound sensors, infrared sensors, imaging devices or any other suitable sensors which may enable a parking space to be identified.

At block 53 of the method the apparatus 11 identifies a gear needed by the vehicle 1 to move the vehicle 1 into the identified parking space. For instance the apparatus 11 may determine whether the vehicle 1 needs to be arranged into a forward or reverse gear.

In order to enable the gear of the vehicle 1 to be changed the apparatus 11 may send a control signal to the clutch control means 37. This causes the clutch to be opened, at block 53, to enable the correct gear to be selected.

At block 55 the apparatus 11 enables an instruction to be provided to the driver. The instruction may be provided by the notification means 43. In order to enable the instruction to be provided the apparatus 11 may provide an output signal to the notification means 43. The output signal may comprise the information that is to be provided to the driver.

In embodiments of the invention the information that is to be provided to the driver may comprise information indicating the gear needed by the vehicle 1 to enable the vehicle 1 to be moved into the identified parking space. For examples the information could indicate to the driver that the vehicle 1 is to be arranged into a forward gear or a reverse gear. This information could be provided as a visual instruction on a display and/or as an audio instruction via a speaker.

When the driver receives the notification the clutch may be already opened by the apparatus 11. In order to change the gear the driver only has to operate the gear control means 41. For example, the driver does not need to depress the clutch pedal but only needs to operate the gear lever or other gear control means. This reduces the amount of input required by the driver in order to cause the gear change. As the clutch is controlled automatically by the apparatus 11 this may also avoid the vehicle 1 from stalling.

Once the driver has selected an appropriate gear the apparatus 11 may control the vehicle 1 to be moved into the identified parking space at block 57. The gear control means 41 may be arranged to provide an input signal to the apparatus 11 indicative of the current gear of the vehicle 1. When the driver selects the appropriate gear the control means 41 may provide an input signal to the apparatus 11 which informs the apparatus 11 that an appropriate gear has been selected.

Once the apparatus 11 has determined that an appropriate gear has been selected the apparatus 11 may send a further output signal to the clutch control means 37 to cause the clutch to be closed and enable torque from the torque provider 33 to be provided to the wheels of the vehicle 1 and cause the vehicle to move in the desired direction. The apparatus 11 may control the steering control means 35 to direct the vehicle 1 into the identified parking space.

The appropriate gear may be the gear indicated in the instruction or an alternative gear which enables the vehicle to be moved into the identified parking space. For instance, if the instruction indicates that first gear should be selected the vehicle 1 may still be moved into the parking space if the driver selects another forward gear such as second gear.

As the vehicle 1 is being moved in to the parking space the apparatus 11 may also control the speed of the vehicle 1. The apparatus 11 may control the speed of the vehicle 1 by controlling the brake control means 39 and/or the torque provider 33. In some examples the apparatus 11 may automatically control the speed of the vehicle 1 without any input from the driver. This may enable the parking to be carried out with minimal input from the driver.

In other examples the apparatus 11 may be arranged to receive feedback signals from the driver and change the speed of the vehicle, or other parameters of the movement of the vehicle 1, in response to the feedback signal. In some examples the feedback signal may comprise the driver actuating one or more pedals of the vehicle 1. The function that is performed in response to the feedback signal may depend on the pedal that is actuated by the driver. For instance, if the driver actuates the brake pedal this may provide a feedback signal indicating that the driver feels the vehicle 1 is moving too quickly. In response to this feedback signal the apparatus 11 may decrease a target speed of the vehicle 1. If the driver actuates the accelerator pedal this may provide a feedback signal indicating that the driver feels the vehicle 1 is moving too slowly. In response to this feedback signal the apparatus 11 may increase a target speed of the vehicle 1. The target speed may be a speed which is automatically set by the apparatus 11 when parking assistance is initiated.

In some embodiments of the invention the function that is performed in response to the feedback signal may depend on the force that is used to actuate the pedal. For instance, if the driver presses the brake pedal with a force which is below a threshold this may be taken as an indication that the vehicle is moving too quickly but the apparatus 11 may retain control of the brakes and adjust the speed of the vehicle 1 accordingly. If the driver presses the brake pedal with a force which is above a threshold this may be taken to be an indication that the driver has noticed something that requires the vehicle to stop immediately. For instance, the driver might have noticed something that has not been detected by the parking sensors. In response to the actuation of the brake pedal with a force which is above the threshold the automatic control of the brakes may be overridden and the vehicle 1 may be stopped by the driver.

In some examples the feedback signals provided by the driver could be used to provide an adaptive parking assistance system 31. For instance, if the driver slows the vehicle down then this may be taken as an indication of the driver's preferred speed. Information indicative

of the driver's preferred speed may be stored in the memory 25 of the apparatus 11 and used to control the vehicle 1 during future manoeuvres.

5 In some embodiments of the invention it may be necessary to make one or more gear changes during the movement of the vehicle into the parking space. In such cases the apparatus 11 may control the notification means 43 to provide a further instruction to the vehicle indicative of the new gear required by the vehicle 1. The apparatus 11 may also control the clutch control means 37 to automatically open the clutch so that the only input the driver needs to make is the manual control of the gear control means 41. Once the correct
10 gear has been selected the apparatus 11 may control the parking assistance system 31 to continue with the manoeuvre.

In some embodiments of the invention the apparatus 11 may be arranged to receive input signals indicative of the status of components within the parking assistance system 31. This
15 may enable the apparatus 11 to take the status of the components of the parking assistance system 31 into account when controlling the movement of the vehicle 1. For instance, in some examples the apparatus 11 may be arranged to receive information relating to the current temperature of the gears. This may enable the apparatus 11 to determine if the gears are overheating or if unnecessary wear on the gears is taking place. The apparatus 11
20 may then be able to control the vehicle 1 to change gear or speed to control the temperature of the gears.

In some examples the apparatus 11 may be arranged to determine an angle of incline of the vehicle 1. The apparatus 11 may use the angle of incline of the vehicle 1 to control the
25 torque provided by the torque provider 33. For instance the apparatus 11 may be arranged to determine if the vehicle 11 is facing uphill or downhill. Any suitable means may be used to enable the apparatus 11 to determine the angle of incline of the vehicle 1. For instance an accelerometer may be arranged to determine an angle of inclination or a navigation system may be used to determine the location of the vehicle 1 and whether or not it is parked on a
30 hill.

The apparatus 11 may be arranged to control the torque provided by the torque provider to take into account whether or not the vehicle 1 needs to be moved up hill or downhill. For instance, if the vehicle 1 is facing downhill but needs to be moved in reverse then a larger

torque would be required than if the vehicle 1 was a flat surface. If the vehicle 1 is facing downhill and needs to be moved forward then a smaller torque would be required. In such examples the apparatus 11 may control the speed of the vehicle 1 by controlling the engagement of the clutch.

5

In some examples the amount of torque required may depend on the surface of the road that the vehicle 1 is travelling on. For instance if the road is uneven or cobbled then a higher torque may be required to keep the vehicle 1 moving. In such examples the apparatus 11 may determine if the vehicle 11 is travelling on an uneven surface and may control the torque provided as needed. In such cases the apparatus 11 may control the torque that is provided by using the brake control means 39 rather than changing the torque provided by the torque provider 33. This may provide for a more responsive parking assistance system 31 and smoother movement during the manoeuvre because it takes less time to adjust the torque by controlling the brakes than it does to adjust the torque by controlling the torque provider. Other surfaces that may affect the torque required to keep the vehicle 1 moving may comprise sand, snow, wet grass or any other suitable surfaces. In some examples the apparatus 11 may be arranged to detect such surfaces.

Fig 5 illustrates the status of components of a parking assistance system 31 during an example parking manoeuvre. The parking assistance system 31 may be as shown in Fig 3. Fig 5 shows the status of the torque provider 33, the steering control means 35 the clutch control means 37, the brake control means 39, the gear control means 41 and also the speed of the vehicle 1. It is to be appreciated that other parking assistance systems could be used in other embodiments of the invention.

25

Between time t_0 and time t_1 the driver is manually driving the vehicle 1. The driver has manual control of the torque provider 33, the steering control means 35 the clutch control means 37, the brake control means 39 and the gear control means 41. Before time t_1 the apparatus 11 does not have control of any of the components of the parking assistance system 31.

30

At time t_1 the driver initiates the parking assistance procedure. The driver may initiate the parking assistance procedure by making a user input via a user interface. Once the parking

assistance procedure has been initiated a parking space is identified and the vehicle 1 is slowed down until it has stopped moving.

5 In the example of Fig 5 the apparatus 11 takes control of the clutch control means 37 at time t_1 . That is, the apparatus 11 may enable automatic control of the clutch control means 37 as soon as the parking assistance procedure is initiated. This may enable the vehicle 1 to be stopped without stalling.

10 In the example of Fig 5 the parking assistance system 31 is arranged so that the driver retains manual control of the torque provider 33, the steering control means 37 and the brake control means 39 until the vehicle 1 is stopped.

15 At time t_2 the vehicle 1 has stopped in gear. There has been no gear change made so the vehicle 1 is still in second gear. The apparatus 11 now takes over automatic control of the torque provider 33, the steering control means 35 the clutch control means 37 and the brake control means 39.

20 However the apparatus 11 does not take over control of the gear control means 41. Instead the apparatus 11 controls the notification means 43 to provide an instruction to the driver to change the gear of the vehicle 1. In the example of Fig 5 the instruction will instruct the driver to arrange the vehicle 1 into a reverse gear. The instruction is given at time t_2 .

25 Shortly after time t_2 the driver has arranged the vehicle 1 into a reverse gear. Once the vehicle 1 is in the correct gear the apparatus 11 controls the clutch control means 37 to at least partially close the clutch and enable torque to be provided from the torque provider 33. The apparatus 11 may control the speed of the vehicle 1 by controlling the torque provider 33, the clutch control means 37 and the brake control means 39 as needed. The apparatus 11 also controls the steering control means 35 to direct the vehicle 1 into the parking space.

30 The apparatus 11 will control the vehicle 1 to stop the vehicle 1 when the vehicle is close to an obstacle positioned behind the vehicle 1. The apparatus 11 may stop the vehicle 1 when the distance between the obstacle and the vehicle 1 reaches a predetermined threshold.

Once the vehicle has stopped, the apparatus 11 controls the notification means 43 to provide a second instruction to the driver to change the gear of the vehicle 1. In the example of Fig 5 the instruction will instruct the driver to arrange the vehicle 1 into a forward gear. The instruction is given at time t_3 .

5

Once the vehicle 1 is in the forward gear the apparatus 11 controls the clutch control means 37 to at least partially close the clutch and enable torque to be provided from the torque provider 33. The apparatus 11 may control the speed of the vehicle 1 by controlling the torque provider 33, the clutch control means 37 and the brake control means 39 as needed.

10

The apparatus 11 controls the steering control means 35 to direct the vehicle 1 into the parking space.

At time t_4 the vehicle 1 is correctly positioned within the parking space. Once the vehicle 1 is correctly positioned the apparatus 11 brings the vehicle 1 to a stop. After time t_4 the driver may take over manual control of the vehicle 1 and so the driver may have full control of the torque provider 33, the steering control means 35, the clutch control means 37 and the brake control means 39.

15

Fig 5 shows that the apparatus 11 takes control of the different components of the parking assistance system 31 at different times during the parking assistance procedure. However the apparatus 11 does not take over control of the gear control means 41 so that the driver retains manual control of the gear control means 41 for the duration of the parking assistance procedure. This enables the parking assistance procedure to be provided in vehicles 1 with a manual transmission.

20

25

Fig 6 illustrates another example method which may be performed by the apparatus 11 to determine how to control components of the parking assistance system 31.

At block 61 the apparatus 11 determines the torque needed at the wheels of the vehicle 1. To determine the torque needed at the wheels the apparatus 11 may take into account a plurality of factors such as the angle of incline of the vehicle 1, the evenness of the road surface, the speed at which the vehicle 1 is to be moved and any other suitable factors.

30

The apparatus 11 may also obtain information from the torque provider 33 of the current torque being provided. At block 63 the apparatus 11 determines whether the torque provided needs to be increased or decreased.

5 If the torque needs to be increased then at block 65 the apparatus 11 provides a control signal to the torque provider 33 to increase the torque. In the example of Fig 6 there may be more than one torque provider 33. For example there may be provided an electrical machine, an internal combustion engine and any other suitable type of torque provider 33. The control signals may be provided to each of the different torque providers 33 to increase
10 the torque as needed.

If the torque needs to be reduced then at blocks 67 and 69 the apparatus 11 provides a control signal to the clutch control means 37 and/or the brake control means 39 as needed.

15 The blocks illustrated in Figs 4 and 6 may represent steps in a method and/or sections of code in the computer program 27. The illustration of a particular order to the blocks does not necessarily imply that there is a required or preferred order for the blocks and the order and arrangement of the block may be varied. Furthermore, it may be possible for some steps to be omitted.

20

Alternatively the vehicle 1 one may comprise an automatic transmission, and an apparatus, system and example method for a vehicle 1 with an automatic transmission as shown respectively in Figs. 7, 8 and 9.

25 Fig 7 illustrates an apparatus 111 which may be provided within the vehicle 1. The apparatus 111 may be arranged to provide parking assistance of the vehicle 1.

The apparatus 111 comprises a controller 121. The controller 121 may be a chip or a chip set. The controller 121 may form part of one or more systems comprised in the vehicle 1.

30 The controller 121 may be arranged to control any suitable functions or applications within the vehicle 1. In embodiments of the invention the controller 121 may be arranged to control parking assistance of the vehicle 1.

The controller 121 comprises at least one processor 123, at least one memory 125 and at least one computer program 127.

Implementation of a controller 121 may be as controller circuitry. The controller 121 may be implemented in hardware alone, may have certain aspects in software including firmware alone or may be a combination of hardware and software (including firmware).

As illustrated in Fig 7 the controller 121 may be implemented using instructions that enable hardware functionality, for example, by using executable instructions of a computer program 127 in a general-purpose or special-purpose processor 123 that may be stored on a computer readable storage medium (disk, memory etc) to be executed by such a processor 123.

The processor 123 may be arranged to read from and write to the memory 125. The processor 123 may also comprise an output interface via which data and/or commands are output by the processor 123 and an input interface via which data and/or commands are input to the processor 123.

The memory 125 may be arranged to store a computer program 127 comprising computer program instructions 129 (computer program code) that controls the operation of the controller 121 when loaded into the processor 123. The computer program instructions 129, of the computer program 127, provide the logic and routines that enables the controller 121 to detect that parking assistance has been selected and to implement the parking assistance methods. The processor 123 by reading the memory 125 is able to load and execute the computer program 127.

In some examples the controller 121 may be arranged to identify a parking space for the vehicle 1. In other examples the controller 121 may obtain information indicative of an identified parking space from a different controller.

The controller 121 may be arranged to identify the forwards or reverse direction of travel needed by the vehicle to move vehicle 1 into the identified parking spaces and may be arranged to operate the automatic transmission accordingly. The controller 121 may also be arranged to control the vehicle to be moved into the identified parking space.

As illustrated in Fig 7, the computer program 127 may arrive at the controller 121 via any suitable delivery mechanism 131. The delivery mechanism 131 may be, for example, a non-transitory computer-readable storage medium, a computer program product, a memory device, a record medium such as a compact disc read-only memory (CD-ROM) or digital versatile disc (DVD), an article of manufacture that tangibly embodies the computer program 127. The delivery mechanism may be a signal arranged to reliably transfer the computer program 127. The controller 121 may propagate or transmit the computer program 127 as a computer data signal.

Although the memory 125 is illustrated as a single component/circuitry it may be implemented as one or more separate components/circuitry some or all of which may be integrated/removable and/or may provide permanent/semi-permanent, dynamic/cached storage.

Although the processor 123 is illustrated as a single component/circuitry it may be implemented as one or more separate components/circuitry some or all of which may be integrated/removable. The processor 123 may be a single core or multi-core processor.

Fig 8 schematically illustrates an example system 131 which comprises an apparatus 111 as described above. The system 131 may be a parking assistance system which enables the vehicle 1 to be moved into a parking space with minimal input from the driver.

The example system 131 of Fig 8 comprises an apparatus 111, a torque provider 133, steering control means 135, automatic transmission control means 137, and brake control means.

In relation to Fig. 7 the apparatus 111 may be as described above in relation to Fig 8. The apparatus 111 may comprise one or more controllers 121. In some examples the controller 121 may be dedicated to the parking assistance system 131 and may solely control functions related to the parking assistance system 131. In other examples the controller 121 may be arranged to control functions of the other systems of the vehicle 1. This may enable the same controller 121 to be used for different systems. This may reduce the number of controllers 121 needed within the vehicle 1.

The torque provider 133 may comprise any means which may be arranged to provide a torque to the wheels of the vehicle 1. In some examples the torque provider 133 may comprise an engine which may be an internal combustion engine. The internal combustion
5 engine may be a petrol engine, a diesel engine or any other suitable type of engine. In some examples the torque provider 133 may comprise an electric machine or any other suitable type torque provider 133.

The torque provider 133 may be coupled to the wheels of the vehicle by a drive shaft. A
10 transmission may be used to couple the torque provider 133 to the drive shaft and control the power provided to the drive shaft and the wheels of the vehicle 1.

In the example system of Fig 8 the torque provider 133 is coupled to the apparatus 111 so that the torque provider 133 can send an input signal to the apparatus 111 and receive an
15 output signal from the apparatus 111. The input signal 111 that is provided from the torque provider 133 to the apparatus 111 may enable information about the current operating state of the torque provider to be provided to the apparatus 111. For example, it may enable information about the current power output to be provided to the apparatus 111.

The output signal that is provided by the apparatus 111 to the torque provider may enable
20 the apparatus 111 to control the output provided by the torque provider 133. For example it may enable the apparatus 111 to increase or decrease the power provided by the torque provider 133.

The steering control means 135 may comprise any means which enables the steering of the
25 vehicle 1 to be controlled. The steering of the vehicle 1 may control the direction of travel of the vehicle 1 when it is moving. In some examples the steering control means 135 may comprise a steering wheel and steering column which are coupled to the wheels of the vehicle 1. The steering wheel may be arranged so that it can be operated by the driver of the
30 vehicle 1 to enable manual control of the steering control means 135.

The steering control means 135 may also be coupled to the apparatus 111 to enable the steering control means 135 to receive an input signal from the apparatus 111. The input signal from the apparatus 111 may enable the steering control means 135 to be controlled

by the apparatus 111. When the steering control means 135 is being controlled by the apparatus 111 this enables automatic control of the steering of the vehicle 1. The automatic control requires no input from the driver.

5 The automatic control of the steering control means 135 may be enabled when the vehicle 1 is in some modes of operation and disabled when the vehicle 1 is in other modes of operation. For instance, during normal driving the driver may control the steering control means 135. If an assisted mode of driving is selected, for instance if parking assistance is selected, then the apparatus 111 may control the steering control means.

10

In some examples the brake control means 139 may be arranged so that the automatic control of the brake control means 39 may be overridden in response to a manual input from the driver. For instance, if the driver becomes aware of a reason to stop the vehicle 1 they may actuate the brake pedal of the vehicle 1. This may ensure that the vehicle can be
15 stopped even if the parking sensors have failed to detect a reason for stopping.

15

Fig 9 illustrates an example method according to embodiments of the invention. The method may be implemented using a parking assistance system 131 as described above. The blocks of the method, or at least some of the blocks of the method may be performed by the
20 apparatus 111.

20

The method comprises, at block 151, detecting that parking assistance has been selected. The parking assistance may be detected by a driver making a user input to select parking assistance. In some examples the driver may stop the vehicle 1 before selecting parking
25 assistance. In other examples the vehicle 1 may be arranged to enable the driver to select parking assistance while the vehicle 1 is still moving.

25

When the driver selects parking assistance an input signal is provided to the apparatus 111. In response to the input signal the apparatus 111 may enable a parking assist mode of
30 operation. In the parking assist mode of operation the apparatus 111 may take control of the steering control means 135, automatic transmission control means 137 and the brake control means 139.

30

Once parking assistance has been selected a parking space for the vehicle 1 may be identified. In some examples the parking space may be identified by the apparatus 111. In other examples one or more different controllers may identify the parking space and then provide information indicative of the identified parking space to the apparatus 111. The vehicle 1 may comprise ultrasound sensors, infrared sensors, imaging devices or any other suitable sensors which may enable a parking space to be identified.

At block 153 the apparatus 111 identifies the direction of travel needed by the vehicle to move the vehicle 1 into the identified parking space. For instance the apparatus 111 may determine whether the vehicle 1 needs to be arranged to move forwards or rearwards.

Once the apparatus 111 has determined a direction to be travelled by the vehicle, torque from the torque provider 133 is provided to the wheels of the vehicle 1 causing the vehicle to move in the desired direction. The apparatus 111 may control the steering control means 135 to direct the vehicle 1 into the identified parking space 155.

As the vehicle 1 is being moved in to the parking space the apparatus 111 may also control the speed of the vehicle 1. The apparatus 111 may control the speed of the vehicle 1 by controlling the brake control means 139 and/or the torque provider 133. In some examples the apparatus 111 may automatically control the speed of the vehicle 1 without any input from the driver. This may enable the parking to be carried out with minimal input from the driver.

In other examples the apparatus 111 may be arranged to receive feedback signals from the driver and change the speed of the vehicle, or other parameters of the movement of the vehicle 1, in response to the feedback signal. In some examples the feedback signal may comprise the driver actuating one or more pedals of the vehicle 1. The function that is performed in response to the feedback signal may depend on the pedal that is actuated by the driver. For instance, if the driver actuates the brake pedal this may provide a feedback signal indicating that the driver feels the vehicle 1 is moving too quickly. In response to this feedback signal the apparatus 111 may decrease the speed of the vehicle 1. If the driver actuates the accelerator pedal this may provide a feedback signal indicating that the driver feels the vehicle 1 is moving too slowly. In response to this feedback signal the apparatus

111 may increase the speed of the vehicle 1. An initial target speed may be a speed which is automatically set by the apparatus 111 when parking assistance is initiated.

In some embodiments of the invention the function that is performed in response to the feedback signal may depend on the force that is used to actuate the pedal. For instance, if the driver presses the brake pedal with a force which is below a threshold this may be taken as an indication that the vehicle is moving too quickly but the apparatus 111 may retain control of the brakes and adjust the speed of the vehicle 1 accordingly. If the driver presses the brake pedal with a force which is above a threshold this may be taken to be an indication that the driver has noticed something that requires the vehicle to stop immediately. For instance, the driver might have noticed something that has not been detected by the parking sensors. In response to the actuation of the brake pedal with a force which is above the threshold the automatic control of the brakes may be overridden and the vehicle 1 may be stopped by the driver.

In some examples the feedback signals provided by the driver could be used to provide an adaptive parking assistance system 131. For instance, if the driver slows the vehicle down then this may be taken as an indication of the driver's preferred speed. Information indicative of the driver's preferred speed may be stored in the memory 125 of the apparatus 111 and used to control the vehicle 1 during future manoeuvres.

In some embodiments of the invention the apparatus 111 may be arranged to receive input signals indicative of the status of components within the parking assistance system 131. This may enable the apparatus 111 to take the status of the components of the parking assistance system 131 into account when controlling the movement of the vehicle 1.

In some examples the apparatus 111 may be arranged to determine an angle of incline of the vehicle 1. The apparatus 111 may use the angle of incline of the vehicle 1 to control the torque provided by the torque provider 133. For instance the apparatus 111 may be arranged to determine if the vehicle 111 is facing uphill or downhill. Any suitable means may be used to enable the apparatus 111 to determine the angle of incline of the vehicle 1. For instance an accelerometer may be arranged to determine an angle of inclination or a navigation system may be used to determine the location of the vehicle 1 and whether or not it is parked on a hill.

The apparatus 111 may be arranged to control the torque provided by the torque provider to take into account whether or not the vehicle 1 needs to be moved up hill or downhill. For instance, if the vehicle 1 is facing downhill but needs to be moved in reverse then a larger torque would be required than if the vehicle 1 was on a flat surface. If the vehicle 1 is facing downhill and needs to be moved forward then a smaller torque would be required. In such examples the apparatus 111 may control the speed of the vehicle 1 by controlling the engagement of the clutch.

In some examples the amount of torque required may depend on the surface of the road that the vehicle 1 is travelling on. For instance if the road is uneven or cobbled then a higher torque may be required to keep the vehicle 1 moving. In such examples the apparatus 111 may determine if the vehicle 111 is travelling on an uneven surface and may control the torque provided as needed. In such cases the apparatus 111 may control the torque that is provided by using the brake control means 139 rather than changing the torque provided by the torque provider 133. This may provide for a more responsive parking assistance system 131 and smoother movement during the manoeuvre because it takes less time to adjust the torque by controlling the brakes than it does to adjust the torque by controlling the torque provider. Other surfaces that may affect the torque required to keep the vehicle 1 moving may comprise sand, snow, wet grass or any other suitable surfaces. In some examples the apparatus 111 may be arranged to detect such surfaces.

Although embodiments of the present invention have been described in the preceding paragraphs with reference to various examples, it should be appreciated that modifications to the examples given can be made without departing from the scope of the invention as claimed.

Features described in the preceding description may be used in combinations other than the combinations explicitly described.

Although functions have been described with reference to certain features, those functions may be performable by other features whether described or not.

Although features have been described with reference to certain embodiments, those features may also be present in other embodiments whether described or not.

5 Whilst endeavoring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

10

CLAIMS

1. An apparatus for providing parking assistance within a vehicle, the apparatus comprising:
means for detecting that parking assistance has been selected;
- 5 means for controlling the vehicle to be moved into an identified parking space; means for automatically controlling the speed of the vehicle; means for detecting a feedback signal from the driver that the speed of the vehicle should be reduced or increased, and means for changing the speed of the vehicle in response to the detected feedback signal.
- 10 2. An apparatus as claimed in claim 1 wherein the apparatus automatically sets a target speed when the apparatus detects that parking assistance has been selected.
3. An apparatus as claimed in claim 2 wherein the target speed of the vehicle is changed when a feedback signal from the driver that the speed of the vehicle should be reduced or
15 increased is detected.
4. An apparatus according to any of the preceding claims wherein the detected feedback signal comprises the driver actuating one or more of the pedals of the vehicle.
- 20 5. An apparatus as claimed in claim 4 wherein, in response to detected actuation of the brake pedal by the driver, the speed of the vehicle is reduced.
6. An apparatus as claimed in claim 5 wherein if the driver presses the brake pedal with a force which is below a threshold, the speed of the vehicle is reduced, but if the driver
25 presses the brake pedal with a force which is above a threshold, the parking assistance is overridden and the vehicle may stop.
7. An apparatus as claimed in any of claims 4 to 6 wherein, in response to detected actuation of the accelerator pedal by the driver, the speed of the vehicle is increased.
- 30 8. An apparatus as claimed in any preceding claim comprising means for determining an angle of incline of the vehicle and means for controlling the torque provided in response to the determined angle of incline of the vehicle.

9. An apparatus as claimed in any preceding claim comprising means for determining if the vehicle is travelling on at least one of; an uneven surface, sand, snow, wet grass.

10. An apparatus as claimed in any preceding claim comprising means for obtaining a control signal indicating a status of one or more components of the vehicle.

11. An apparatus as claimed in any preceding claim for providing parking assistance within a vehicle with manual transmission, the apparatus comprising means for identifying a gear needed by the vehicle to move the vehicle into an identified parking space; means for automatically opening a clutch to enable a gear to be selected; means for enabling an instruction to be provided to the driver of the vehicle where the instruction indicates the gear needed by the vehicle to enable the vehicle to be moved into the identified parking space; the means for controlling the vehicle to be moved into the identified parking space being operable after the driver has selected an appropriate gear.

12. An apparatus as claimed in claim 11 wherein the clutch is an electronic clutch.

13. An apparatus as claimed in claims 11 or 12 wherein the means for opening a clutch comprises means for automatically providing a control signal to the clutch.

14. An apparatus as claimed in any of claims 11 to 13 wherein the means for controlling the vehicle to be moved comprises means for automatically controlling a clutch.

15. An apparatus as claimed in any of claims 11 to 14 wherein the appropriate gear comprises at least one of; the gear indicated in the instruction, an alternative gear which enables the vehicle to be moved into the identified parking space.

16. An apparatus as claimed in any of claims 1 to 10 for providing parking assistance within a vehicle with automatic transmission.

17. An apparatus as claimed in any preceding claim wherein the means for controlling the vehicle to be moved comprises means for automatically controlling the steering of the vehicle.

18. An apparatus as claimed in any preceding claim wherein the means for controlling the vehicle to be moved comprises means for automatically controlling the brakes of the vehicle.

5 19. An apparatus as claimed in any preceding claim wherein the means for controlling the vehicle to be moved comprises means for automatically controlling a torque provider.

20. An apparatus as claimed in any preceding claim wherein the respective means are provided by one or more controllers.

10

21. A vehicle comprising an apparatus as claimed in any preceding claim.

22. A method for providing parking assistance within a vehicle, the method comprising:
detecting that parking assistance has been selected;

15

controlling the vehicle to be moved into an identified parking space;

automatically controlling the speed of the vehicle;

detecting a feedback signal from the driver and changing the speed of the vehicle in response to the detected feedback signal.

20

23. A method as claimed in claim 22 wherein the apparatus automatically sets a target speed when the apparatus detects that parking assistance has been selected.

24. A method as claimed in claim 23 wherein the target speed of the vehicle is changed when a feedback signal from the driver that the speed of the vehicle should be reduced or

25

increased is detected.

25. A method as claimed in any of claims 22 to 24 wherein the detected feedback signal comprises the driver actuating one or more of the pedals of the vehicle.

30

26. A method as claimed in claim 25 wherein in response to detected actuation of the brake pedal by the driver the speed of the vehicle is reduced.

27. A method as claimed in claim 26 wherein if the driver presses the brake pedal with a force which is below a threshold, the speed of the vehicle is reduced, but if the driver

presses the brake pedal with a force which is above a threshold, the parking assistance is overridden and the vehicle may stop.

28. A method as claimed in any of claims 25 to 27 wherein in response to detected actuation
5 of the accelerator pedal by the driver the speed of the vehicle is increased.

29. A method as claimed in any of claims 22 to 28 comprising determining an angle of incline
of the vehicle and controlling the torque provided in response to the determined angle of
incline of the vehicle.

10

30. A method as claimed in any of claims 22 to 29 comprising determining if the vehicle is
travelling on at least one of; an uneven surface, sand, snow, wet grass.

15

31. A method as claimed in any of claims 22 to 30, wherein the vehicle has manual
transmission, the method comprising identifying a gear needed by the vehicle to move the
vehicle into an identified parking space;

automatically opening a clutch to enable a gear to be selected;

enabling an instruction to be provided to the driver of the vehicle where the instruction
indicates a gear needed by the vehicle to enable the vehicle to be moved into the identified

20

parking space, the vehicle being controlled to move into the identified parking space after the
driver has selected an appropriate gear.

32. A method as claimed in claim 31 wherein the clutch is an electronic clutch.

25

33. A method as claimed in claims 31 or 32 wherein opening a clutch comprises
automatically providing a control signal to the clutch.

34. A method as claimed in any of claims 31 to 33 wherein controlling the vehicle to be
moved comprises automatically controlling a clutch.

30

35. A method as claimed in any of claims 31 to 34 wherein the appropriate gear comprises
at least one of; the gear indicated in the instruction, an alternative gear which enables the
vehicle to be moved into the identified parking space.

36. A method as claimed in any of claims 22 to 30 wherein the vehicle has automatic transmission.

5 37. A method as claimed in any of claims 22 to 36 wherein controlling the vehicle to be moved comprises automatically controlling the steering of the vehicle.

38. A method as claimed in any of claims 22 to 37 wherein controlling the vehicle to be moved comprises automatically controlling the brakes of the vehicle.

10 39. A method as claimed in any of claims 22 to 38 wherein controlling the vehicle to be moved comprises automatically controlling the torque provider.

40. A computer program for providing parking assistance within a vehicle, the computer program comprising instructions that, when executed by one or more processors, cause an
15 apparatus to perform, at least:
detecting that parking assistance has been selected;
controlling the vehicle to be moved into an identified parking space
automatically controlling the speed of the vehicle;
detecting a feedback signal from the driver and changing the speed of the vehicle in
20 response to the detected feedback signal.

41. A non-transitory computer readable medium comprising a computer program as claimed in claim 40.

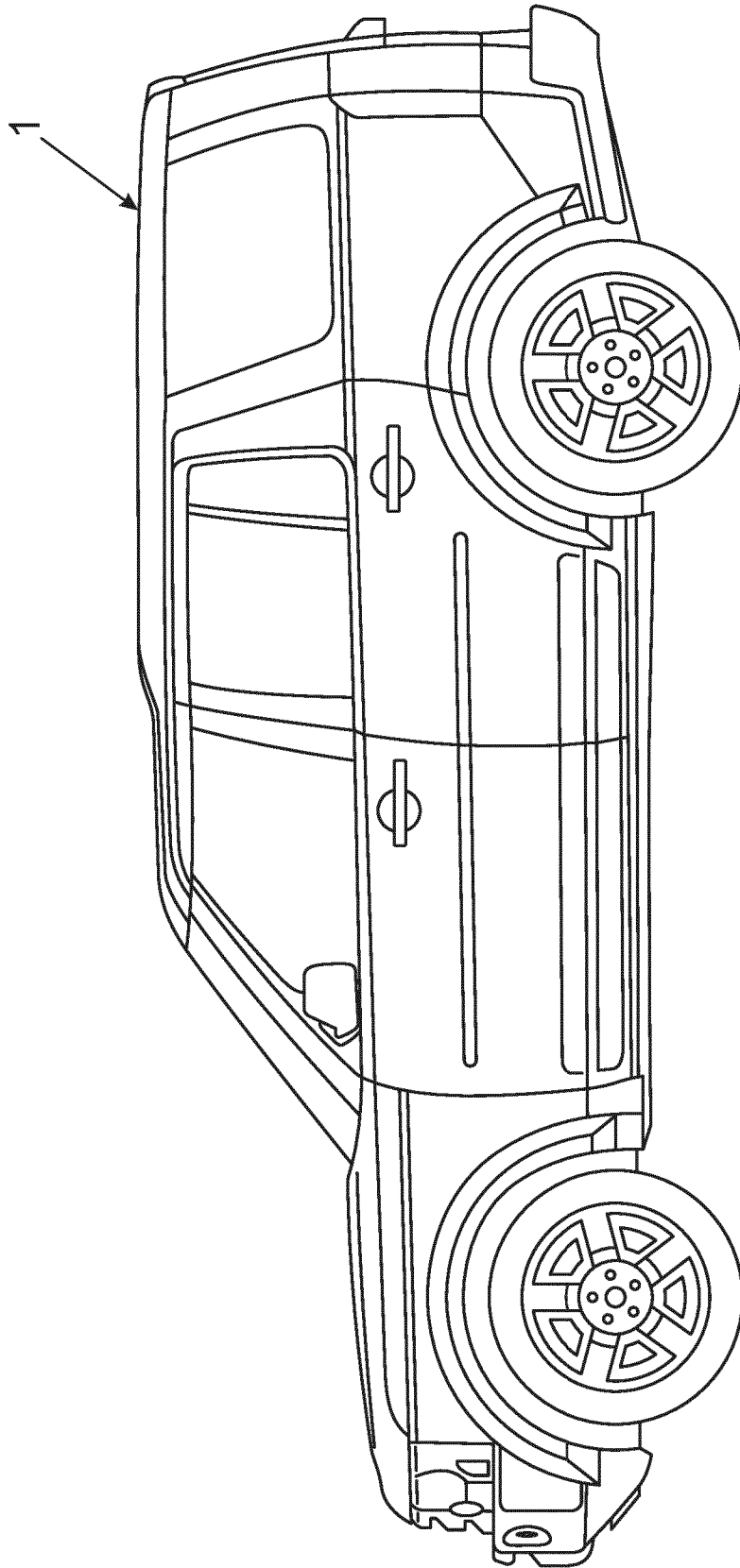


FIG. 1

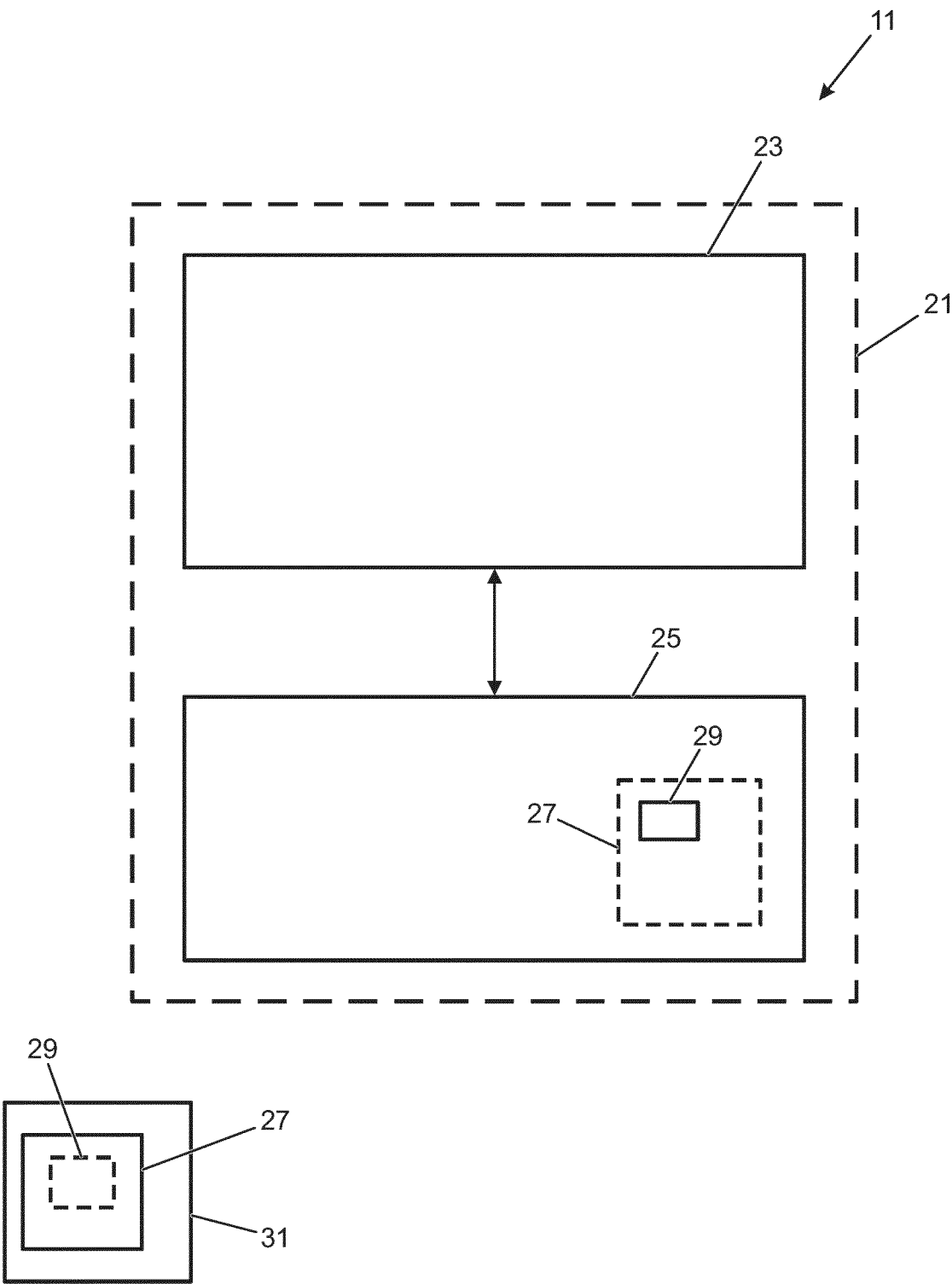


FIG. 2

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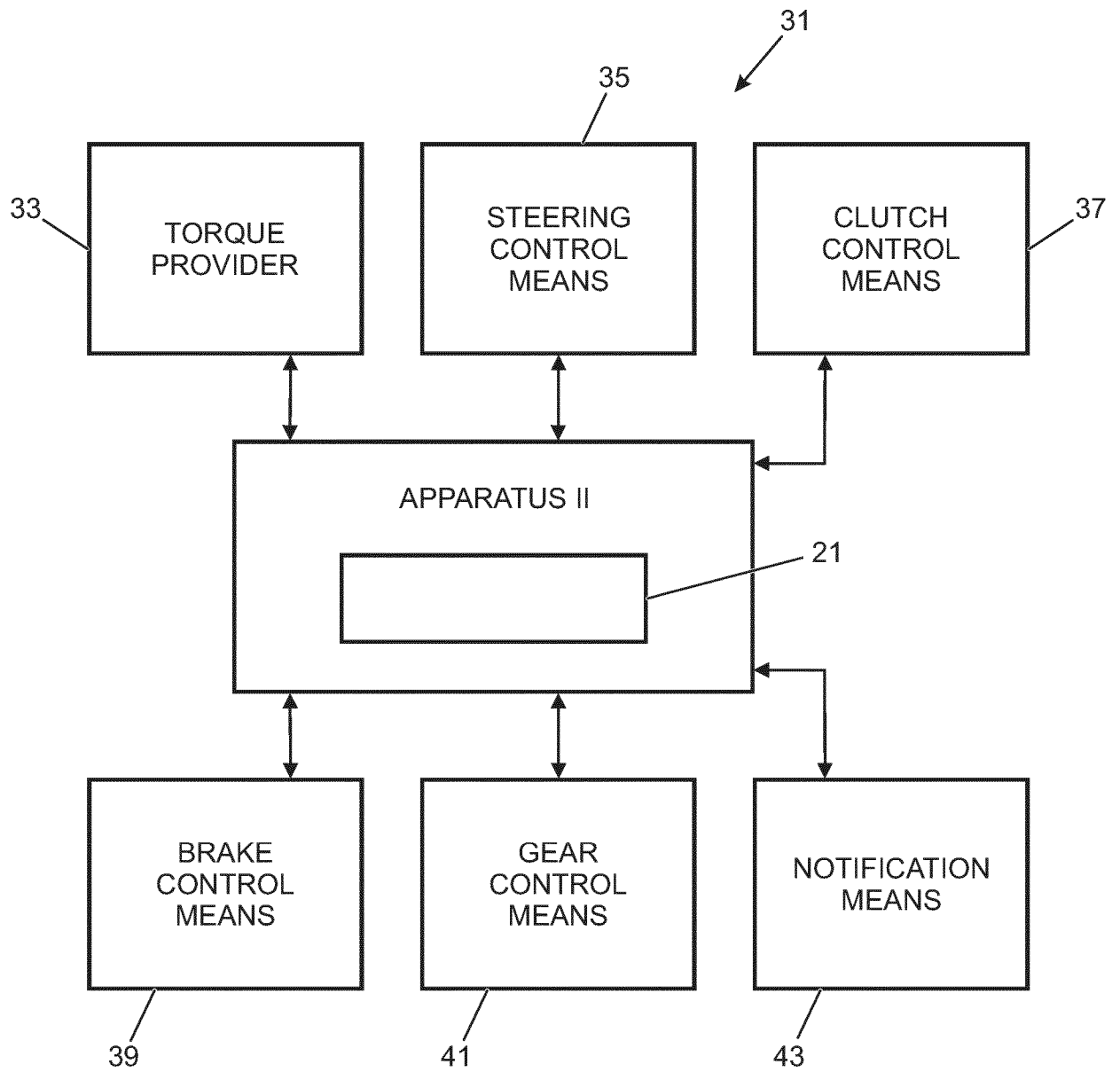


FIG. 3

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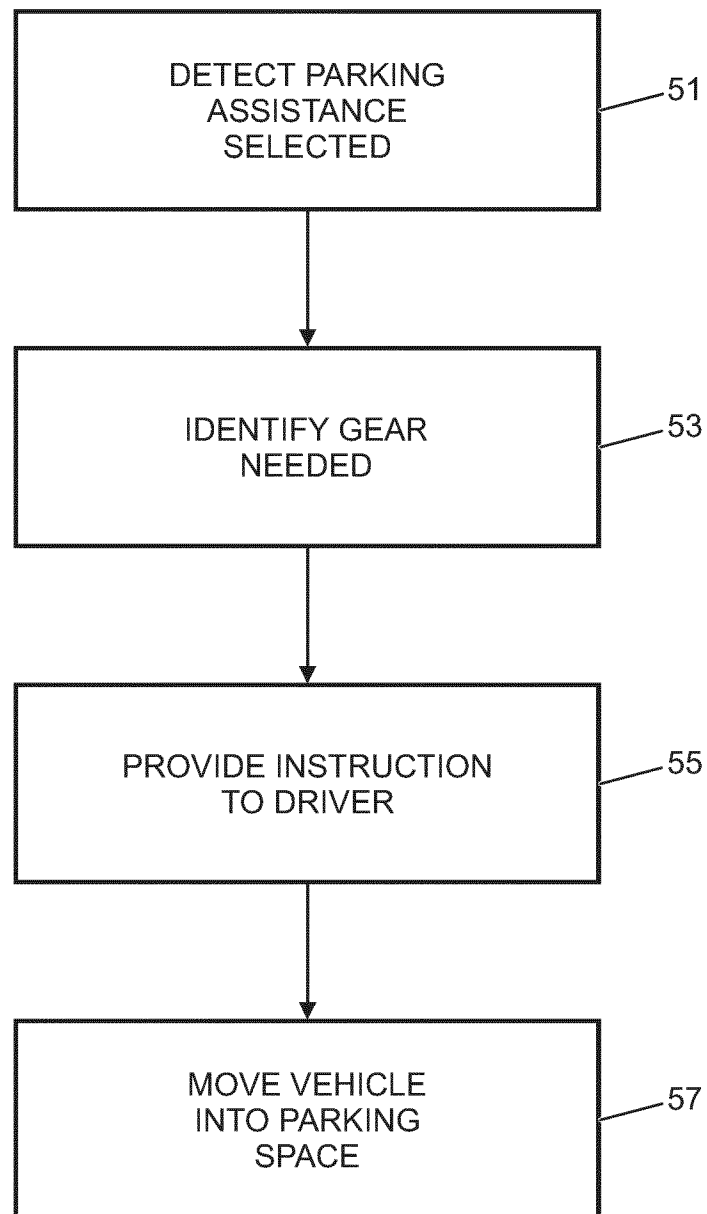


FIG. 4

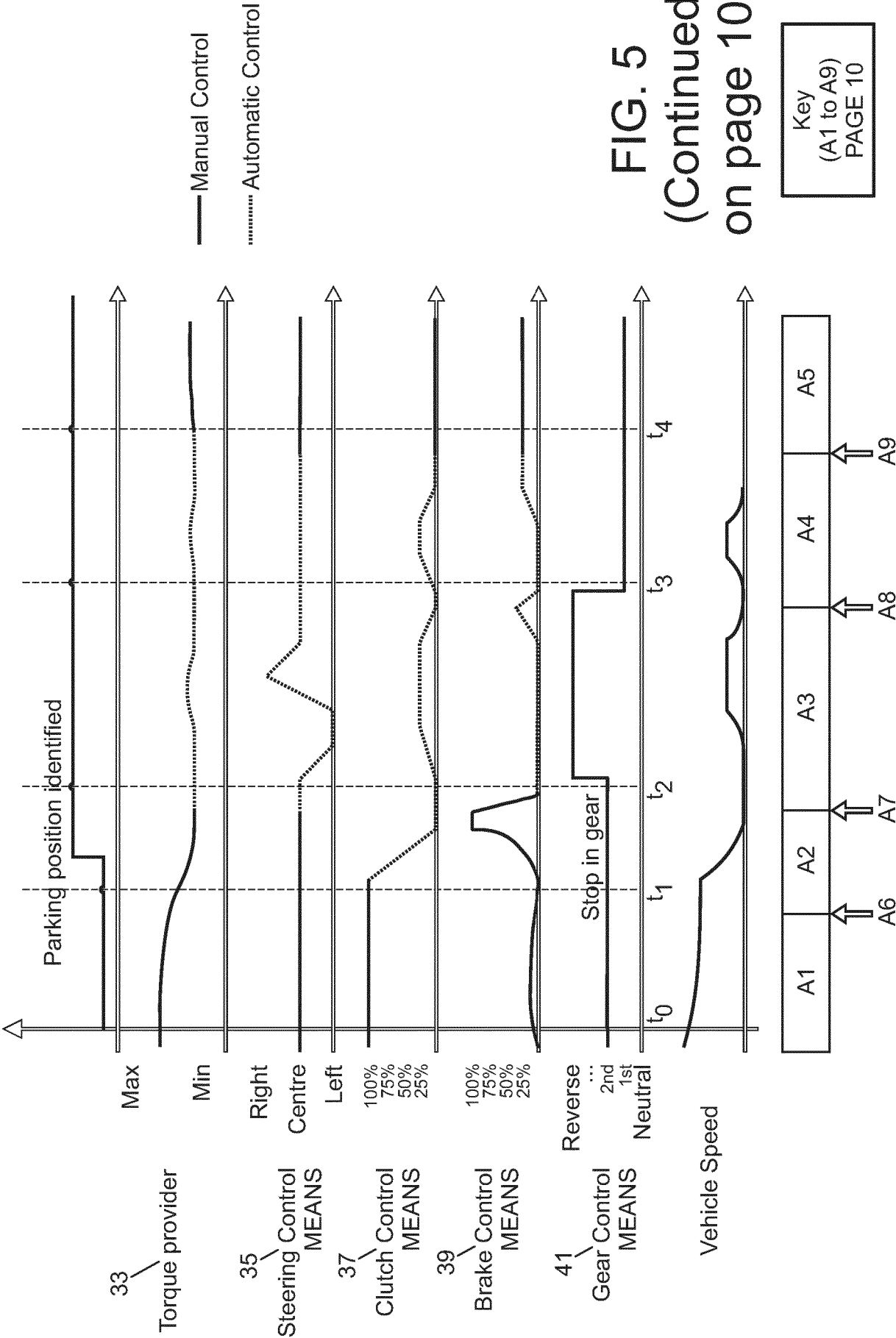


FIG. 5
(Continued
on page 10)

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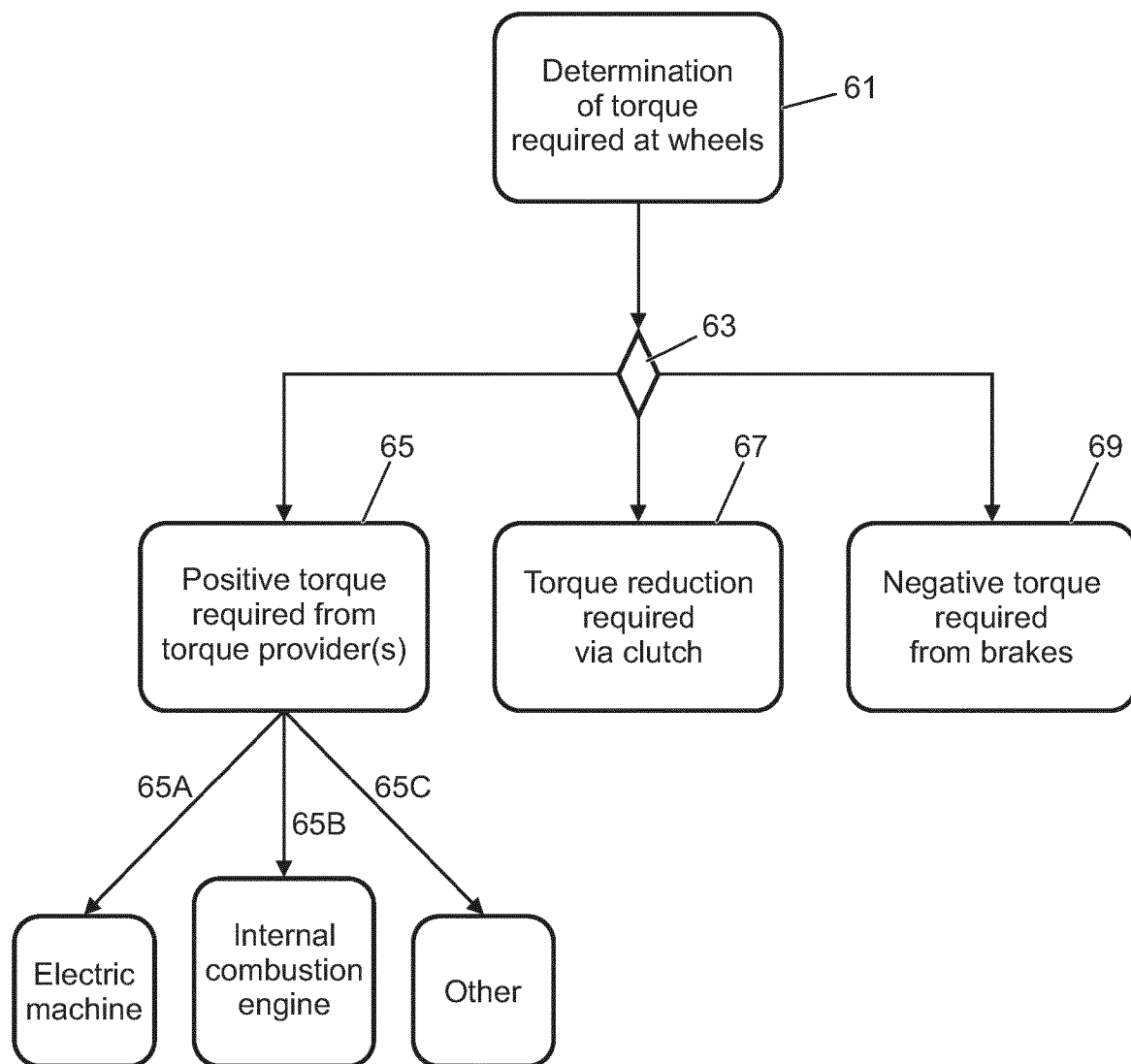


FIG. 6

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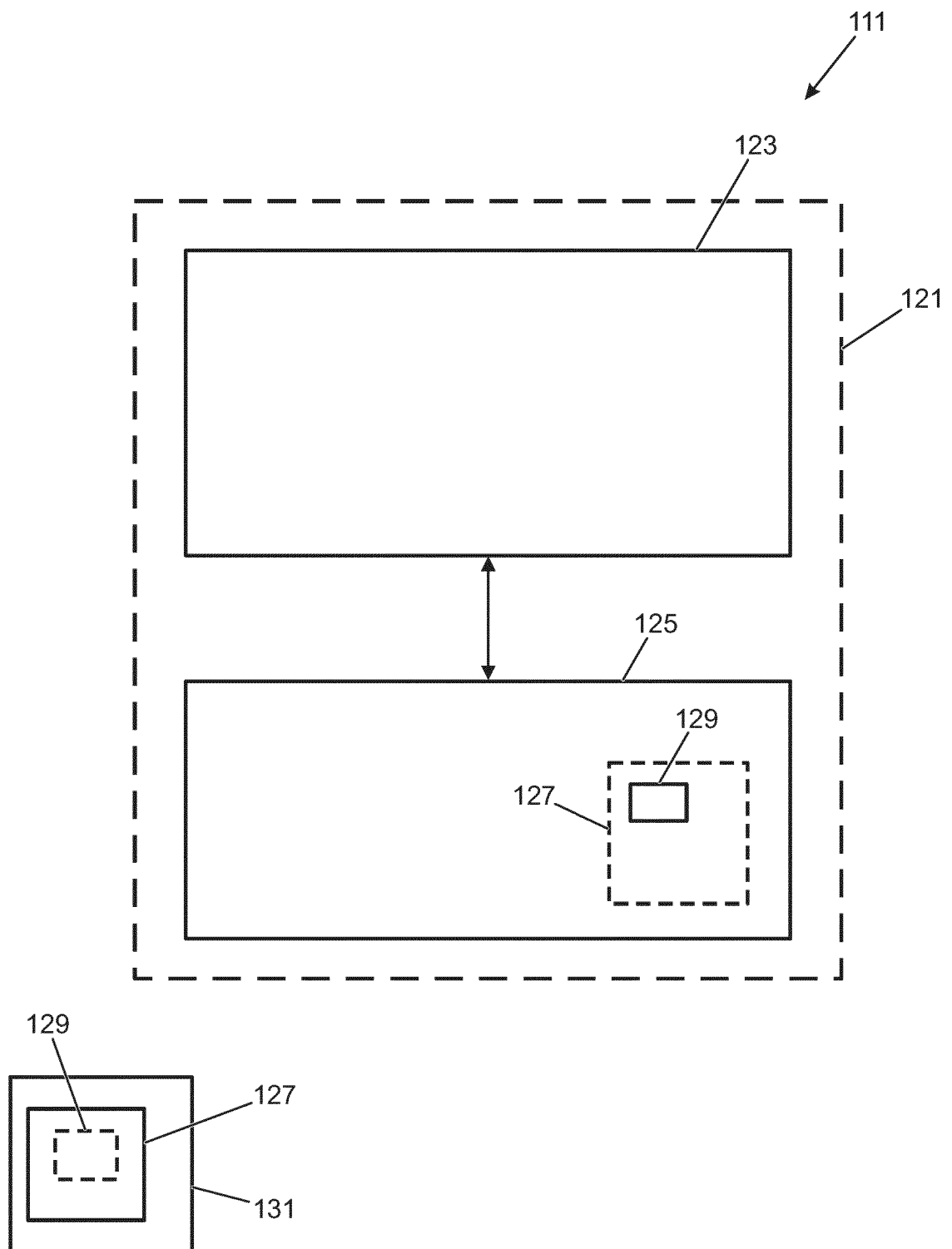


FIG. 7

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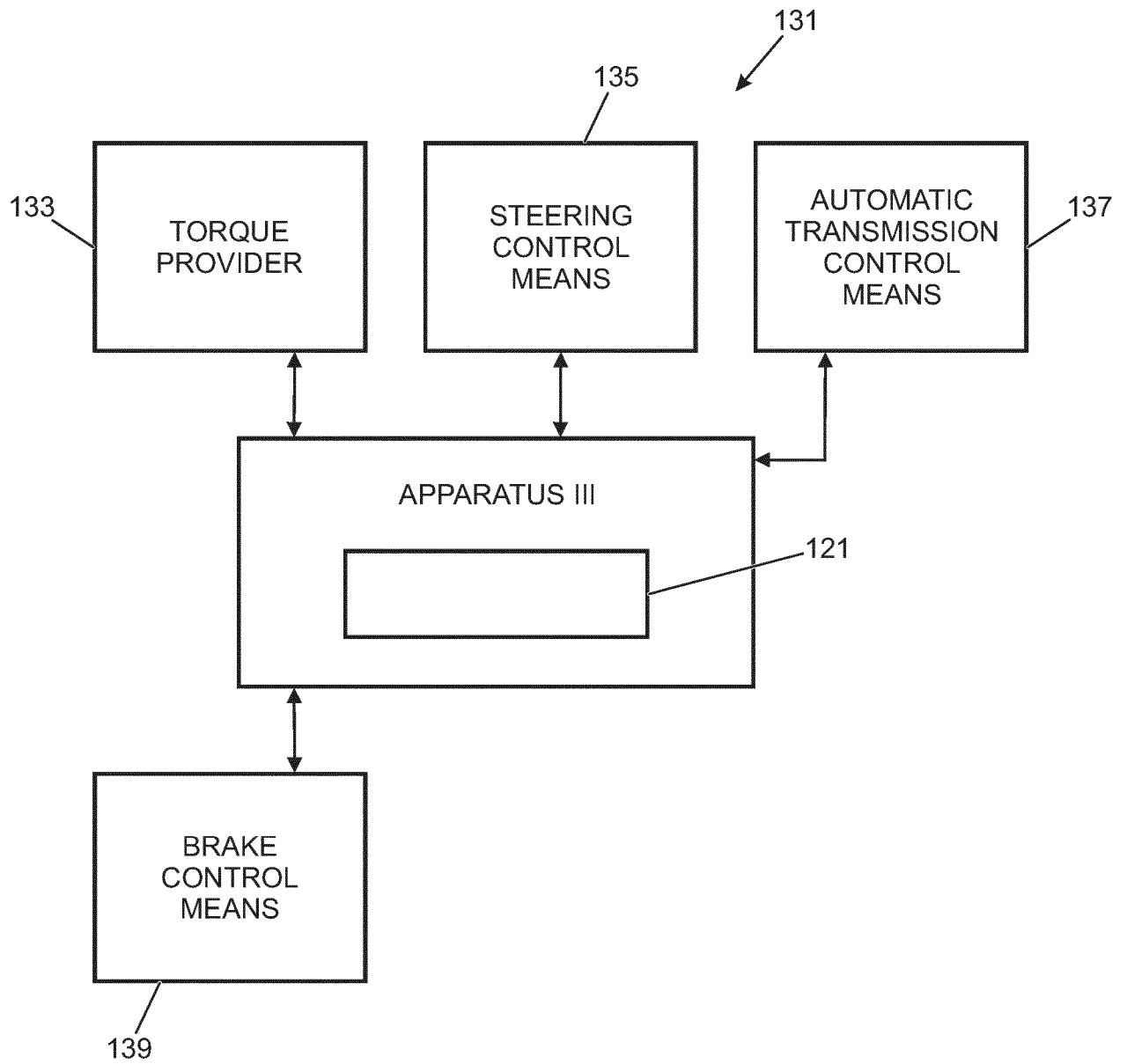


FIG. 8

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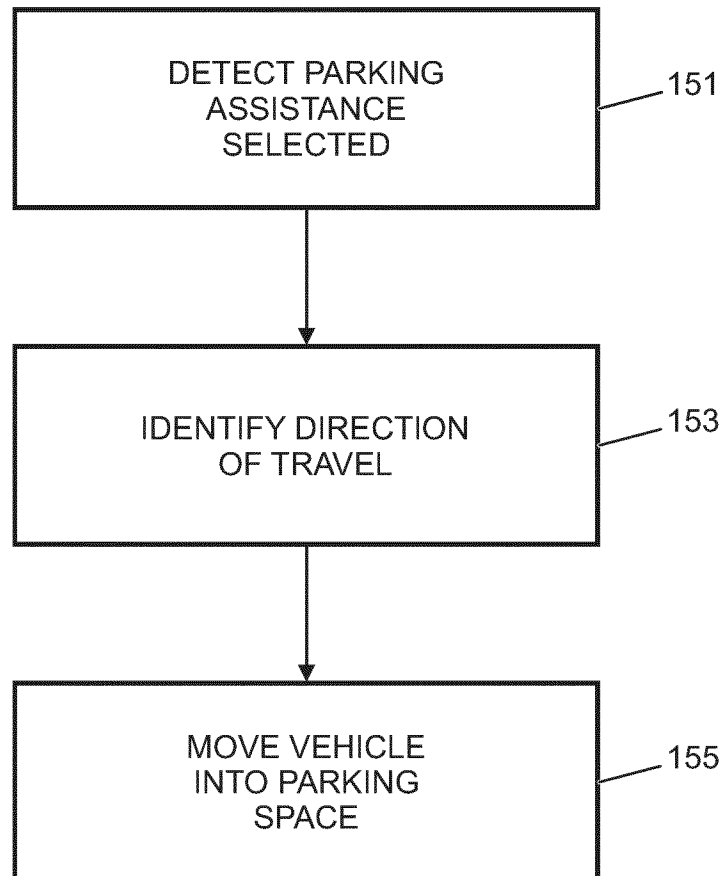


FIG. 9

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Key - (A1 to A9) Figure 5 Page 5.

A1	Driver drives vehicle
A2	Parking position identified and vehicle slows down to a stop (in gear)
A3	Vehicle is automatically driven in reverse and is stopped when it gets close to the obstacle behind
A4	Vehicle is automatically driven forward until positioned correctly
A5	Driver has full control
A6	Driver initialises the parking procedure
A7	Outputs message to the driver to release all pedals and shift in reverse
A8	...outputs message to the driver to shift in 1st gear
A9	Parking successful! Driver is invited to take over the commands of the vehicle

FIG. 5
(Continued from page 10)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/068483

A. CLASSIFICATION OF SUBJECT MATTER
INV. B62D15/02
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B62D

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 965 965 A1 (TOYOTA MOTOR CO LTD [JP]) 13 January 2016 (2016-01-13)	1-7,10, 16-28, 36-41
Y	paragraphs [0013], [0016] - [0020], [0035] - [0045]; claims; figures	8,9, 11-15, 29-35
X	----- EP 2 159 121 A1 (BOSCH GMBH ROBERT [DE]) 3 March 2010 (2010-03-03) paragraphs [0005], [0006], [0009], [0010], [0014], [0015], [0017], [0019], [0023]; claims; figures	1,22,40
Y	----- EP 1 327 553 A2 (TOYOTA MOTOR CO LTD [JP]) 16 July 2003 (2003-07-16) paragraphs [0049], [0050]; claims; figures	8,29
	----- -/-	



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

27 September 2017

Date of mailing of the international search report

09/10/2017

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

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PCT/EP2017/068483

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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Y	US 6 018 692 A (SHIMIZU YASUO [JP] ET AL) 25 January 2000 (2000-01-25) column 2, lines 12-20 column 5, lines 55-61; claims; figures -----	9,30
Y	WO 2016/089640 A1 (BORGWARNER INC [US]) 9 June 2016 (2016-06-09) page 2, paragraph 1 - page 3, paragraph 2 page 5, paragraphs 1,2; claims; figures -----	11-15, 31-35

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International application No

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