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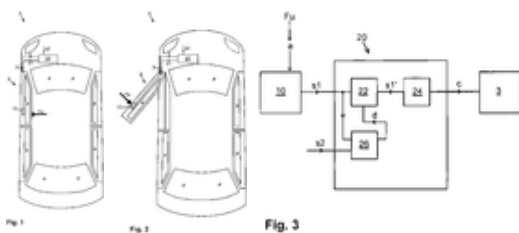
System and method for door actuation in a vehicle

Abstract

translated from German

The invention relates to a door actuation system for a vehicle (1) with a door (2) and a controllable drive device (3) for driving the door (2) in an opening direction and / or closing direction of the door (2). The system has: a sensor device (10) for generating a sensor signal (s1) which is caused by a force exerted by a user in the opening and / or closing direction on the door (2) and / or by a force exerted therewith in the opening or closing direction Movement (a) of the door (2) depends; and a control device (20) which is designed to process the sensor signal (s1), to evaluate the processed sensor signal (s1'), and depending on a result of the evaluation of the processed sensor signal (s1'), a control signal (c) to control the drive device (3). The control device (20) is also designed to carry out an analysis of the sensor signal (s1) and / or at least one further supplied signal (s2) in order to detect any disturbances in the sensor signal (s1) and, depending on a result of this analysis, the Adapt the processing of the sensor signal (s1) in order to reduce the influence of the interference on the generation of the control signal (c).

Images (3)



Classifications

- **E05F15/73** Power-operated mechanisms for wings with automatic actuation responsive to movement or presence of persons or objects

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Claims (12)

Hide Dependent ^
translated from German

System (10, 20) for door actuation for a vehicle (1) with a door (2) and a controllable drive device (3) for driving the door (2) in an opening direction and / or closing direction of the door (2), the system having: - A sensor device (10) for generating a sensor signal (s1) which is generated by a force exerted by a user in the opening and / or closing direction on the door (2) and / or by a movement (a) caused thereby in the opening or closing direction depends on the door (2), - A control device (20) which is designed to process the sensor signal (s1), to evaluate the processed sensor signal (s1'), and depending on a result of the evaluation of the processed sensor signal (s1'), a control signal (c) to control the drive device (3), wherein the control device (20) is also designed to carry out an analysis of the sensor signal (s1) and / or at least one further supplied signal (s2) in order to avoid any disturbances in the sensor signal (s1) and, depending on a result of this analysis, adapt the processing of the sensor signal (s1) in order to reduce the influence of the interference on the generation of the control signal (c). System (10, 20) Claim 1, wherein the sensor device (10) has an acceleration sensor arranged on the door (2). System (10, 20) according to one of the preceding claims, wherein the sensor device (10) has a rotation rate sensor arranged on the door (2). System (10, 20) according to one of the preceding claims, wherein the sensor device (10) has a force sensor arranged on the door (2). System (10, 20) according to one of the preceding claims, wherein the processing of the sensor signal (s1) includes filtering. System (10, 20) according to one of the preceding claims, wherein the evaluation of the processed sensor signal (s1') is provided for recognizing one of several predetermined operating actions of the user, wherein the predetermined operating actions include at least one operating action to initiate an automatic opening of the door and / or contain at least one operator action to initiate automatic closing of the door. System (10, 20) according to one of the preceding claims, wherein the analysis includes an assignment of a current fault situation to one of several predetermined fault scenarios, and where, depending on the result of this assignment, one of several predetermined processing types for processing the sensor signal (s1) is selected. System (10, 20) Claim 7, wherein at least one of the fault scenarios is characterized by an inclination of the vehicle (1) influencing the sensor signal (s1). System (10, 20) Claim 7 or 8th, wherein at least one of the fault scenarios is characterized by a vibration influencing the sensor signal (s1). A method for operating the door for a vehicle (1) with a door (2) and a controllable drive device (3) for driving the door in an opening direction and / or closing direction of the door (2), the method comprising: generating a sensor signal (s1) by a force exerted on the door (2) by a user in the opening direction and / or closing direction and / or depends on a movement (a) of the door (2) caused thereby in the opening or closing direction, processing the sensor signal (s1), evaluating the processed sensor signal (s1'), and generating a control signal (c) for controlling the Drive device (3) as a function of a result of the evaluation of the processed sensor signal (s1'), the method further comprising: - Analyzing the sensor signal (s1) and / or at least one further supplied signal (s2) in order to avoid any disturbances in the sensor signal (s1) and, depending on a result of this analysis, adapt the processing of the sensor signal (s1) in order to reduce the influence of the interference on the generation of the control signal (c). Vehicle (1) with a door (2) and a controllable drive device (3) for driving the door (2) in an opening direction and / or closing direction of the door (2), equipped with a system (10, 20) according to one of the Claims 1 until 9. Computer program product comprising a program code, which is executed on a data processing device according to a method Claim 10 performs.

Description

translated from German

The present invention relates to a system and a method for door actuation for a vehicle, the vehicle being equipped with a door and a controllable drive device for driving the door in an opening direction and / or closing direction of the door.

Such systems and methods can be used, for example, for door actuation in modern motor vehicles such as cars, trucks, etc. in order to bring about an automatic opening of the door and / or an automatic closing of the door.

In the example of use for a motor vehicle, the door can be in particular z. B. to a passenger compartment door such. B. act a driver's door. As an alternative or in addition, this convenient type of door operation can also be used on other doors of the vehicle concerned, in particular on cargo hold doors such as. B. trunk lids, tailgates etc.

It is an object of the present invention to show a way by means of which, in vehicles, convenient door operation of the type mentioned at the beginning can be implemented in a simple and reliable manner.



According to the invention, this object is achieved by a system according to claim 1 and a method according to claim 10. The dependent claims are directed to advantageous developments of the invention.

- eine Sensoreinrichtung zum Erzeugen eines Sensorsignals, das von einer durch einen Benutzer in Öffnungsrichtung und/oder Schließrichtung auf die Tür ausgeübten Kraft und/oder von einer damit in Öffnungsrichtung bzw. Schließrichtung bewirkten Bewegung der Tür abhängt, und
- eine Steuereinrichtung, die dazu ausgebildet ist, eine Verarbeitung des Sensorsignals durchzuführen, eine Auswertung des verarbeiteten Sensorsignals durchzuführen, und in Abhängigkeit von einem Ergebnis der Auswertung des verarbeiteten Sensorsignals ein Steuersignal zum Ansteuern der Antriebseinrichtung zu erzeugen.

The system according to the invention has:

- a sensor device for generating a sensor signal which depends on a force exerted by a user in the opening direction and / or closing direction on the door and / or on a movement of the door caused thereby in the opening direction or closing direction, and
- a control device which is designed to process the sensor signal, to evaluate the processed sensor signal, and to generate a control signal for controlling the drive device as a function of a result of the evaluation of the processed sensor signal.

According to the invention, the control device which z. B. can be designed as a microcontroller, further designed to carry out an analysis of the sensor signal and / or at least one further supplied signal in order to detect any disturbances in the sensor signal and to adapt the processing of the sensor signal as a function of a result of this analysis to reduce the influence of the disturbances on the generation of the control signal.

In the sensor signal generated by the sensor device, a useful signal corresponding to the operating action of a user and, depending on the "environmental scenario", one or more interference signals are superimposed. B. can lead to incorrect control of the drive device for driving the door. In the invention can be advantageous in particular z. B. a scenario-based, i. H. Processing adapted to a current scenario, in particular filtering of the sensor signal, can be implemented in order to suppress such interference signals or to filter them out of the sensor signal before it is evaluated as the "processed sensor signal". For the determination or assessment of the current scenario z. B. signals available on board the vehicle (z. B. data signals) and / or signals communicated from an external source to the vehicle (z. B. data signals) are used and fed to the analysis provided according to the invention. In the analysis, for. For example, an analysis part for determining (assessing) a "vibration scenario" can be provided, which takes into account a large number of conceivable types of vibrations. A second analysis part can, for. B. determine (assess) a "vehicle position scenario" which describes the spatial position of the vehicle (inclination) and / or changes in this spatial position over time. In a third analysis part, based on the results of the first and second analysis parts, a resulting malfunction scenario can be determined on which the processing of the sensor signal provided according to the invention is dependent. Depending on the fault scenario identified, z. B. a certain filtering of the sensor signal can be provided. With the invention, a signal-to-noise ratio (SNR) of the sensor signal can thus advantageously be improved. Incorrect activation of the drive device for driving the door can thus be better avoided.

With the invention, for example, a very convenient "door actuation by means of hand pressure" can be advantageously implemented, in which a user presses his hand against the relevant door in order to command a desired control of the drive device for (motorized) driving of the door.

In particular, z. For example, it can be provided that an exertion of force in the opening direction of a (z. B. closed, but unlocked) door causes an automatic opening and / or an exertion of force in the closing direction of a (completely or partially opened) door causes an automatic closing (and, if necessary, subsequent locking).

In the case of a door pivoted about a vertical axis such. B. the driver's door or passenger door of a vehicle then corresponds to a push of the user on the inside of the door to a command to open and / or a push of the user on the outside of the door to a command to close.



According to an operating concept realized with the invention, such operating actions for door actuation of one or more doors of the same vehicle can be specified, so z. B. in a motor vehicle to operate at least one passenger compartment door and / or at least one cargo hold door such. B. a trunk lid or a tailgate.

Notwithstanding the case of a purely rotationally about a pivot axis, z. B. a vertical or horizontal pivot axis, pivotably mounted on the vehicle door is provided according to one embodiment that the door when opening and closing each z. B. performs a substantially translational movement or z. B. performs a combined translational-rotary movement. The latter can be the case, for example, in motor vehicles with a so-called sliding door. Even with such doors, the user can z. B. exert a force with his hand in order to trigger a corresponding defined drive process using the controllable drive device.

In one embodiment, the sensor device is structurally combined with a device (also) arranged for other purposes in the door in question, such as. B. an electronic control unit, e.g. B. a control unit for controlling a drive of a vehicle window and / or a drive of a vehicle exterior mirror.

In one embodiment, the sensor device is designed to generate a sensor signal which depends on the force exerted on the door by the user, in particular e.g. B. from the force component oriented in the opening or closing direction of the door. If the door is pivotably mounted on the vehicle, then as an alternative or in addition to recording the force exerted by the user, it is also possible to record the torque exerted on the door as a result of this force. In this respect, the sensor device according to the invention can in this case, for. B. also include a torque sensor.

Alternatively or additionally, the sensor device can be designed to generate a sensor signal that depends on the movement of the door caused by the user force.

For the example of a pivotable door mounted on the vehicle, this means, for example, that z. B. instead of detecting the force exerted by the user on the door, detecting the movement (e.g. pivoting) of the door caused thereby can also be provided. For this, z. B. an acceleration sensor or a rotation rate sensor can be used.

In one embodiment it is provided that the sensor device has an acceleration sensor arranged on the door and / or a rotation rate sensor arranged on the door.

In a more specific embodiment, the sensor device has both an acceleration sensor and a rotation rate sensor. Sensor modules suitable for this (e.g. MEMS sensor modules) are commercially available and can be used for the invention.

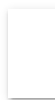
In a preferred embodiment, the sensor device, for. B. several sensors structurally combined in a sensor module, in particular z. B. an acceleration sensor for a multi-axis, z. B. three-axis acceleration measurement, and z. B. a rotation rate sensor for a multi-axis, z. B. three-axis rotation rate measurement. With each such sensor, the axes of which z. B. be oriented in pairs orthogonally to one another.

In one embodiment it is provided that the sensor device has a force sensor arranged on the door. The force sensor can, for. B. can be used to measure a compressive force exerted by a user in the opening direction on an inside of the door and / or to measure a compressive force exerted by a user in the closing direction on an outside of the door.

Accordingly, the sensor device can, for. B. have an operating element arranged on the inside of the door (or interact with it) and / or have an operating element arranged on the outside of the door (or interact with it).

The control element can, for. B. designed as a pressure plate or pressure bar and coupled to the force sensor in such a way that the pressure force exerted by the user is measured in the corresponding direction (opening direction or closing direction).

In particular, on the outside of the door, alternatively or additionally, however, also on the inside of the door, an operating element can, for. B. be designed as a handle ("door handle") coupled to the force sensor of the sensor device, on which a user can selectively exert a compressive force or a tensile force after reaching around the same.



So are z. For example, operating concepts are possible in which the user, as an alternative or in addition to "door actuation by hand pressure", can also conveniently "door actuation by hand pull", in which a user can use his hand on a suitably designed control element (e.g. handle) pulls on the door concerned in order to command a desired activation of the drive device for (motorized) driving of the door.

Here z. For example, it can be provided that a tensile force exerted on an operating element on the outside of a door (e.g. closed, but already unlocked) causes automatic opening in the opening direction of the door.

Furthermore, this z. For example, it can be provided that a tensile force exerted on an operating element on the inside of an (open) door causes an automatic closing in the closing direction of the door.

Any control element (e.g. handle, grip strip, etc.) that is designed to be suitable for exerting a tensile force by the user can, as an alternative or in addition to being used for the aforementioned tensile force detection, also be used for compressive force detection.

At this point, with regard to the above operating concepts, it should be pointed out that the terms "hand pressure" and "hand pull" primarily designate the operating actions that can be carried out by a user, whose detection by means of the sensor device, however, is independent of this. As already described, this detection can be based on a corresponding force measurement (or torque measurement), but alternatively or additionally also on a "movement measurement", since the user force causes or changes a movement of the door. Against this background, the term "caused movement" in the sense of the invention can be understood broadly, whereby the caused movement can be recorded differently depending on the door construction and measuring principle, e.g. B. as a speed or e.g. B. an acceleration (in each case, for example, a linear movement or, for example, a rotary movement), or as a time curve of such variables.

In one embodiment it is provided that the processing of the sensor signal includes filtering (e.g. high-pass filtering or band-pass filtering).

If the sensor signal generated by the sensor device is an analog signal, then z. B. analog filtering of this signal can be provided. Alternatively or additionally, however, z. B. digital filtering can be provided, be it after analog / digital conversion of an analog sensor signal or in the case of a sensor signal already provided in digital form by the sensor device.

If the processing of the sensor signal includes filtering, the adaptation of the processing of the sensor signal that takes place according to the invention as a function of a result of the analysis of the sensor signal, in particular z. B. include an adjustment (setting or changing) of "filter parameters" as required.

As a filter parameter of a high-pass filtering z. B. the relevant cutoff frequency (and / or edge steepness) can be adjusted.

As a filter parameter of a bandpass filtering, for. B. at least one of the two relevant limit frequencies (and / or the associated edge steepness) or a bandwidth of the bandpass filtering can be adapted.

Alternatively or additionally, other parameters of a filtering, such as in particular other parameters of a frequency response of a transfer function of the filtering, can be adapted.

In one embodiment it is provided that the evaluation of the processed sensor signal is provided for the detection of one of several predetermined operating actions of the user, the predetermined operating actions at least one operating action to initiate an automatic opening of the door and / or at least one operating action to initiate an automatic closing of the Include door.

As an operating action for initiating an automatic opening of a door, e.g. B. be provided that when the door is unlocked, a user exerts a force in the opening direction on the door. As an operating action for initiating an automatic opening of a pivotable door, for. B. be provided that when the door is unlocked, a user exerts a pressure force on the inside of the door. As an alternative or in addition, it can be provided here as such an operator action that a user exerts a pulling force on the outside of the door.



As an operator action for initiating automatic closing of a door, e.g. B. be provided that when the door is not closed, a user exerts a force in the closing direction on the door. As an operator action to initiate automatic closure of a pivotable door, for. B. be provided that when the door is not closed, a user exerts a pressure force on the outside of the door. As an alternative or in addition, it can be provided as such an operator action that a user exerts a tensile force on the inside of the door.

In one embodiment it is provided that the analysis of the sensor signal includes an assignment of a current fault situation to one of several predetermined "fault scenarios", one of several predetermined processing types being selected for processing the sensor signal as a function of the result of this assignment.

Each type of processing can, for. B. be defined by appropriately predetermined processing parameters. In the case of filtering taking place in the course of processing the sensor signal (e.g. high-pass filtering or band-pass filtering), the processing parameters can e.g. B. contain one or more of the filter parameters already mentioned above (e.g. cut-off frequency (s) and / or edge steepness (s) in the case of high-pass or band-pass filtering).

If the analysis of the sensor signal includes an assignment of a current malfunction situation to one of several predetermined "malfunction scenarios", one embodiment provides that at least one of the malfunction scenarios is characterized by an inclination of the vehicle that influences the sensor signal, and / or that at least one of the Disturbance scenarios is characterized by a vibration influencing the sensor signal.

An inclination of the vehicle with respect to a horizontal normal position of the vehicle, the sensor signal z. B. influence that a component of the gravitational force acting on the door is caused in the opening or closing direction of the door or changes when the inclination changes.

The inclination of the vehicle can, for. B. be done by a provided for measuring the same sensor system of the vehicle. In modern motor vehicles, such a sensor system is often available anyway (e.g. for automatic headlight range adjustment of a headlight device), so that in this case, data indicating the inclination that are advantageously available in the vehicle can be used.

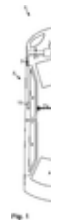
Otherwise, reference can be made to the state of the art in this regard with regard to the manner in which the inclination is determined. Since, in the context of the invention, only the inclination will be relevant when the vehicle is stationary, for inclination measurement z. B. an acceleration sensor fixed to the vehicle can be used, the sensor signal of which depends on the inclination of the vehicle.

In one embodiment it is provided that the sensor device provided according to the invention has an acceleration sensor for generating the sensor signal, this sensor signal also being used to detect the inclination of the vehicle. In this embodiment, an acceleration sensor is particularly preferably provided for a three-axis acceleration measurement in order to be able to detect all conceivable inclinations (as a vector quantity).

A vibration at any point in the vehicle can influence the sensor signal in particular in that a corresponding vibration is generated at the location where the sensor device (on the door) or a sensor contained therein (e.g. acceleration sensor and / or force sensor) is installed, and thus one of these Vibration corresponding fluctuation (interference signal component) is caused in the sensor signal generated. The term "vibration" includes in particular z. B. rather short-term "shocks" and z. B. also as "structure-borne noise" in the vehicle propagating acoustic vibrations.

It is therefore advantageous if a current inclination of the vehicle and / or a current vibration is taken into account in the predetermined malfunction scenarios in order to select a certain processing type (characterized by certain processing parameters) based on the malfunction scenario assigned to the current malfunction situation in such a way that the influence of the currently existing disturbances (such as e.g. inclination and / or vibration) is reduced to the generation of the control signal.

With the analysis of the sensor signal z. B. one or more vibrations of the type described below by way of example can be detected. In addition, as already mentioned above, the analysis of the sensor signal can be used to detect an inclination of the vehicle (if the sensor device contains an acceleration sensor and the sensor signal depends on the inclination of the vehicle).



As an alternative or in addition to the analysis of the sensor signal, at least one further signal that is provided or fed to the control device can also be analyzed in order to detect any disturbances in the sensor signal, as also explained below by way of example.

A first group of any malfunctions (which can be detected by the analysis according to the invention) is characterized in that they have a cause or source of malfunction located within the vehicle.

An example of this is the operation of an electric motor drive to drive a movable vehicle component such as, for. B. a vehicle window ("automatic window regulator") or an outside mirror ("automatic mirror adjustment"). An electric motor drive such vehicle components causes a respective characteristic vibration that z. B. can be detected by analyzing the sensor signal.

A second example is the vibration that occurs when an internal combustion engine (e.g. Otto engine or diesel engine) is started and switched off, be it due to appropriate operation by a user or due to an automatic control (e.g. "start-stop automatic"). An analysis of the sensor signal can be designed to detect this vibration.

A third example is a vibration that is caused by the operation of a loudspeaker in the vehicle, for example a loudspeaker (in particular, for example, a subwoofer) of an audio system in the vehicle. This vibration can also be detected by analyzing the sensor signal.

A fourth example is a vibration or shock that is caused by an actuation of mechanical controls by the user, in particular z. B. when actuating an operating element (e.g. a switch) that is arranged on the door (e.g. a switch for operating a window or an exterior mirror or a seat heater). This disturbance can also be detected by a suitably designed analysis of the sensor signal.

The analysis of the sensor signal provided in the invention can in particular, for. B. include an analysis of the frequency spectrum of the sensor signal (z. B. Fourier analysis) in order to identify one or more sources of interference based on a detection of peaks in the frequency spectrum (cf. z. B. the above four examples), then z. B. to define a suitable "fault scenario", be it z. B. by selecting a certain failure scenario from a plurality of fixed failure scenarios, or z. B. by establishing a disturbance scenario defined by disturbance parameter values.

In one embodiment of the invention it is provided that at least one of the above four examples of disturbances is detected by means of the analysis of the sensor signal and / or at least one further signal.

In all of the above four examples, a signal that is already available in the vehicle can advantageously be used as the "further" signal.

In the first example, i. H. a vibration caused by the operation of an electric motor drive can in particular z. B. a corresponding drive control signal or a signal derived therefrom can be used. In the example of an electric window regulator, a further signal could be e.g. B. a control signal generated by a window regulator can be analyzed. In an electric exterior mirror adjustment can be used in an analogous manner as a further signal z. B. a signal tapped from the relevant exterior mirror control can be used.

For the second example, i. H. a vibration / shock caused by starting / stopping an internal combustion engine, a control signal available in the area of the engine control can be picked up and fed to the analysis as a further signal.

In the third example, i. H. a vibration caused by the operation of a loudspeaker, e.g. B. a signal tapped from the relevant control device (z. B. audio system of the vehicle) can be used as a further signal, which indicates the loudspeaker operation. As an alternative or in addition, the audio signal supplied to the loudspeaker to operate it can itself be used as the further signal d. H. be fed to the analysis.

Also for the fourth example, i. H. a vibration or shock caused by the actuation of a mechanical control element, at least in the case of an electrical switch or button as the control element of the analysis, a further signal can be supplied, namely a z. B. from that electrical device tapped signal which monitors the operating state of the control element.



A second group of any malfunctions (which can be detected by the analysis according to the invention) is characterized in that they have a cause or source of malfunction located outside the vehicle.

A first example of this is the vibration of vehicle components (e.g. the vehicle doors, or e.g. other components) by varying Wind forces, e.g. B. by varying wind strength and / or wind direction, or z. B. by stimulating resonant vibrations.

A second example is a vibration or shock caused by the impact of a foreign body (e.g. soccer ball) on the vehicle or in particular e.g. B. the door in question arises.

In one embodiment of the invention it is provided that at least one of the above two examples of disturbances is detected by means of the analysis of the sensor signal and / or at least one further signal.

Such disturbances can also be detected by the analysis of the sensor signal provided in the invention. B. an analysis of the frequency spectrum of the sensor signal (as already described above) can be used, and after identifying one or more disturbances (cf. z. B. the above two examples) z. B. a suitable "fault scenario" can be defined for this (as already described above).

In each of the two above examples, a "further" signal can also be fed to the analysis according to the invention (as an alternative to or in addition to the sensor signal).

In the first example, i. H. a possible disturbance by wind, a further signal can be analyzed for a detection of the disturbance, which indicates a current extent of the wind (z. B. wind strength) at the location of the vehicle, or from which such information can be derived. Such a further signal can e.g. B. generated by means of suitable sensors of the vehicle or z. B. by means of a cellular connection as a data signal z. B. containing weather report data from an external device (data server) are transmitted to the vehicle. Information about the location of the vehicle will often be available in the vehicle anyway, e.g. B. from the one z. B. satellite-based positioning system of the vehicle (z. B. GPS unit or navigation system) generated data.

In the second example, i. H. a vibration or shock caused by a foreign body (e.g. soccer ball) hitting the vehicle, a further signal can be used for the analysis according to the invention, at least in the case of a vehicle with suitable sensors for detecting the surroundings. Such a sensor system for capturing the surroundings can in particular have one or more imaging sensors (for example cameras) which output image data relating to the surroundings of the vehicle to an image evaluation device which determines an "environmental scenario" therefrom. Such systems comprising the sensors and the image evaluation device are z. B. is often provided anyway in autonomous vehicles. In the context of the invention, a signal provided by an image evaluation device (e.g. containing data relating to the surrounding scenario) can be tapped and fed to the analysis as a further signal.

In the event of any interference with the sensor signal due to the vehicle being inclined, the interference due to an inclination deviating from a normal horizontal position of the vehicle has already been discussed above. This disturbance arises z. B. with a vehicle parked on an incline and / or uneven surface. As an alternative or in addition to such a "static" disturbance due to vehicle inclination, the analysis can be designed to take into account inclinations of the vehicle which are to be designated as "dynamic" and which are characterized in that the inclination changes over time according to a change in the load over time and / or Load distribution changes. If z. B. people get on or off, or z. B. move people inside the vehicle, it can (depending on the suspension of the vehicle) be accompanied by a corresponding change in the inclination. The analysis of the sensor signal can, for. B. be designed to detect this disturbance taking into account typical characteristics of such inclination changes.

In the context of the invention, the analysis of the sensor signal and / or at least one further signal for the detection of one or more possible disturbances is provided, whereby z. B. one or (preferably) several of the disorders described by way of example can be detectable.

In the context of the invention, the processing of the sensor signal is adapted as a function of a result of the analysis, that is to say adjusted appropriately or z. B. suitably (if necessary) changed in order to reduce the



influence of the interference on the generation of the control signal.

During the analysis, in particular the explained assignment of a current fault situation to one of several predetermined fault scenarios can be carried out. B. can be a certain number of mutually different scenarios. Alternatively or additionally, a "parameterized" fault scenario can be determined (estimated) based on the result of the analysis in order to adapt the processing of the sensor signal as a function thereof (e.g. by adapting parameters of a processing algorithm and / or e.g. adapting filter parameters in the case of a filtering of the sensor signal).

- Erzeugen eines Sensorsignals, das von einer durch einen Benutzer in Öffnungsrichtung und/oder Schließrichtung auf die Tür ausgeübten Kraft und/oder von einer damit in Öffnungsrichtung bzw. Schließrichtung bewirkten Bewegung der Tür abhängt,
- Verarbeiten des Sensorsignals, Auswerten des verarbeiteten Sensorsignals, und Erzeugen eines Steuersignals zum Ansteuern der Antriebseinrichtung in Abhängigkeit von einem Ergebnis der Auswertung des verarbeiteten Sensorsignals, und
- Analysieren des Sensorsignals und/oder wenigstens eines weiteren zugeführten Signals, um damit etwaige Störungen des Sensorsignals zu detektieren und in Abhängigkeit von einem Ergebnis dieser Analyse die Verarbeitung des Sensorsignals anzupassen, um den Einfluss der Störungen auf die Erzeugung des Steuersignals zu reduzieren.

According to a further aspect of the invention, a method is proposed for operating the door for a vehicle with a door and a controllable drive device for driving the door in an opening direction and / or closing direction of the door, the method comprising:

- Generating a sensor signal that depends on a force exerted on the door by a user in the opening and / or closing direction and / or on a movement of the door caused thereby in the opening or closing direction, Processing the sensor signal, evaluating the processed sensor signal, and generating a control signal for controlling the drive device as a function of a result of the evaluation of the processed sensor signal, and
- Analyzing the sensor signal and / or at least one further supplied signal in order to detect any disturbances in the sensor signal and, depending on a result of this analysis, adapt the processing of the sensor signal in order to reduce the influence of the disturbances on the generation of the control signal.

According to a further aspect of the invention, a vehicle with (at least) one door and a controllable drive device for driving the (at least one) door in an opening direction and / or closing direction of the door is proposed, the vehicle being equipped with a system of the type described here .

According to a preferred use, the vehicle is a road motor vehicle such as, in particular, a car or truck. When the door to be operated according to the invention, it can be, for. B. to (at least) one passenger compartment door such. B. act a driver's door. Alternatively or additionally, however, the door actuation can also be used on other doors of the vehicle concerned, e.g. B. in (at least) one cargo hold door such. B. a trunk lid or a tailgate. When using the invention for several doors of a vehicle z. For example, a control device used jointly for all these doors can be provided (e.g. central control unit).

According to a further aspect of the invention, a computer program product comprising a program code is proposed which, when executed on a data processing device (e.g. program-controlled control device of a vehicle), carries out a method of the type described here.

The embodiments and special configurations described here for the door operating system according to the invention or the vehicle equipped with it can also be provided, individually or in any combination, in an analogous manner as embodiments or special configurations of the door operating method according to the invention, and vice versa.



- 1 eine schematische Draufsicht eines Fahrzeuges mit einem Türbetätigungssystem gemäß eines Ausführungsbeispiels,
- 2 eine der 1 entsprechende Draufsicht des Fahrzeuges, jedoch in einem Zustand nach Öffnung einer Tür des Fahrzeuges, und
- 3 ein Blockschaltbild des Türbetätigungssystems des Fahrzeuges.

The invention is further described below on the basis of exemplary embodiments with reference to the accompanying drawings. They represent:

- 1 a schematic top view of a vehicle with a door operating system according to an embodiment,
- 2 one of the 1 Corresponding top view of the vehicle, but in a state after a door of the vehicle has been opened, and
- 3 a block diagram of the vehicle's door operating system.

1 shows a vehicle 1 with a door 2 and a controllable drive device 3 for controllable driving of the door 2 in an opening direction and in a closing direction of the door 2 .

In the example shown, it is the vehicle 1 around a four-door car, the doors of which can be pivoted on the vehicle in a conventional manner around a vertical pivot axis 1 are hinged. The door 2 In this example, denotes the driver's door of the car shown.

The vehicle 1 is with a system 10 , 20th equipped for door operation, by means of which at least the door in the example shown 2 can be operated, with an automatic drive of the door 2 with the help of the drive device 3 takes place, which for this purpose has, for example, an electric motor.

The system 10 , 20th has a sensor device 10 to generate a sensor signal s1, which is transmitted by a user to the door 2 exerted force and / or a movement of the door caused thereby 2 depends.

In the example shown, it is further assumed that the sensor signal s1 only depends on the movement of the door in the opening or closing direction caused by a user.

The system 10 , 20th furthermore has a control device 20th (z. B. electronic program-controlled control device) to which the sensor signal s1 is fed and which, according to a control algorithm, a control signal c for controlling the drive device 3 generated and to the drive device 3 issues.

In 1 is an example of the situation in which an in the interior of the vehicle 1 Driver (user) located after unlocking the door 2 briefly a force F_u on the door 2 exercises and thus a corresponding movement (here: pivoting) of the door 2 causes in the opening direction. Alternatively, a user could briefly exert a tensile force on the door from the outside 2 exercise.

The resulting opening movement of the door 2 is from the sensor device 10 recorded for this in the door 2 is installed and z. B. can have an acceleration sensor and / or a rotation rate sensor.

If in the example of 1 the sensor device 10 has an acceleration sensor, it should expediently z. B. at least measure the acceleration in the direction in which the movement caused by the user runs. In the example shown, the door that can be pivoted about a pivot axis (e.g. door 2) Both the opening movement and the closing movement take place (at the location of the sensor device 10 measured) always in the tangential direction or always in a fixed predetermined direction with respect to the door. At the door shown 2 this is the one to a "plate level" of the door 2 orthogonal direction.

If the sensor device 10 has a rotation rate sensor, this should expediently z. B. measure at least the rate of rotation around an axis of rotation, the orientation of which corresponds to the orientation of the pivot axis of the door. At the door shown 2 this is the rate of rotation measured around a vertical axis.

By using an acceleration sensor and / or a rotation rate sensor, opening movements and closing movements of the door caused by the user can therefore advantageously be recorded.



In a departure from the example shown, the sensor device could 10, as an alternative or in addition to an acceleration sensor and / or rotation rate sensor, but also z. B. have a force sensor for generating a sensor signal which depends on the force exerted on the door by the user.

The system 10, 20th realizes in the example shown an operating concept in which a user starting from the in 1 situation represented by a minor and z. B. only brief opening movement of the door 2 can initiate an automatic further movement of the door in the opening direction (e.g. up to a fully open position).

This opening movement of the door 2 is in the example by the z. B. equipped with an electric motor drive device 3 causes which, for this purpose, is in turn controlled by means of the control signal c, which is sent by the control device 20th is generated and output.

2 shows an example of a state of the vehicle 1 after the door 2 opened.

That from the system 10, 20th The implemented operating concept provides that, based on this situation (2) a user by causing the door to move slightly 2 in the closing direction by means of the drive device 3 can initiate further movement effected in the closing direction (preferably up to the completely closed state).

In 2 a force F_u is shown as an example, which is applied by a user to the door for the purpose of automatic door closing 2 is exerted, be it as a compressive force from the outside or as a tensile force from the inside.

After the automatic door closure has been completed, the vehicle has 1 again the in 1 State shown with the door closed 2 .

3 shows a block diagram of the control device 20th . This includes a processing unit 22nd for processing (e.g. filtering) the sensor signal s_1 to form a processed sensor signal s_1' , the specific manner of this processing being controlled by a supplied analysis result signal d.

The analysis result signal d can, for. B. be representative of a certain scenario or failure scenario and enables the processing unit 22nd In the example shown, to adapt the processing accordingly, for example to "filter out" a disturbance that is present for the disturbance scenario (e.g. vibration from a running electric window regulator motor) or to attenuate its intensity (interfering signal component).

The processed (e.g. adapted filtered) sensor signal s_1' is sent to an evaluation unit 24 the control device 20th fed. The evaluation unit 24 carries out an evaluation of the processed sensor signal s_1' in order to activate the drive device as a function of a result of this evaluation 3 to create.

In the example shown, the evaluation of the signal s_1' serves to identify the above-explained operating actions of a user, specified according to an operating concept, and by means of the control signal c, the door drive provided for a recognized operating action 2 head for.

The control device 20th further comprises an analysis unit 26th to which the (not yet processed) sensor signal s_1 is fed. The unit of analysis 26th is used to detect certain predetermined types of faults (such as a running window regulator motor) based on an analysis algorithm and, based on the result of this analysis, to generate the analysis result signal d and to send it to the processing unit 22nd to spend.

In the example of 3 is also the advantageous option of supplying (at least) one "further signal" s_2 to the analysis unit 26th drawn. In this way, the reliability of their detection and thus the quality of the adaptation of the processing of the sensor signal s_1 can be improved for many disturbances conceivable in practice. The (at least one) further signal s_2 can be, for. B. be a signal that indicates the operation of an electric motor drive of a vehicle component (z. B. window motor).

In the example of 3 that is symbolized by a user on the door 2 exerted user force F_u an acceleration "a" at the location of the sensor device (e.g. containing an acceleration sensor) 10 is effected. The sensor device 10 thus generates a sensor signal s_1 in the example shown, the acceleration "a" of the door caused by the user force 2 depends.



Patent Citations (7)

Publication number	Priority date	Publication date	Assignee	Title
DE102007062472A1	2007-12-20	2009-06-25	Technische Universität München	Translatory or rotatory opening door or flap, particularly vehicle door, comprises one actuator which is assigned for motor support of opening or closing movement or unlocking operation or locking operation
DE102017103445A1	2016-02-29	2017-08-31	Ford Global Technologies, Llc	Mobile device control for electrically operated door
DE102018107477A1	2017-09-14	2019-03-14	Huf Hülsbeck & Fürst Gmbh & Co. Kg	Arrangement of a vehicle
DE102019117771A1	2018-07-03	2020-01-09	Magna Closures Inc.	Intelligent handle arrangement with force-based sensor and backup energy source
DE102019204170A1	2019-03-26	2020-10-01	Brose Fahrzeugteile Se & Co. Kommanditgesellschaft, Bamberg	Vehicle door arrangement with a sensor device for recognizing an adjustment request
Family To Family Citations				
DE102007062473A1 *	2007-12-20	2009-07-02	Technische Universität München	Door i.e. vehicle door, has actuators provided in operative connection with sensor devices, and kinematics degrees of freedom assigned to actuators for motor support of opening and/or closing motion and/or unlocking-or locking process
DE102018211385A1 *	2018-07-10	2020-01-16	Bayerische Motoren Werke Aktiengesellschaft	DEVICE AND METHOD FOR OPERATING A VEHICLE DOOR AND VEHICLE

* Cited by examiner, † Cited by third party

Similar Documents

Publication	Publication Date	Title
EP3033289B1	2022-06-22	Monitoring system of a lift system

DE102015007156B4	2020-11-19	Method in which an unmanned aerial vehicle interacts with a motor vehicle, and motor vehicle
EP1182647B1	2007-11-28	Method of voice control over devices in noisy environments
EP2607180B1	2015-05-20	Method for the determination of the weight of at least one occupant of a vehicle
DE19749372A1	1999-05-12	Electronic recognition system for acoustic signals
WO2020011307A1	2020-01-16	Device and method for actuating a vehicle door, and vehicle
DE102010062589A1	2012-06-14	Camera-based method for distance determination in a stationary vehicle
DE102016115756A1	2017-03-16	Diagnosis of a pressure sensor in a vehicle body structure
EP3517398A1	2019-07-31	Method for interior state monitoring, as well as a vehicle having interior state monitoring device
DE102006040653B4	2017-02-16	Device and method for detecting a pedestrian impact
EP1870688B1	2018-04-18	Method for a functional test of a pressure pick-up
DE102020206012A1	2021-11-18	System and method for door actuation in a vehicle
DE102017103391A1	2018-08-23	Method for improving the user-friendliness of a vehicle
DE102010008898B4	2020-08-13	Motor vehicle with a device for warning seat belts
DE102018222825A1	2020-06-25	Method and system for operating a vehicle with acoustic detection of an external vehicle environment
DE10251281B3	2004-06-03	Method for motion detection of a motor vehicle
DE102020211410A1	2022-03-10	Method for operating a weight recording system for a motor vehicle or a trailer, corresponding weight recording system and motor vehicle and trailer
DE102020205678A1	2020-11-12	Method and device for detecting damage to a motor vehicle
DE102011116356A1	2013-04-25	Warning device for warning about collision at rear-end of vehicle, has output unit that outputs audible warning to operator of sliding door, when evaluation unit generates a warning if a collision is to occur between object and door
DE10334020A1	2005-02-10	Window or door opening or closing control for road vehicle uses sensors connected to power drive system, determining whether door is fully open or fully shut
WO2019081236A1	2019-05-02	Device and method for documenting technical problems in a motor vehicle
WO2018010853A1	2018-01-18	Control device and method for the voice-based operation of a motor vehicle
DE102009059802A1	2010-09-09	Vehicle e.g. hybrid vehicle, monitoring method, involves determining, storing and analyzing detected signals in time and/or position dependent manner, where signals are analyzed upon changes and/or deviations
DE102017208382B4	2022-11-17	Method for improving temporarily impaired speech recognition in a vehicle



EP1206361B1	2004-04-21	Method and device for automatically adjusting an opening in the skin of a vehicle compartment
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Priority And Related Applications

Priority Applications (2) ▲

Application	Priority date	Filing date	Title
DE102020206012.6A	2020-05-13	2020-05-13	System and method for door actuation in a vehicle
PCT/DE2021/200058	2020-05-13	2021-05-05	System and method for actuating a door in a vehicle

Applications Claiming Priority (1) ▲

Application	Filing date	Title
DE102020206012.6A	2020-05-13	System and method for door actuation in a vehicle

Legal Events ▲

Date	Code	Title	Description
2020-05-13	R012	Request for examination validly filed	
2021-09-22	R016	Response to examination communication	

Concepts ▲

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Name	Image	Sections	Count	Query match
■ analytical method		claims,abstract,description	52	0.000
■ evaluation		claims,abstract,description	15	0.000
■ method		claims,abstract,description	4	0.000
■ acceleration		claims,description	21	0.000
■ filtration		claims,description	20	0.000
■ controlling effect		claims,description	5	0.000
■ computer program		claims,description	2	0.000
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