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(54) A METHOD OF DETERMINING THE STATE OF A DEVICE IN A FORKLIFT TRUCK

(57) The present disclosure relates to a method performed in a forklift truck of determining the state of a device in the fork lift truck. The method comprises a first step of determining a first value of at least one parameter related to an operating condition of the device based on a computational model of the at least one parameter. In a next step, a second value is determined of the at least one parameter from a sensor in the fork lift truck sensing the parameter directly or indirectly. Next, a difference is determined between the first value and the second value. Thereafter, in the following step, the state of the device is determined based on the difference.

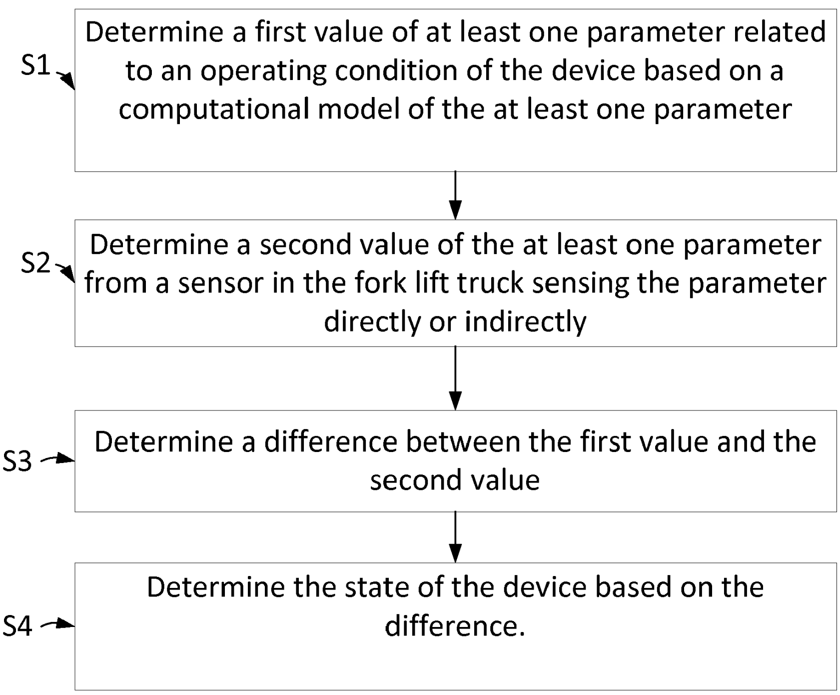

Fig. 2

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a method of determining the state of a device in a fork lift truck. The disclosure also relates to a method in a server and a forklift truck of determining the state of the device in the fork lift truck.

BACKGROUND

[0002] In a fork lift truck there are several devices that are subject to wear. For instance are electrical motors, e.g. for moving the fork lift truck, for power steering or for providing hydraulic pressure to the lifting system subject to different types of wear.

[0003] Due to the wear the state of these devices in the fork lift truck degrades which in turn may lead to malfunctioning of these devices, which in turn can cause malfunctioning of the entire fork lift truck. A faulty device in the forklift truck leads to unscheduled stops for service or replacement of the device. This is disadvantageous since these stops are costly.

[0004] It is known in the art to monitor the state of devices in the forklift truck. One method of monitoring the state of devices is to manually check the state of the devices at regular service intervals. If the device is broken or shows signs of successive wear the device is replaced.

[0005] Another method is to replace devices in the fork lift truck after predetermined hours of operation. However, although proven useful, these methods do not provide information about the state of different devices in the fork lift truck between service intervals.

[0006] There is therefore a need for an improved solution for determining the state of the devices in the forklift truck, which solution solves or at least mitigates at least one of the above mentioned problems.

SUMMARY

[0007] It is an object of the present disclosure to provide embodiments solving the problem of determining the state of the devices in a fork lift truck.

[0008] The disclosure presents a method performed in a forklift truck of determining the state of a device in the fork lift truck. The method comprises a first step of determining a first value of at least one parameter related to an operating condition of the device based on a computational model of the at least one parameter. In a next step, a second value is determined of the at least one parameter from a sensor in the fork lift truck sensing the parameter directly or indirectly. Next, a difference is determined between the first value and the second value. Thereafter, in the following step, the state of the device is determined based on the difference.

[0009] Thus an object of the disclosure, to determining the state of the device in the fork lift truck is obtained by analyzing the difference between the first value and the second value instead of determining the state based on only the second value. An advantage by determining the state of the device by analyzing the difference between the first value and the second value is that there is not necessary to determine which second values that indicate that the device is malfunctioning. A process of determining which second value that indicates that the device is malfunctioning is complicated since the forklift truck is used in many difference ways. A high second value does not necessary mean that the device is malfunction. A high second value can be a result of that the forklift truck has been driven hard or with a heavy load.

[0010] The present disclosure also relates to a method in a server for determining the state of the device in the fork lift truck. The method comprises the steps of, receiving the difference between the first value of the parameter and the second value of the parameter, wherein the first value being the value of the parameter related to the operating condition of the device based on the computational model of the parameter, and the second value being the value of the parameter from the sensor in the fork lift truck sensing the parameter. In a next step determining the state of the device based on the difference.

[0011] The present disclosure also presents a forklift truck arranged to be able to perform the method according to any of the below described exemplary embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Further objects, features, and advantages of the present disclosure will appear from the following detailed description, wherein some aspects of the disclosure will be described in more detail with reference to the accompanying drawings, in which:

Figure 1 schematically illustrates a forklift truck according to an embodiment of the present disclosure.

Figure 2 is a flow chart illustrating the proposed methods performed in a forklift truck.

Figure 3 is a flow chart illustrating the proposed methods performed in a server.

DETAILED DESCRIPTION

[0013] The general object or idea of embodiments of the present disclosure is to address at least one or some of the disadvantages with the prior art solutions described above as well as below. The various steps described below in connection with the figures should be primarily understood in a logical sense.

[0014] The terminology used herein is for the purpose of describing particular aspects of the disclosure only, and is not intended to limit the disclosure to any particular embodiment. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise.

[0015] The present disclosure relates to the area of forklift trucks 1, such as disclosed in Figure 1 The illustrated forklift truck 1 includes a load carrier 2. In the example of Fig. 1, the load carrier 2 comprises two forks. The load carrier 2 is attached to a lifting mechanism such that the load carrier 2 can move vertically. The load carrier 2 is also provided with hydraulics such that it can move in the lateral direction of the forklift truck 1. The forklift truck 1 is in general provided with a mast 11. However the present disclosure is not limited to forklift trucks having a mast 11. The forklift truck 1 comprises a forklift truck body 10. The forklift truck body 10 is defined as remaining part of the forklift truck 1 when the load carrier 2 and an optional mast 11 are removed. The forklift truck 1 in general also comprises a drive motor (not shown) that is used for driving a drive wheel and thus moving the forklift truck 1 in a desired direction. The forklift truck 1 further comprises a motor (not shown) for driving a hydraulic pump; hereinafter we call this motor the pump motor. The hydraulic pump pressurizes a hydraulic system of the forklift truck 1. The hydraulic system of the forklift truck 1 is used for the hydraulic functions of the truck in a manner known to a person skilled in the art. Examples of functions that are handled by the hydraulic system are lifting of the load carrier 2, side shift of the load carrier 2, and longitudinal movement of the mast 11 if the forklift truck 1 is a reach truck, and tilting of the load carrier 2 in the longitudinal direction. In another example side shift of the load carrier 2 and/or tilting of the load carrier 2 are performed by electrical motors. The drive motor and the pump motor are for the discussed type of forklift trucks electrically powered by an energy source. The energy source is in general a suitable rechargeable battery. However, it should be understood that the present disclosure can be used with any type of forklift truck. If the disclosure is to be used on other industrial vehicles comprising load carrier 2 in the form of forks, modifications can be needed as the surroundings alters, and differences in design of their respective lifting mechanisms. However, the use of what is written in this disclosure in other industrial vehicles comprising load carrier 2 is also part of this invention.

[0016] A load carrier 2 control unit 5 controls the hydraulics system of the forklift truck 1. The load carrier control unit 5 is also arranged to be able to control a drive motor for a movement of the load carrier 2 in particular in a longitudinal direction of the forklift truck 1. The load carrier control unit 5 also controls other functions for altering position of the load carrier 2, such as controlling a reach function of a forklift truck 1 that comprises such a function, the lift function, the side shift function etc. The load carrier control unit 5 can be fully integrated into a main control unit 6 of the forklift truck 1. This provides for a simple solution and provides for less hardware needed on the forklift truck 1. The load carrier control 5 unit can also be an independent control unit 5. This will make service of the load carrier control unit 5 simpler and will make upgrades of it easier to perform.

[0017] As mentioned above the prior art methods for determining the state of the devices in the forklift truck 1 have drawbacks. There is therefore a need for an improved solution for determining the state of the devices in the forklift truck 1.

[0018] One object of the present disclosure is to provide a method of determining when the forklift truck needs service. Today service is performed when the forklift truck 1 malfunction or according to a predetermined service schedule, such as e.g. after every 500 hours of operation.

[0019] One desire is to avoid that the forklift truck 1 malfunction, but also to increase the service intervals to e.g. 700 hours of operation.

[0020] Devices in forklift truck 1 that it is advantageous to determine when they need service are among others the drive motor, the hydraulic pump motor, the steer servo motor, the power steering motor or an electro-mechanical brake. Faults or maintenance needs, which it is desirable to detect, are for example, problems with the bearings.

[0021] Now turn to figure 2, which schematically illustrates an embodiment of a method performed in the forklift truck 1 of determining the state of the device in the fork lift truck 1. In a first step S1 a first value of at least one parameter is determined, the at least one parameter being related to an operating condition of the device. The first value is determined based on a computational model of the at least one parameter. As will be described below the at least one parameter can for instance be a temperature value of the drive motor, the hydraulic pump motor or the steer servo motor. The temperature of the drive motor, the hydraulic pump motor or the steer servo motor is dependent of the operating condition of the forklift truck. If for instance the forklift truck is driven for a long period of time or with heavy load the temperature of the drive motor, the hydraulic pump motor or the steer servo motor is likely to be high.

[0022] The computational model of the at least on parameter typically calculates the at least one parameter based on other parameters. For example, the temperature of the drive motor, the hydraulic pump motor or the steer servo motor is a function of ambient temperature, thermal inertia, current flow into the drive motor, the hydraulic pump motor or the steer servo motor etc. According to aspects of the present disclosure typical parameters that may be included in the computational model of the at least on parameter are temperature, current, voltage, load weight, total weight, velocity, acceleration and time.

[0023] In a second step S2 a second value of the at least one parameter is determined from a sensor in the fork lift truck sensing the parameter directly or indirectly. In the example above were the at least one parameter is the temperature value of the drive motor, the hydraulic pump motor or the steer servo motor. The second value is determined by a sensor sensing the temperature value directly or indirectly of the drive motor, the hydraulic pump motor or the steer servo motor.

[0024] In a next step S3 a difference between the first value and the second value is determined. Thereafter in step S4 the state of the device is determined based on the difference. Thus by analyzing the difference, in step S4, between the first value and the second value the state of the device can be determined.

[0025] There are many different ways of determining what value of the difference between the first value and the second value that represent a certain state of the device.

[0026] According to one aspect of the present disclosure are values of the difference between the first value and the second value at the beginning of the life cycle of the forklift truck 1 considered to be a normal difference between the first value and the second value. When the difference between the first value and the second values begin to differ in any way from these normal values of the difference a change in the state of the device is determined in step S4.

[0027] According to another aspect of the present disclosure is a small difference between the first value and the second value an indication that the device is working properly. If the difference between the first value and the second value is large the device or components related to the device is considered to malfunction in step S4.

[0028] An advantage by determining the state of the device by analyzing the difference between the first value and the second value instead of determining the state based on only the second value is that there is not necessary to determine which absolute second values that indicate that the device is malfunctioning. A process of determining which second value that indicates that the device is malfunctioning is complicated since the forklift truck is used in many difference ways. A high second value does not necessary mean that the device is malfunction. A high second value can be a result of that the forklift truck has been driven hard or with a heavy load.

[0029] Another advantage by determining the state of the device by analyzing the difference between the first value and the second value is that it is not important that the computational model of the at least one parameter is exact. As long as the computational model of the at least one parameter give the same result every time. Nor does it matter if the sensor that sense the second value of the at least one parameter is exact. As long as the sensor give the same result every time. This since it is the difference between the first value and the second value that is of importance when determining the state of the device in step S4. Not the absolute values of the first value and the second value.

[0030] As briefly described above, according to another aspect of the present disclosure, the method comprises a further step S3b (not shown), prior to the step S4. In this step S3b a normal difference is determined based on a number of determined differences in step S3. The normal difference is a value representing a difference between the first value and the second value when the state of the device is considered to be normal. As mentioned above in one exemplary embodiment the normal difference between the first value and the second value is determined during the forklift trucks 1 first number of operating hours. The normal difference can be determined this way since the device in the forklift truck 1 is considered to function normally during the first number of operating hours.

[0031] According to another aspect of the present disclosure the normal difference is used in step S4 when determining the state of the device. After a certain number of operating hours the normal difference has been determined. Thereafter the forklift truck 1 continuously determines the differences between the first value and the second value in step S3. These new differences represent the current state of the device. In step S4 the forklift truck then determine the state of the device by comparing the normal difference with a new difference between the first value and the second value representing the current state of the device.

[0032] In yet another aspect of the present disclosure the difference can be represented in the forklift truck 1 in different ways. According to one aspect the difference is represented as a histogram. In this example of representing the difference, the X-axis represent the value of the difference and the Y-axis represent the number of occasions where a certain difference has occurred. The histogram thus represents a type of difference profile for the forklift truck 1.

[0033] According to another aspect of the present disclosure this difference profile can be used in step S4 when determining the state of the device. After a certain number of operating hours the difference profile has been determined. Thereafter the forklift truck 1 continuously represents differences in a new histogram. This new histogram represents the current state of the device. In step S4 the forklift truck then determine the state of the device by comparing the difference profile with the new histogram that represents the current state of the device.

[0034] In yet another exemplary embodiment of the present disclosure the first value is a current supply value to the drive motor, the hydraulic pump motor or the steer servo motor determined based on a computational model of the current supply. The computational model of the current supply value to the drive motor, the hydraulic pump motor or the steer servo motor can designed in different ways. The computational model of the current supply value to the drive motor, the hydraulic pump motor or the steer servo motor calculates the current supply based on other parameters. For example, the current supply to the drive motor, the hydraulic pump motor or the steer servo motor is a function of the weight of the load and the speed of the forklift truck 1. In this aspect of the present disclosure the second value is a current supply value from a current sensor sensing the current supply to one of the drive motor, the hydraulic pump motor or the steer servo motor directly or indirectly.

[0035] According to another exemplary embodiment of the present disclosure the first value is a voltage value to the drive motor, the hydraulic pump motor or the steer servo motor determined based on a computational model of the voltage value. The computational model of the voltage value supplied to the drive motor, the hydraulic pump motor or the steer servo motor can be designed in different ways. The computational model of the voltage value value to the drive motor, the hydraulic pump motor or the steer servo motor calculates the voltage value based on other parameters. For example, the voltage value to the drive motor, the hydraulic pump motor or the steer servo motor is a function of the weight of the load and the speed of the forklift truck 1. In this aspect of the present disclosure the second value is a voltage value from a voltage sensor sensing the voltage supply to one of the drive motor, the hydraulic pump motor or the steer servo motor directly or indirectly.

[0036] Obviously there is a difference between the motor temperature at the start of a session or if the truck has been driven hard for 15 minutes. There is also a difference between the motor temperature if the forklift truck has been stopped for e.g. charging. According to another aspect of the present disclosure the forklift truck can for these cases set the first value to the current motor temperature when then the forklift truck starts to work again.

[0037] According to another aspect of the present disclosure the method further comprises issuing an indication, such as an alarm or a visual notification to the driver if the difference between the first value and the second value exceeds a threshold.

[0038] Further, in yet another aspect of the present disclosure the method further comprises transmitting the difference between first value and the second value to a server for further analysis of the difference. An advantage by only transmitting the difference is the significantly smaller amount of data that needs to be transmitted, since only the difference values are transmitted.

[0039] According to one aspect, the difference between first value and the second value is transmitted continuously to the server with a suitable interval. In another aspect of the present disclosure the difference between first value and the second value is transmitted to the server at predetermined times or at predetermined locations. Yet another advantage by only transmitting the difference with a suitable interval or at predetermined locations is the smaller amount of data that needs to be transmitted compared to if the difference values were sent continuously.

[0040] Now turn to figure 4, which schematically illustrates an embodiment of a method performed in a server for determining the state of a device in the forklift truck 1. In a first step S10 the difference between the first value and the second value is received. In a next step S20 the state of the device is determined based on the difference between the first value and the second value. As described above for the exemplary embodiments of the method in the forklift truck the there are many different ways of determining, in the step S20, what value of the difference between the first value and the second value that represents a certain state of the device.

[0041] According to one aspect of the present disclosure the server considers, in step S20, values of the difference between the first value and the second value at the beginning of the life cycle of the forklift truck 1 to be a normal difference between the first value and the second value. When the difference between the first value and the second values begin to differ in any way from these normal values the server determines a change in the state of the device in step S20.

[0042] According to another aspect of the present disclosure, in the step of determining S20, a small difference between the first value and the second value is an indication that the device is working properly. If the difference between the first value and the second value is large the device or components related to the device is considered to malfunctioning in step S20.

[0043] The advantages mentioned above for the exemplary embodiment of the methods in the forklift truck are also relevant for the method in the server. Thus an advantage by determining the state of the device, in step S20, by analyzing the difference between the first value and the second value instead of determining the state based on only the second value is that there is not necessary to determine which second values that indicate that the device is malfunctioning.

[0044] As with the method in the forklift truck 1, an advantage by determining the state of the device, in step S20, by analyzing the difference between the first value and the second value is that it is not important that the computational model of the at least one parameter is exact. As long as the computational model of the at least one parameter give the same result every time. Nor does it matter if the sensor that sense the second value of the at least one parameter is exact. As long as the sensor gives the same result every time. This since it is the difference between the first value and the second value that is of importance when determining the state of the device, in step S20. Not the absolute values of the first value and the second value.

[0045] According to another aspect of the method in the server, the method comprises a further step S10b, prior to the step S20. In this step S10b a normal difference is determined based on a number of received differences in step S10b. As for the method in the forklift truck 1, the normal difference is a value representing a difference between the first value and the second value when the state of the device is considered to be normal. In one exemplary embodiment the normal difference between the first value and the second value is determined by the server during the forklift trucks 1 first number of operating hours. The normal difference can be determined this way since the device in the forklift truck 1 is considered to function normally during the first number of operating hours.

[0046] According to another aspect of the present disclosure the normal difference is used in step S20 when determining the state of the device. After a certain number of operating hours the normal difference has been determined. Thereafter the server continuously receives differences between the first value and the second value in step S10. These new differences represent the current state of the device. In step S20 the server then determine the state of the device by comparing the normal difference with a new difference value representing the current state of the device.

[0047] In yet another aspect of the present disclosure the difference can be represented in the server in different way as a histogram. In this example of representing the difference the X-axis represent the value of the difference and the Y-axis represent the number of occasions where a certain difference has occurred. The histogram thus represents a type of difference profile for the forklift truck 1.

[0048] According to another aspect of the method in the server this normal difference profile can be used in step S20 when determining the state of the device. After a certain number of operating hours the difference profile has been determined. Thereafter the server continuously receives differences and represents these differences in a new histogram. This new histogram represents the current state of the device. In step S20 the server then can determine the state of the device by comparing the difference profile with the new histogram representing the current state of the device.

[0049] According to another aspect of the method in the server, if any received difference higher than 50 % exceeds its normal distribution with more than 5 %, the server determines in step S20 that the device is malfunctioning. The limit for a deviation when the server, in step S20, determines that the device is malfunctioning can be adjusted. This is particularly advantageous in case there are many false alarms. Then it is enough to change the limit for a deviation in the server, instead of changing the limit for the deviation on every single forklift truck 1.

[0050] According to another aspect of the method in the server a normal difference profile from another identical forklift truck 1 can be used when determining the state of the device. Thus the continuously received differences are represented in a histogram. In step S20 the server then can determine the state of the device by comparing the normal difference profile from another identical forklift truck 1 or many identical forklift trucks 1 with the histogram of the received differences.

[0051] As mentioned above in relation to the exemplary embodiments in the server, the first value can be a current supply value to the drive motor, the hydraulic pump motor or the steer servo motor determined based on a computational model of the current supply. In this aspect of the present method in the server the second value is a current supply value from a current sensor sensing the current supply to one of the drive motor, the hydraulic pump motor or the steer servo motor directly or indirectly. Also as mentioned above, the first value can be a voltage value to the drive motor, the hydraulic pump motor or the steer servo motor determined based on a computational model of the voltage value. In this aspect of the method in the server the second value is a voltage value from a voltage sensor sensing the voltage supply to one of the drive motor, the hydraulic pump motor or the steer servo motor directly or indirectly.

[0052] According to another aspect of the present disclosure the method in the server further comprises issuing an indication, such as an alarm or a visual notification if the difference between the first value and the second value exceeds a threshold.

[0053] According to another aspect of the present disclosure the method in the server further comprises deciding of an action to be performed if the difference between the first value and the second value exceeds a threshold. This action can for instance be booking service, ordering spare parts or limiting driving parameters for the forklift truck 1.

[0054] The present disclosure also relates to a fork-lift truck arranged to be able to perform the methods of according to any of the above described exemplary embodiments.

Claims

1. A method in a fork lift truck (1) of determining the state of a device in the fork lift truck (1), comprising the steps of:

   - determining (S1) a first value of at least one parameter related to an operating condition of the device based on a computational model of the at least one parameter;
   - determining (S2) a second value of the at least one parameter from a sensor in the fork lift truck sensing the parameter directly or indirectly;
   - determining (S3) a difference between the first value and the second value; and
   - determining (S4) the state of the device based on the difference.

2. The method according to claim 1, wherein the method comprising a further step of, prior to the step of determining (S4) the state, determining a normal difference based on a number of determined differences, the normal difference being a value representing a difference between the first value and the second value for the device when the state is considered to be normal.

3. The method according to claim 2, wherein the step of determining (S4) the state further comprising determining the state based on a comparison between the normal difference and the difference.

4. The method according to any of claims 1 to 3, wherein the device is a drive motor, a hydraulic pump motor

or a steer servo motor.

5. The method according to claim 4, wherein the first value is a temperature value of the drive motor, the hydraulic pump motor or the steer servo motor, determined based on a computational model of the temperature and the second value is a temperature value from a temperature sensor sensing the temperature of the drive motor, the hydraulic pump motor or the steer servo motor directly or indirectly.

6. The method according to claim 4, wherein the first value is a current supply value to the drive motor, the hydraulic pump motor or the steer servo motor determined based on a computational model of the current supply and the second value is a current supply value from a current sensor sensing the current supply to one of the drive motor, the hydraulic pump motor or the steer servo motor directly or indirectly.

7. The method according to claim 4, wherein the first value is a voltage value to the drive motor, the hydraulic pump motor or the steer servo motor determined based on a computational model of the voltage and the second value is a voltage value from a voltage sensor sensing the voltage to one of the drive motor, the hydraulic pump motor or the steer servo motor directly or indirectly.

8. The method according to any of claims 1 to 7, wherein the method further comprises issuing an indication, such as an alarm or a visual notification to the driver if the difference exceeds a threshold.

9. The method according to any of claims 1 to 8 further comprising:

- transmitting the difference to a server for further analysis of the difference.

10. A method in a server for determining the state of a device in a fork lift truck (1), comprising the steps of:

- receiving (S10) a difference between a first value of a parameter and a second value of a parameter, wherein the first value being a value of the parameter related to an operating condition of the device based on a computational model of the parameter, and the second value being a value of the parameter from a sensor in the fork lift truck sensing the parameter;
- determining (S20) the state of the device based on the difference.

11. The method according to claim 10, wherein the method comprising a further step of, prior to the step of determining (S20) the state, determining a normal difference based on a number of received differences, the normal difference being a value representing a difference between the first value and the second value for the device when the state is considered to be normal.

12. The method according to claim 11, wherein the step of determining the state further comprising determining the condition based on a comparison between the normal difference and the difference.

13. The method according to claim 11, wherein the step of determining the state further comprising determining the condition based on a comparison between the difference and a normal difference for another forklift truck 1.

14. The method according to any of claims 10 to 13, wherein the device is a drive motor, a hydraulic pump motor or a steer servo motor.

15. The method according to claim 14, wherein the first value is a temperature value of the drive motor, the hydraulic pump motor or the steer servo motor determined based on a computational model of the temperature and the second value is temperature value from a temperature sensor sensing the temperature off the drive motor, the hydraulic pump motor or the steer servo motor.

16. The method according to claim 14, wherein the first value is a current supply value to the drive motor, the hydraulic pump motor or the steer servo motor determined based on a computational model of the current supply and the second value is a current supply value from a current sensor sensing the current supply off the drive motor, the hydraulic pump motor or the steer servo motor.

17. The method according to claim 14, wherein the first value is a voltage value to the drive motor, the hydraulic pump motor or the steer servo motor determined based on a computational model of the voltage and the second value is a voltage value from a voltage sensor sensing the voltage of the drive motor, the hydraulic pump motor or the steer servo motor.

18. The method according to any of claims 13 to 16, wherein the method further comprising an indication, such as an alarm or a visual notification if the difference exceeds a threshold.

19. Fork-lift truck arranged to be able to perform the method according to any of the claims 1-9

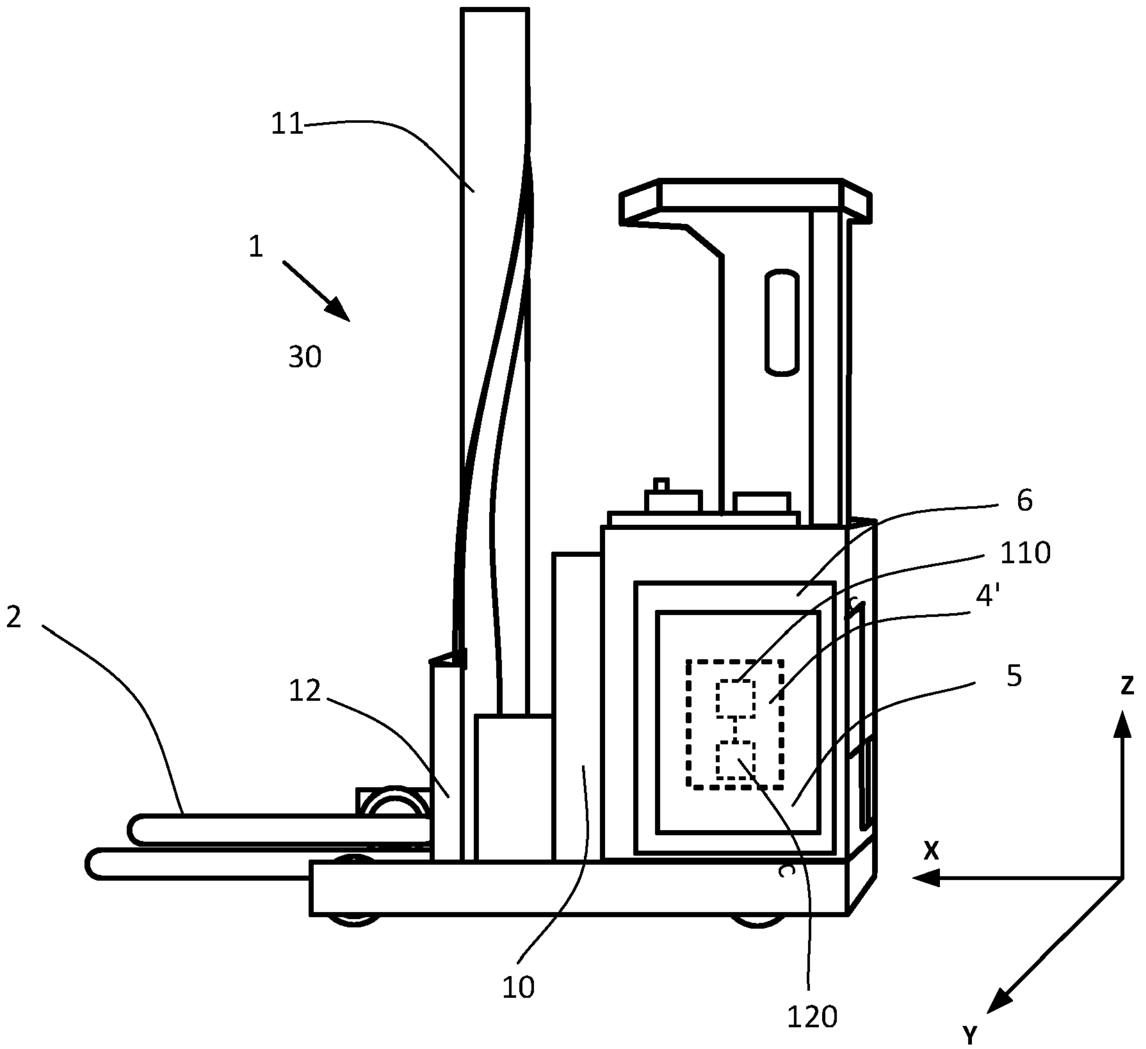

Fig. 1

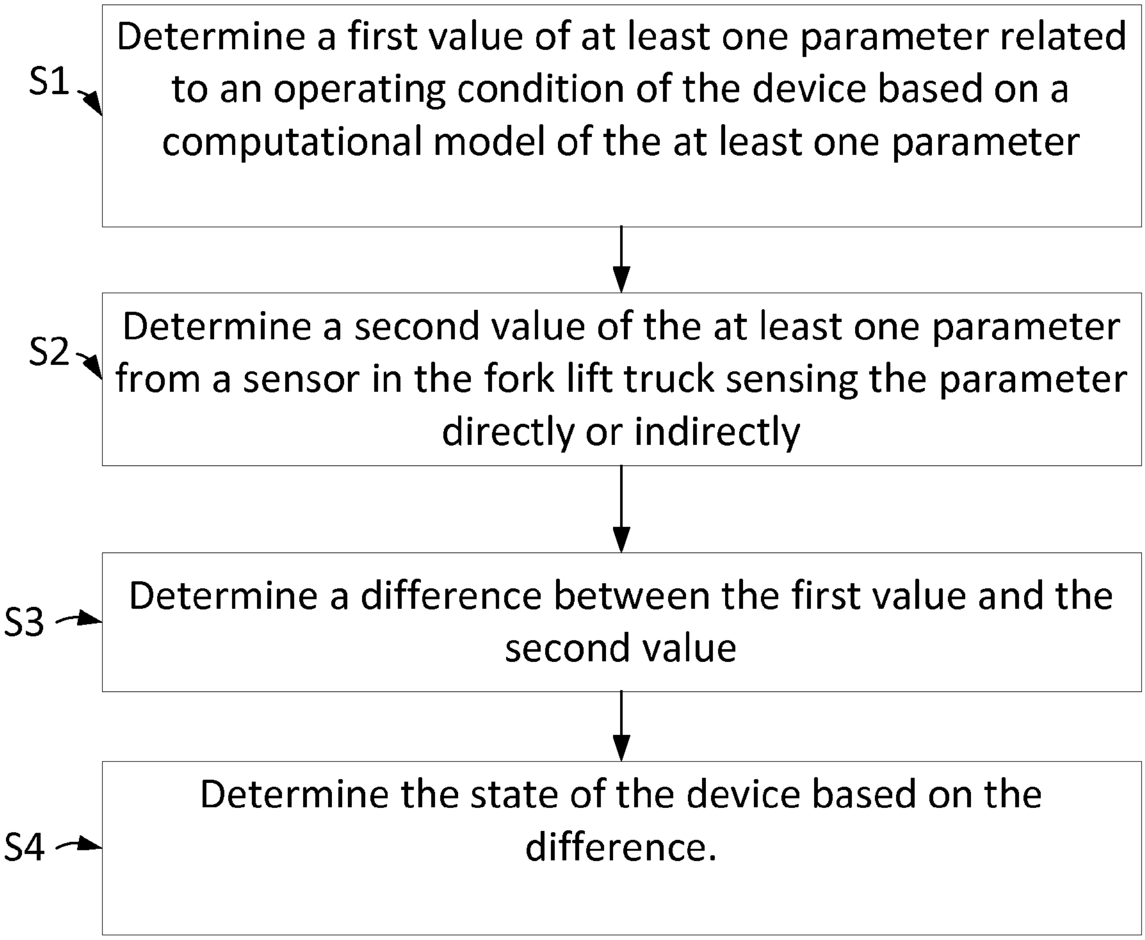
S1
Determine a first value of at least one parameter related to an operating condition of the device based on a computational model of the at least one parameter
S2
Determine a second value of the at least one parameter from a sensor in the fork lift truck sensing the parameter directly or indirectly
S3
Determine a difference between the first value and the second value
S4
Determine the state of the device based on the difference.

Fig. 2

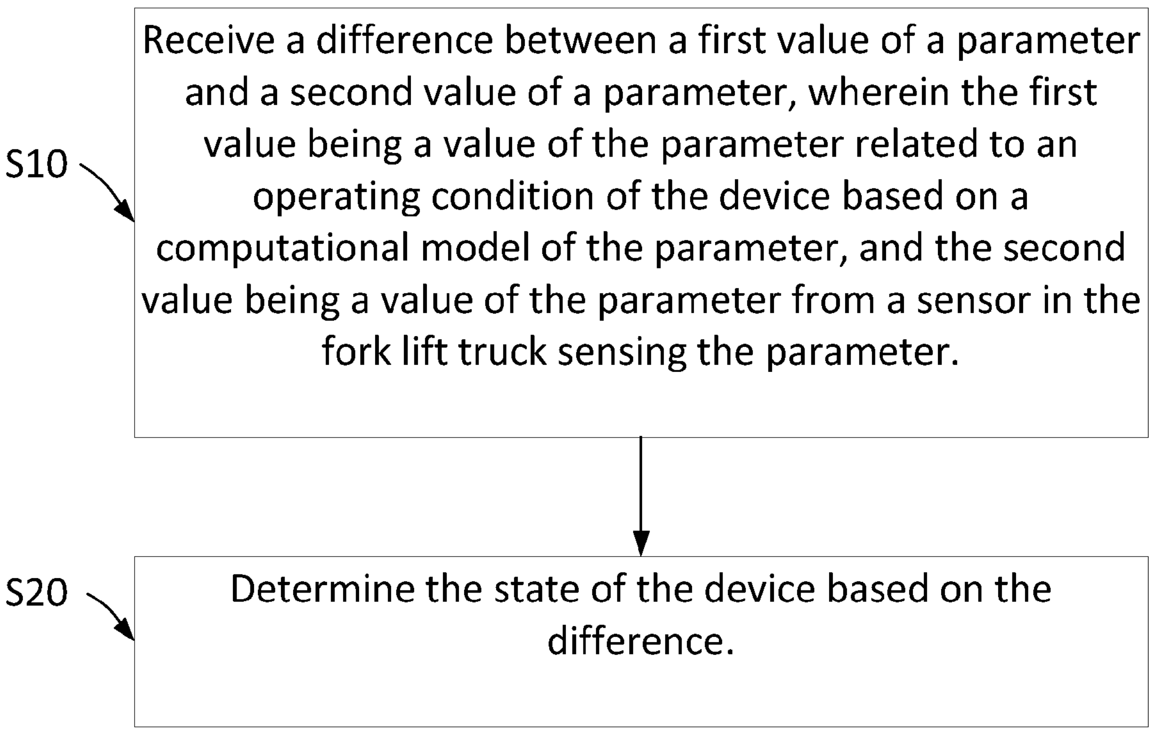
S10
Receive a difference between a first value of a parameter and a second value of a parameter, wherein the first value being a value of the parameter related to an operating condition of the device based on a computational model of the parameter, and the second value being a value of the parameter from a sensor in the fork lift truck sensing the parameter.
S20
Determine the state of the device based on the difference.

Fig. 3

Europäisches Patentamt
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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 5883

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search	Date of completion of the search	Examiner
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