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[0001] The invention relates to a method for troubleshooting a device via a user interface of the device and a corresponding device, in particular a heating device. The method can be used in particular for safety-related troubleshooting a (heating) device via a non-safety-related user interface.

[0002] Modern heating devices, which have a combined display and operating unit, such as a so-called touch display, for operation by a user, are generally divided into a safety-relevant system and a non-safety-relevant system. The safety-relevant system usually includes the operating control system of the device, in which the functions, parameters, limitations and the like required for safe operation of the device run or are stored. The non-safety-related system normally includes the display and operating unit, which is often integrated into the device as a purchased part with its own non-safety-related software.

[0003] If there is an error in the safety-relevant system of the device that could endanger further safe operation of the device, a so-called safety-relevant incident has occurred. In the event of a safety-related incident, regular operation of the device is deactivated or the device is blocked. The device is then in a state that is also referred to as a safety-related fault. The device remains in this state until the error has been rectified and/or a safety-related troubleshooting takes place.

[0004] However, comparatively high demands are placed on a safety-relevant troubleshooting. For example, one or more unintentional resets of the safety-relevant system should be avoided due to an error in the non-safety-relevant software of the display and operating unit. Thus, it has hitherto been customary for safety-relevant troubleshooting for the user input for troubleshooting to be read in directly by the safety-relevant system and transmitted to it via a pure hardware circuit without the influence of non-safety-relevant software.

[0005] However, this always requires the provision of at least one pure hardware circuit in the device, even if the rest of the interaction between the device and the user can already take place entirely via the display and operating unit. An example of a commonly used hardware circuit is a separate reset button with a dedicated line to the safety critical system. However, this is disadvantageous for the clarity and/or ease of operation of the device. Furthermore, it must be taken into account that the options for troubleshooting via a bus system are limited by specifications.

[0006] EP 2 686 601 A discloses a method for troubleshooting a device via a user interface.

[0007] It is therefore the object of the invention to provide a method and a device which each contribute at least to simplifying the operation of the device and/or making it clearer.

[0008] This object is achieved according to the features of claim 1 in that a method for troubleshooting a device via a user interface of the device is provided, comprising at least the following steps:

a) receiving a troubleshooting signal output by a display and operating unit of the device by means of a control unit of the device,

b) converting the troubleshooting signal into a hardware signal by means of the control unit,

c) direct transmission of the hardware signal from the control unit to an operation control system of the device,

d) verifying the troubleshooting signal by interrogating the operation control system at the user interface via a communication unit of the device.

[0009] Advantageous configurations result from the features of the dependent claims.

[0010] The method advantageously allows a safety-related troubleshooting a device to be carried out via a non-safety-related user interface of the device. A safety-related troubleshooting is usually necessary when an error has occurred in the device's operating control system that could endanger further safe operation of the device (safety-related fault). If such a security-related fault occurs, the regular operation of the device is deactivated or the device is blocked until a security-related troubleshooting has been carried out.

[0011] A particular advantage is that the user interface, which can also include the display and operating unit, does not have to meet the requirements of a safety-related system. Rather, the user interface can be operated with (own) non-safety-related software. In order to still be able to carry out safety-relevant troubleshooting via the non-safety-relevant user interface, it is advantageously proposed here to provide an (additional) control unit in the device with which a non-safety-relevant troubleshooting signal coming from the display and operating unit can be converted into a hardware signal. In addition, an (additional) verification step is carried out in a particularly advantageous manner in order to check the hardware signal for plausibility.

[0012] In step a), a troubleshooting signal transmitted by a display and operating unit of the device is received by a control unit of the device. In this context, the troubleshooting signal can be received, for example, by a component of the user interface and forwarded (possibly modified and/or amplified) to the control unit, or it can be received directly by the control unit. In particular, the control unit can be part of the user interface of the device. In this context, the control unit can, for example, be integrated into the user interface. However, it is also conceivable for the control unit to be provided separately from the user interface and, if necessary, to be connected to it in terms of signals.

[0013] The display and operating unit can, for example, be a so-called touch display. In particular, the display and operating unit can transform specific user inputs, which are made by the user touching the display, into specific output signals. For example, the display and operating unit can output a troubleshooting signal when a user touches a corresponding troubleshooting button on the display of the display and operating device. The display and control unit can be part of the user interface of the device. In this context, the display and operating unit can, for example, be integrated into the user interface. However, it is also conceivable for the display and operating unit to be provided separately from the user interface and, if necessary, to be connected to it in terms of signals.

[0014] In step b), the troubleshooting signal is converted into a hardware signal by means of the control unit. In particular, the control unit converts a troubleshooting signal generated by non-safety-related software into a hardware signal for safety-related troubleshooting in a safety-related operating control system of the device. As a result, the control unit generates the hardware signal. In this case, the control unit can, for example, convert a digital signal and/or software signal into a hardware signal. The hardware signal can, for example, be an analog signal, an electrical voltage signal and/or an electrical current signal. Alternatively or additionally, the hardware signal can differ from other signals of the device in that it is transmitted from the control unit to the operating control system via a dedicated hardware connection, such as an electrical line. For example, the control unit can switch an (analog) signal transmitted via a corresponding electrical line from “high” to “low” and vice versa. The control unit preferably converts a specific (digital) output signal from the display and operating unit (troubleshooting signal) into a specific (analog) output signal from the control unit or input signal for the operating control system.

[0015] In step c), the hardware signal is transmitted directly from the control unit to an operating control system of the device. The direct transmission takes place in particular via a dedicated connection, such as a dedicated electrical line (separate cable) between the control unit and the operating control system. Direct transmission differs in particular from transmission via a communication unit, such as a bus system, via which a number of end components or users can communicate with one another.

[0016] In step d), the troubleshooting signal is verified by the operating control system querying the user interface via a communication unit of the device. Step d) is used in particular to query whether or not a user input has actually been made with the aim of troubleshooting (touch reset plausibility check). In this way, it is advantageously possible to check whether the troubleshooting signal was emitted by the display and operating unit unintentionally (e.g., due to an error). For example, the verifying can take place in order to query whether (immediately) before the (last) troubleshooting signal was output, a troubleshooting button on the display of the display and operating unit was touched. In particular, if the display and operating unit is provided separately from the user interface, the user interface can in this context read in information from the display and operating unit that allows a corresponding verification.

[0017] According to an advantageous embodiment, it is proposed that the device is a heating device. The heating device is usually a gas and/or oil heating device. In other words, this relates in particular to a heating device which is designed to burn one or more fossil fuels such as natural gas and/or oil, possibly with the supply of ambient air from a building, in order to generate energy for heating water, for example, for use in a to create an apartment. For example, the heating device can be a so-called gas condensing boiler. The heating device typically has at least one burner and a delivery device, such as a fan, that delivers a mixture of fuel (gas) and combustion air (through a mixture duct of the heating device) to the burner. The exhaust gas resulting from the combustion can then be routed through an (internal) exhaust pipe of the heating device to an exhaust system (of a house). Several heating devices are usually connected to this exhaust system.

[0018] According to a further advantageous embodiment, it is proposed that the control unit be a microcontroller (semiconductor chip). The microcontroller is set up in particular to read in a troubleshooting signal, to output a hardware signal and to convert the troubleshooting signal into the hardware signal. For this purpose, the microcontroller can have, for example, a corresponding input, a corresponding output, a processor and a memory. Functions and/or algorithms can be stored in the memory in order to convert the troubleshooting signal into the hardware signal.

[0019] According to a further advantageous embodiment, it is proposed that the communication unit is a bus system. The bus system usually comprises at least one bus. In this context, a bus or bus system is a system for data transmission between several participants via a common transmission path. In particular, at least the user interface and at least one component of the operating control system are connected to the bus or the bus system.

[0020] According to the invention, it is proposed that the communication device is bypassed in the direct transmission according to step c). In particular, the control unit is not connected to the bus or the bus system. The direct transmission takes place in particular via a dedicated connection, such as a dedicated electrical line (separate cable) between the control unit and the operating control system. In other words, in this context, this dedicated connection forms a “bypass” around the communication unit.

[0021] According to a further advantageous embodiment, it is proposed that the verifying according to step d) comprises the following intermediate steps:

i) transmitting a request message from the operation control system to the user interface via the communication unit,

ii) Transmitting a response message from the user interface to the operation control unit,

wherein the verification is successful if the operation control unit receives the response message within a specified time window.

[0022] The time window can, for example, start with the transmission of the request message and end after a specified period. Such a verification advantageously allows a random signal emission from a non-safety-related component to be recognized and ignored. For example, the user interface can read information from the display and operating unit that allows the user interface to check whether the user (actually) wants troubleshooting. In this context, the user interface can, for example, read in information about touching the display of the display and operating unit, which allows conclusions to be drawn as to whether the user has touched a reset button on the display of the display and operating unit.

[0023] As an alternative or in addition to the verification via the specified time window, it can be provided that the request message prompts the user interface, in particular the display and operating unit, to request a confirmation input (via the display and operating unit) from the user. In this context, the (positive) reply message is sent (only) if the user confirms the fault clearance, for example by touching the fault clearance button again and/or by touching a confirmation button on the display of the display and control unit. In this context, the verification is successful if the operating control system receives the response message at all and/or possibly (when the two forms of verification are combined) within the specified time window.

[0024] According to a further advantageous embodiment, it is proposed that after a predetermined number of preceding troubleshootings, the verification of a further troubleshooting signal requires a user to confirm the (further) troubleshooting via the display and operating unit. In this context, too, the request message can cause the user interface, in particular the display and operating unit, to request a confirmation input from the user.

[0025] According to a further advantageous refinement, it is proposed that a fault in the operating control system of the device is deleted in step e) if the verification was successful in an immediately preceding step d). After erasing, the device can return to regular operating mode. Factory settings of the operating control system and/or the user interface can, for example, be restored to clear the fault.

[0026] A particularly advantageous embodiment can be described as follows: the non-safety-related user interface (user interface) reads the touch display signal via a microcontroller, which converts the input into a hardware signal that is read in by the safety-related system (operating control system). The safety-related system verifies the input via a message via a non-safety-related bus system to the user interface. The user interface must respond to this message within a specified time window. After a predetermined number of previous (for example, after five) clearings, (additionally) a (such) second message (response message) must be sent by the user interface, the content of which must in particular match the data of the first message (request message of the operation control system).

In this context, for example, during the subsequent or further (for example, sixth) troubleshooting, the (request) message of the operation control system to the user interface may differ in that an additional confirmation of the user is requested and/or (possibly in addition to the request for the user confirmation) a random number is transmitted. After the user's confirmation, a (positive) (response) message is transmitted from the user interface to the operation control system. In order for this message or the response message to be accepted by the operation control system, it must in particular match the data (exemplarily comprising the random number) of the first message (request message), for which purpose it may for example contain the binary inverted random number from the first message.

[0027] According to a further aspect, the task described at the outset is also solved by a device having a user interface and an operation control system, wherein the user interface and the operation control system can communicate with one another via a communication unit of the device, and wherein the device further comprises a control unit which can convert a troubleshooting signal emitted by a display and operating unit of the device into a hardware signal and transmit this directly to the operation control system, wherein the device is set up to carry out a method described herein.

[0028] Accordingly, the details, features and advantageous embodiments discussed in connection with the method may also occur in the device presented herein and vice versa. In this respect, reference is made in full to the explanations given there for a more detailed characterization of the features.

[0029] The invention will now be explained in detail with reference to the figures. The following shows:

Figure 1: schematic of an exemplary sequence of a process described here,

Figure 2: schematic of an exemplary structure of a device described here,

Figure 3: schematically a further exemplary sequence of a process described herein, and

Figure 4: schematic of a further exemplary sequence of a process described here.

[0030] Figure 1 schematically shows an exemplary sequence of a process described here. The method is used for troubleshooting a device 1 via a user interface 2 of the device 1. The sequence of steps a), b), c), and d) shown with blocks 110, 120, 130, 140, and 150, as well as the optional step e), usually presents itself in a usual course of the method.

[0031] In block 110, a troubleshooting signal 4 transmitted by a display and operating unit 3 of the device 1 is received by means of a control unit 5 of the user interface 2 in accordance with step a). In block 120, the troubleshooting signal 4 is converted into a hardware signal 6 by means of the control unit 5 in accordance with step b). In block 130, according to step c), a direct transmission of the hardware signal 6 from the control unit 5 to an operation control system 7 of the device 1 takes place. In block 140, according to step d), a verification of the troubleshooting signal 4 takes place by a query of the operation control system 7 to the user interface 2 via a communication unit 8 of the device 1.

[0032] In block 150, moreover, according to optional step e), a fault of the operation control system 7 of the device 1 may be cleared if verification was successful in an immediately preceding step d).

[0033] Figure 2 schematically shows an exemplary structure of a device 1 described here. The device 1 has a user interface 2 and an operation control system 7. The user interface 2 and the operation control system 7 can communicate with each other via a communication unit 8 of the device 1. Furthermore, the device 2 comprises a control unit 5 which can convert a troubleshooting signal 4 emitted by a display and operating unit 3 of the device 1 into a hardware signal 6 and transmit this directly to the operation control system 7. As an example, the control unit 5 is integrated into the display and control unit 3.

[0034] For example, the device 1 is arranged to perform a method described herein. Further, by way of example, the device 1 is a heating device, the control unit 5 is a microcontroller, and the communication unit 8 is a bus system. Figure 2 also illustrates that by transmitting the hardware signal 6 directly from the control unit 5 to an operation control system 7, the communication unit 8 is advantageously bypassed.

[0035] Figure 3 schematically shows a further exemplary sequence of a process described here. Here, a user 9 makes a user input 10 for troubleshooting. The user interface 2 comprises here exemplarily the display and operating unit and the control unit. In response to the user input 10, the control unit of the user interface 2 sends the hardware signal 6 to the operation control system 7.

[0036] Figure 3 shows in this context by way of example that the verification according to step d) may comprise at least two intermediate steps, namely a transmission of a request message 11 from the operation control system 7 to the user interface 2 via the communication unit and a transmission of a response message 12 from the user interface 2 to the operation control system 7.

[0037] In this context, verification is successful if the operation control system 7 receives the (positive) response message 12 within a predetermined time window. After successful verification, exemplary recovers 13 of factory settings of the operation control system 7 and the user interface 2 are performed to eliminate the malfunction.

[0038] Figure 4 schematically shows another exemplary sequence of a process described herein. This sequence may occur after a predetermined number(s) of previous clearings. Figure 4 thus shows an example of the sequence for the further (n+1) fault.

[0039] In this context, Figure 3 shows by way of example that after a predetermined number of previous troubleshootings, verification of a further troubleshooting signal may require that a user 9 confirms the troubleshooting via the display and control unit. For this purpose, the operation control system 7 sends a request message 11 here, which causes the user interface 2, in particular the display and operating unit, to request a confirmation input from the user 9. Receipt of such a request message 11 may be acknowledged by a confirmation message 14.

[0040] The display and control unit then sends a user request 15 to the user 9, for example by asking him to confirm the troubleshooting. The user interface forwards the (positive) user response 16 to the operation control system 7 in the form of the (positive) response message 12. This can then also send back a confirmation message 14, whereupon a recovery 13 is carried out on the part of the operation control system 7 and on the part of the user interface 2.

[0041] Furthermore, provision can also be made, for example, for the content of the response message 12 to match the data of the request message 11 after the specified number of preceding (for example after five) troubleshootings (as an alternative or in addition to the user confirmation). To this end, for example, in the subsequent or further (for example, sixth) troubleshooting, the request message 11 may differ in that additional confirmation of the user 9 is requested (in this case, via the user request 15) and a random number is transmitted (with the request message 11). After confirmation from the user 9 (user response 16), a response message 12 is transmitted from the user interface to the operation control system 7. In order for this message to be accepted by the operation control system 7, it must, in this example, match the data (exemplarily comprising the random number) of the request message 11, for which purpose it may include, for example, the binary inverted random number from the request message 11.

List of reference numerals

1	Device
2	Interface
3	Display and control unit
4	Troubleshooting signal
5	Control unit
6	Hardware signal
7	Operation control system
8	Communication unit
9	User
10	User input
11	Request message
12	Response message
13	Recovery
14	Confirmation message
15	User request
16	User response
17	Confirmation message

Patentkrav

1. Fremgangsmåde til støjdæmpning af et apparat (1) over en brugergrænseflade (2) i apparatet (1) omfattende mindst følgende trin:

a) modtagelse af et fra en visnings- og betjeningsindretning (3) i apparatet (1) udsendt støjdæmpningssignal (4) ved hjælp af en styreindretning (5) i apparatet (1),

b) omformning af støjdæmpningssignalet (4) til et hardwaresignal (6) ved hjælp af styreindretningen (5),

c) direkte overførsel af hardwaresignalet (6) fra styreindretningen (5) til et driftsstyresystem (7) i apparatet (1),

d) verifikation af støjdæmpningssignalet (4) ved en forespørgsel fra driftsstyresystemet (7) til brugergrænsefladen (2) over en kommunikationsindretning (8) i apparatet (1);

idet kommunikationsindretningen (8) omgås ved den direkte overførsel ifølge trin c).

2. Fremgangsmåde ifølge krav 1, ved hvilken apparatet (1) er et varmeapparat.

3. Fremgangsmåde ifølge krav 1 eller 2, ved hvilken styreindretningen (5) er en mikrocontroller.

4. Fremgangsmåde ifølge et af de foregående krav, ved hvilken kommunikationsindretningen (8) er et bussystem.

5. Fremgangsmåde ifølge et af de foregående krav, ved hvilken verifikationen ifølge trin d) omfatter følgende mellemtrin:

i) overførsel af en forespørgsels-meddelelse (11) fra driftsstyresystemet (7) til brugergrænsefladen (2) over kommunikationsindretningen (8),

ii) overførsel af en svar-meddelelse (12) fra brugergrænsefladen (2) til driftsstyresystemet (7), idet verifikationen er lykkedes, når driftsstyresystemet (7) modtager svar-meddelelsen (12) inden for et forudbestemt tidsvindue.

6. Fremgangsmåde ifølge krav 5, ved hvilken verifikationen af et yderligere støjdæmpningssignal (4) efter et forudbestemt antal forudgående støjdæmpninger kræver, at en bruger (9) bekræfter støjdæmpningen over visnings- og betjeningsindretningen (3).

7. Fremgangsmåde ifølge et af de foregående krav, ved hvilken et funktionssvigt i apparatets (1) driftsstyresystem (7) nulstilles i et trin e), når verifikationen i et umiddelbsrt forudgående trin d) var vellykket.

8. Apparat (1) med en brugergrænseflade (2) og et driftsstyresystem (7), hvor brugergrænsefladen (2) og driftsstyresystemet (7) kan kommunikere med hinanden over en kommunikationsindretning (8) i apparatet (1), og hvor apparatet (1) endvidere omfatter en styreindretning (5), der kan omforme et fra en visnings- og betjeningsindretning (3) i apparatet (1) udsendt støjdæmpningssignal (4) til et hardwaresignal (6) og overføre dette direkte til driftsstyresystemet (7), og hvor apparatet (1) er indrettet til gennemførelse af en fremgangsmåde ifølge et af kravene 1 til 7.

Fig. 1

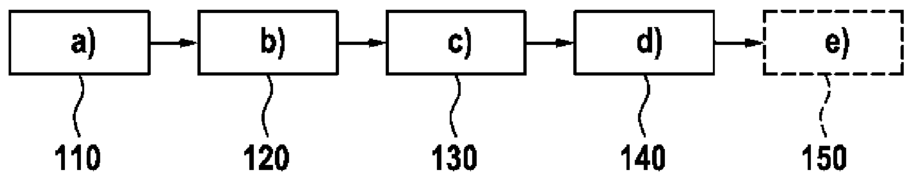

Fig. 2

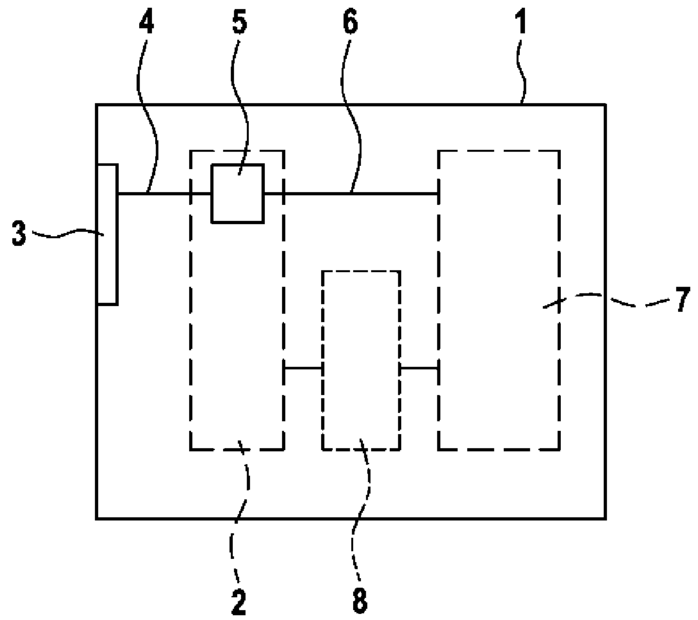

Fig. 3

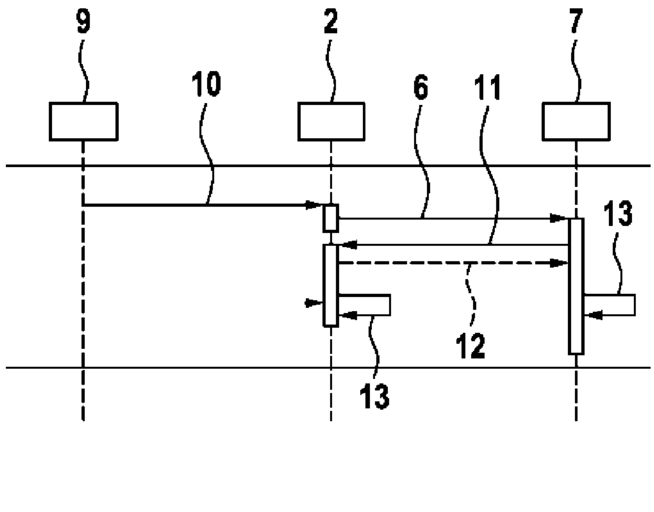

Fig. 4