

Operating device and loading crane having an operating device

5 The invention concerns an operating device for a loading crane having the features of the classifying portion of claim 1 and a loading crane having such an operating device.

 An operating device of the general kind set forth has long been used in loading cranes.

10 What is problematical in that respect is that loading cranes have a highly dynamic field of use, which makes it difficult to plan operations thereof. Therefore safety-relevant decisions have to be made by the user of the crane during operation thereof on site. Frequently the working area can be difficult to oversee, and the result of this is that the user has to change his position. The user often has to turn his view
15 away from the load to be craned in order to look at the operating device. Often the user is uncertain about the currently prevailing operating parameters of the crane. If the user is to have a clear picture about the currently prevailing operating parameters of the crane the question which also arises is how they can be processed and communicated to the user.

20 The object of the invention is to provide an operating device of the general kind set forth and a loading crane, in which the above-discussed problems are avoided.

 That object is attained by an operating device having the features of claim 1 and a loading crane have such an operating device. Advantageous embodiments of the invention are defined in the appendant claims.

25 Like an operating device of the general kind set forth for a loading crane, the operating device which is used in relation to the present invention also has a crane control means for controlling actuators of the loading crane and an input device for the input of control commands for the crane control means. In that case the actuators of the loading crane are controlled by the crane control means based on the input control
30 commands. In addition the crane control means is adapted to evaluate sensor signals from sensors of the loading crane and to generate sensor data on the basis of the sensor signals. Furthermore the input device is spatially separate from the crane control means, as is the case for example with a radio remote control.

 The crane control means has a first telecommunication device for the
35 exchange of data signals with the input device, the data signals delivered by the crane

control means including sensor data. Similarly thereto the input device has a second telecommunication device for the exchange of data signals with the first telecommunication device, the data signals delivered by the input device including control commands. Therefore (inter alia) data signals in the form of sensor data and control commands can be exchanged by the crane control means and the input device.

According to the invention it is now further provided that the operating device has a signalling device which is spatially separate from the input device and which can be worn by a user on the body. In that respect it is provided that the input device has a transmitting device for the delivery of data signals which can be received by a receiving device of the signalling device. It is further provided that the signalling device, which can be worn by a user on the body, has a displaying device, by which audio and/or image data can be displayed, wherein the signalling device signals the audio data and/or image data to a user.

The represented audio data and/or image data may include information about the currently prevailing operating parameters of the loading crane and optionally the operating device itself, information about a working process or lifting process of the loading crane, which is planned, which is currently being performed or which is to be performed, information about the surroundings of the crane and/or the user or information for the support of repair and/or maintenance operations on the loading crane. The working stress for a user can be reduced and the operating safety of a loading crane can be enhanced by the representation of audio data and/or image data.

The audio data and/or image data are basically (but not necessarily exclusively) produced on the basis of the sensor data, wherein there are provided three variants for the generation thereof:

In a first variant the data signals delivered by the crane control means to the input device include sensor data and the input device delivers those data to the signalling device by means of the transmitting device. The signalling device has a processor which now generates the audio data and/or image data on the basis of those sensor data.

In a second variant the input device has a processor which generates the audio data and/or image data on the basis of the sensor data delivered by the crane control means to the input device. The audio data and/or image data are now output by means of the transmitting device to the signalling device.

In a third variant it is provided that the control means has a processor which generates audio data and/or image data on the basis of the sensor data, and outputs same to the input device by means of the first and second telecommunication devices and the input device delivers the audio data and/or image data to the signalling device
 5 by means of the transmitting device.

Therefore the three variants substantially differ as to where the audio data and/or image data which are signalled to a user by means of the signalling device are generated on the basis of the sensor data.

The crane control means is adapted to control actuators of the loading crane.
 10 Control of the actuators is effected on the basis of control commands, wherein the control can include for example switching valves (like for example a directional control valve), hydraulic devices or supplying power to electrical devices.

The actuators can generally involve electric or hydraulic drives of a loading crane or mobile crane like for example hydraulic cylinders, electric or hydraulic drives
 15 of winches, electric or hydraulic drives of slewing drives or electric or hydraulic drives for or of working devices or attachments.

Control commands for the crane control means can be input by the input device which is spatially separate from the crane control means. Input of the control commands can be effected for example by a user by way of a keypad, operating
 20 knobs, operating levers or the like. In that respect however the possibility should not be excluded that control commands for the crane control means can also be input by other units of the operating device. The input device can be arranged for example in a mobile operating console like for example a radio remote control, or in an operating station. The mobile operating console which can be portable and the operating station
 25 which can be arranged on the loading crane and/or on a vehicle having a loading crane can communicate wirelessly or wired with the crane control means. The input device can therefore be in the form of a mobile control means or a mobile control module. The input device can be interpreted as (at least one) part of a stand-alone (possibly portable) operating unit, with which a user can move substantially freely in a
 30 certain area around a loading crane or a hydraulic lifting apparatus.

The sensors of the loading crane can be sensors for detecting the state of the loading crane and the state of attachments and the area around the loading crane. Examples of such sensors are for instance pressure sensors, rotary encoders, angle sensors, force measuring cells, optical sensors, ultrasound sensors, proximity sensors,

acoustic sensors, temperature sensors or acceleration sensors. Sensor signals can respectively emanate from those sensors like for example analog and/or digital electrical signals. The crane control means is adapted to generate corresponding sensor data from the sensor signals fed to the crane control means for example by way of wired or wireless signal connections. Thus for example sensor data corresponding to a measured pressure can be generated by the crane control means from an electric voltage output by a pressure sensor. In generation of the sensor data for example the geometry, equipment and operating state of the loading crane can be incorporated.

10 Data signals which are exchanged between the crane control means and the input device can include sensor data and control commands.

Data signals exchanged between the input device and the signalling device can include sensor data, however it should not be excluded that those data signals also include control commands.

15 A user can be a person who is operating the loading crane by means of control commands. In that respect it can be provided that the loading crane is also operated by a plurality of users.

It is provided that the signalling device is so designed that it can be worn by a user on the body, that is to say the at least one part of the signalling device can be arranged on or at a part of the body of a user. Such a signalling device can be in the form of data goggles, a smartwatch, a smartphone, a tablet, a headset, ear buds and the like.

It is further provided that the signalling device has a displaying device, by means of which audio data and/or image data can be displayed to a user. Image data can be reproduced by the displaying device in such a way that they can be optically perceived by a user. A displaying device for image data, that is to say an optical display, can be for example in the form of an optical display like for example an at least partially opaque, semi transparent or transparent display. Audio data can be reproduced by a displaying device for audio data in such a way that they can be perceived acoustically by a user. A displaying device for audio data, that is to say an acoustic display, can be for example in the form of a sound transducer like for example a loudspeaker or a bone conduction headphone. The audio data and/or image data can basically include status information about the operating state of the loading crane,

information relating to the area around the loading crane and the user as well as acoustic and/or optical warning alerts.

The signalling device can superimpose the image data at least on a part of a visual field of the user or fill at least a part of a visual field of the user with the image data. The audio data and/or image data can be displayed to the user without the user having to turn his view away from what is actually happening at the time, that is to say for example a working operation or lifting operation which is currently being performed. Audio data and/or image data of regions which are outside the visual field of the user can also be represented to the user.

In that respect it may be advantageous that the signalling device superimposes the visualised image data only on a part of the visual field of the user or fills only a part of the visual field of the user with the image data. The image data are therefore not superimposed on the entire visual field of the user or it is not the entire visual field of the user that is filled with image data. With a suitably designed signalling device therefore the user always sees a real image on which a virtual image is superimposed. In the case of lags in the representation or even a failure of the superimposed or inserted image (virtual image) the user always still has what is actually happening (the real image) in his field of view.

The processor or a processor of the crane control means, the input device or the signalling device is adapted to produce audio data and/or image data on the basis of the sensor data. The processor can be in the form of an autonomous component or a data-processing logic unit (for example a processor core).

The first and second telecommunication devices can be in the form of wireless telecommunication devices, preferably short-wave telecommunication devices, particularly preferably ISM telecommunication devices, wifi telecommunication devices or Bluetooth® telecommunication devices. Generally the transmitting device and the receiving device can be in the form of wireless communication devices or wired telecommunication devices.

It can be advantageous for sensor data and control commands to be communicated by way of different communication channels or by way of the same communication channel. It can therefore be provided that the communication of given data signals is effected by way of a dedicated parallel second transmission channel. In that way for example the transmission of control commands and the transmission of other data signals can be effected separately from each other. Thus it is also possible

to use different communication standards. Thus it can be possible for safety-relevant data signals like for example a control command to use certified hardware with for example suitable encryption, frequency spread or plausibility control while for the transmission of other data signals it is possible to use a simpler and possibly also
 5 faster connection like for example an ISM radio connection.

It can be advantageous in that respect for the communication channel or channels to be encrypted. In that way eavesdropping on or influencing of the transmission of data signals can be prevented or made difficult. The demands on encryption can in that case distinguish different data signals.

10 It can be advantageous if the transmitting device of the input device is formed by the second telecommunication device.

It can generally be advantageous if the input device has a power storage means for the power supply for the signalling device. The power supply which can also include charging up a power storage device of the signalling device can be
 15 effected in that case in wired or wireless fashion (for example inductively).

It can be provided that the crane control means for generating the sensor data from the sensor signals is or can be connected to a cloud computing computer unit. Thus for example the sensor signals detected by the crane control means, which correspond to the geometry, equipment and the operating state of the loading crane,
 20 can be communicated to a cloud service by way of a suitable telecommunication device. There, sensor data can be generated from the communicated sensor signals by the cloud computing unit and subsequently communicated to the crane control means.

It can be advantageous if the crane control means detects the position of the signalling device. Alternatively thereto or in combination therewith it can be provided
 25 that the signalling device detects a position of the user and/or a part of the body of the user and/or a visual field of the user (direction of view) relative to the loading crane. Detection of the or a position and/or the visual field can be effected for example by radio direction finding, a GPS system or by means of an optical detection device like
 30 for example a camera of the signalling device.

The detected position or positions or the detected visual field are communicated as data signals which can be generated for example by a processor to the input device by means of a communication device and the input device outputs the communicated data signals to the crane control means by way of the second and first

telecommunication device. The crane control means is adapted to implement control commands output by a user in dependence on the detected position of the signalling device and/or the user and/or the part of the body of the user and/or the visual field of the user relative to the loading crane. Detection of the or a position and/or the visual field can be effected for example by way of radio direction finding, a GPS system or by means of an optical detection device like for example a camera of the signalling device.

The output of control commands by a user or the implementation of control commands by the crane control means can therefore be permitted or prevented in dependence on the detected position of the signalling device and/or the user and/or the part of the body of the user and/or the visual field of the user relative to the loading crane. It is also possible for control commands to be generated in dependence on the detected position of the signalling device and/or the user and/or the part of the body of the user and/or the visual field of the user. Thus for example a so-called gesture control can be implemented for example by detection of the position or positions.

It is further possible for audio data and/or image data to be displayed in dependence on the detected position or positions.

As already mentioned in the opening part of this specification protection is also claimed for a loading crane having an operating device as described hereinbefore.

Embodiments by way of example of the invention are discussed with reference to the Figures in which:

Figure 1 shows an embodiment of a loading crane with an operating device, Figures 2a to 2c show various configurations of the operating device, Figure 3 shows a vehicle with a loading crane and an operating device, and Figure 4 shows a vehicle with a loading crane and an operating device and a user.

Figure 1 shows an embodiment of a loading crane 14 with an operating device in the form of a crane control means 1, an input device 2 and a signalling device 3. In the illustrated structure the input device 2 is arranged at a mobile operating console 11 and the signalling device 3 is in the form of data goggles 37. To detect a visual field of the signalling device 3 in the Figure 1 embodiment it has an optical detection device 33 like for example a camera.

The loading crane 14 can be mounted with its crane base 15 for example on a vehicle. A crane post 16 rotatable about a vertical axis is mounted on the crane base

15. A lift arm 17 which is pivotable about a horizontal axis by means of an actuator in the form of a hydraulic cylinder 22 is arranged on the crane post 16. In turn arranged on the lift arm 17 is a crane arm extension 18 which is pivotable about a horizontal axis by means of a further actuator in the form of a hydraulic cylinder 23, the extension
 5 18 having at least one telescopic extension boom arm 19. As shown in the Figure 1 embodiment an attachment arm 20 can be arranged on the crane arm extension 18, the arm 20 also being pivotable by means of a further actuator in the form of a hydraulic cylinder 24 about a horizontal axis. Equally the attachment arm 20 can have at least one telescopic extension boom arm 21. For additional support for the loading
 10 crane 14 or a vehicle carrying the loading crane 14 there is provided a support arrangement with outriggers, of which one outrigger 25 is shown in the Figure 1 view and which can have extendable telescopic support legs. In addition a working unit 36 in the form of a winch is arranged on the attachment arm 20 of the loading crane 14.

Besides the above-mentioned components the loading crane 14 has various
 15 sensors for detecting the instantaneous position or geometry of the loading crane 14. For the outriggers 25 there are provided switches S3, S4 for detecting the supporting state of the outrigger on the ground. It is also conceivable that the extended position of the outrigger 25 is detected by way of a travel measuring device (not shown here). A rotary encoder DG1 is provided for detecting the rotary angle of the crane post 16
 20 relative to the crane base 15. A further rotary encoder DG2 is provided for detecting the bend angle in a vertical plane between the crane post 16 and the lift arm 17. The hydraulic pressure in the hydraulic cylinder 22 of the lift arm 17, which pressure is characteristic of the crane capacity, involves a pressure sensor DS1. A rotary encoder DG3 is provided for detecting the bend angle between the lift arm 17 and the crane
 25 arm extension 18 in a vertical plane. A pressure sensor DS2 is provided for detecting the hydraulic pressure in the hydraulic cylinder 23 of the crane arm extension 18. A switch S1 is provided for detecting the retraction state of an extension boom arm 19 of the crane arm extension 18. A rotary encoder DG4 is further provided for detecting the bend angle between the crane arm extension 18 and the attachment arm 20 in a
 30 vertical plane. A pressure sensor DS3 is provided for detecting the hydraulic pressure of the hydraulic cylinder 24 of the attachment arm 20. A switch S2 is provided for detecting the retraction state of an extension boom arm 21 of the attachment arm 20. In principle it should not be excluded that the extension position of the individual

extension boom arms is detected by way of an extension position sensor with for example a travel measuring device.

The sensor signals are respectively fed to the crane control means 1 by way of signal inputs, of which by way of example the signal inputs 6, 7 for the sensor signals of the pressure sensors DS1, DS2 are shown. Sensor data are then computed in the crane control means 1 from those sensor signals and from data stored in a memory 10 and in this example specific to the loading crane 14, by means of a processor P of the crane control means 1, said sensor data being characteristic of the currently prevailing lift load situation or the operating state of the loading crane 14. The data specific to the loading crane 14 can be for example information relating to equipment, functions and limit values of operating parameters of the loading crane 14 and any working units. Thus for example sensor data which correspond to a measured pressure in the corresponding hydraulic cylinders 22, 23 can be calculated for example from the electrical voltages or signals output by the pressure sensors DS1, DS2. It can also be provided that the crane control means 1 is or can be connected to a cloud computing computer unit for generation of the sensor data from the sensor signals. Thus for example the sensor signals detected by the crane control means 1 can be communicated to a cloud service by way of a suitable telecommunication device. There sensor data can be generated from the communicated sensor signals by the cloud computing computer unit and subsequently communicated to the crane control means 1. It can also be possible to transmit specific data for the loading crane 14 to a cloud service or to retrieve same from a cloud service.

The crane control means 1 is adapted to control the actuators of the loading crane 14. Control commands for the crane control means can be delivered by way of the input device 2. The input device 2 can be spatially separate from the crane control means 1 and in the illustrated embodiment is arranged in a mobile operating console 11.

As can also be seen from a comparison with Figures 2a, 2b and 2c which respectively show diagrammatically different configurations of the operating device the crane control means in each case has a first telecommunication device 4 for the exchange of data signals with the input device 2 and the operating console 11, wherein it is provided that the data signals delivered by the crane control means 1 include the sensor data. Similarly thereto the input device 2 has a respective second telecommunication device 5 for the exchange of data signals with the first

telecommunication device 4, wherein it is provided that the data signals supplied by the input device 2 include control commands.

The operating device further has a respective signalling device 3 which can be worn by a user (41) on the body. It is provided that the input device 2 has a respective transmitting device 6 for outputting data signals, wherein the data signals can be received by a receiving device 7 of the signalling device 3. It is further provided that the signalling device 3 which can be worn by a user (41) on the body has a displaying device 9, by which a user (41) can be displayed audio data and/or image data. The displaying device 9 in that case can include an optical display 33 as discussed hereinbefore as well as an acoustic display 34 as discussed hereinbefore. The signalling device 3 can generally have a processor which for example is adapted to control the displaying device 9 corresponding to the signalling or reproduction of the audio data and/or image data. The operating console 11 can also have a display 12 (and a processor suitably adapted for the display), which for example can serve for the display of data signals like for example sensor signals. It can be provided that the transmitting device 6 of the input device 2 is formed by the second telecommunication device 5.

The input device 2 and the signalling device 3 can respectively have a power storage means 38, 39. The power supply of the signalling device 3 can however also be implemented by way of the input device 2, like for example the power storage means 38 thereof and a suitable connection.

The signalling device 3 can have a communication device 8, by means of which a detected position or a detected visual field of the signalling device 3 can be communicated to the input device 2 as data signals which for example can be generated by a processor of the signalling device 3.

Figure 2a shows a first configuration of the operating device. In this configuration data signals which include sensor data are delivered by the crane control means 1 to the input device 2 by means of a wireless connection 26 and/or a wired cable connection 27 supported by the first telecommunication device 4 and the second telecommunication device 5. The input device 2 passes those sensor data to the signalling device 3 by way of a wireless connection 28 and/or a wired cable connection 29 supported by means of the transmitting device 6 and the receiving device 7. In this embodiment the signalling device 3 has a processor P3 which now on the basis of those sensor data generates the audio data and/or image data which are to be

signalled to a user (41). It will be appreciated that a storage means 30 for the storage of computed and/or received data can be provided for the signalling device 3.

Figure 2b shows a second configuration of the operating device. In this configuration the input device 2 has a processor P2 which on the basis of the sensor data delivered by the crane control means 1 to the input device 2 generates the audio data and/or image data which are to be displayed to a user (41). It is accordingly provided that the audio data and/or image data are delivered by means of the transmitting device 6 to the receiving device 7 of the signalling device 3. It will be appreciated that a storage means 31 for the storage of computer and/or received data can be provided for the input device 2.

Figure 2c shows a third configuration of the operating device. In this configuration the crane control means 1 has a processor P3 which produces audio data and/or image data on the basis of the sensor data and delivers same to the input device 2 by means of the first and second telecommunication devices 4, 5 and the input device 2, by means of the transmitting device 6, delivers the audio data and/or image data to the signalling device 3.

As can be seen from the configuration of the crane control means 1 in Figure 1 the configuration of the operating device shown in Figure 1 can correspond to that of Figure 2a or Figure 2b. With the provision of a processor P3 (and optionally a storage means 32) the configuration of the operating device shown in Figure 1 however can also be of a design corresponding to the configuration shown in Figure 2c.

Generally it should not be excluded that the processors P1, P2, P3 for generating the audio data and/or image data are in the form of an independent processor or an independent component or a data-processing logic unit (for example a processor core) of an existing processor. Similarly thereto the storage means 30, 31, 32 can be independent or in the form of part of existing storage means.

Figure 3 shows a vehicle 40 having a loading crane 14 and an embodiment as shown for example in Figure 1 of the operating device with an input device 2 and a signalling device 3.

Figure 4 shows a further embodiment of a vehicle 40 having a loading crane 14 and a configuration as shown for example in Figure 1 of the operating device with an input device 2 and a signalling device 3 which is carried by a user 41, in the form of a further configuration of data goggles 37. The operating device can be so designed that the position of the signalling device 3 is detected by the crane control means 1. In

the illustrated embodiment therefore the position of the signalling device 3 can be detected in the coordinate system x,y,z of the vehicle 40 or the loading crane 14.

In addition the signalling device 3 can detect a position of the user 41. In the illustrated embodiment it is also possible to determine the orientation of the coordinate system u,v,w of the signalling device 3 relative to the coordinate system x,y,z of the vehicle 40 or the loading crane 14 – and thus an orientation of the user 41 relative to the vehicle 40 or the loading crane 14.

It is further possible to detect the position of a part of the body 42 of the user 41 relative to the loading crane 14 or relative to the signalling device 3. Furthermore the visual field 43 of the user 41 can be detected relative to the loading crane 14. Thus for example it is also possible to detect the position of a part of the body 42 of the user 41 in the visual field 43 of the user 41. In that way it is also possible for example to detect a sequence of movements of a part of the body 42 of the user 41 (gestures). In that case the visual field 43 of the user can be detected for example by way of an optical detection device (see reference 35 in Figure 3).

The detected positions can be communicated by the signalling device 3 as data signals to the input device 2 by means of a communication device 8 and the communicated data signals can be further delivered to the crane control means 1 by the input device 2 by way of the second and first telecommunication devices 5, 4. The crane control means 1 can now basically be adapted in dependence on the detected positions to generate control commands and/or carry them out. Thus control commands of the user 41 can be carried out in dependence on the detected position of the signalling device 3. Furthermore control commands can be carried out in dependence on the detected position of the user 41, therefore for example the detected orientation of the user 41 relative to the vehicle 40 or the loading crane 14. Control commands can further be carried out in dependence on the detected position of the part of the body 42 of the user 41, in which case that can for example also include the generation of control commands by the detected position of the part of the body 42 of the user 41 (gesture control). Furthermore control commands can be carried out in dependence on the detected visual field 43 of the user 41 relative to the loading crane 14. Thus for example the implementation of control commands can also be prevented if it is assumed, by virtue of the detected visual field (or also the detected position) of the user 41, that the visual field or the user is not directed towards the vehicle 40 or the loading crane 14 or a working region of the loading crane 14.

List of references:

	1	crane control means
	2	input device
5	3	signalling device
	4	first telecommunication device
	5	second telecommunication device
	6	transmitting device
	7	receiving device
10	8	communication device
	9	displaying device
	10	storage means
	11	operating console
	12	display
15	14	loading crane
	15	crane base
	16	crane post
	17	lift arm
	18	crane arm extension
20	19	extension boom arm
	20	attachment arm
	21	extension boom arm
	22, 23, 24	hydraulic cylinder
	25	outrigger
25	26	wireless connection
	27	cable connection
	28	wireless connection
	29	cable connection
	30	storage means
30	31	storage means
	32	storage means
	33	optical display
	34	acoustic display
	35	optical detection device

	36	working unit
	37	data goggles
	38, 39	power storage means
	40	vehicle
5	41	user
	42	part of the body
	43	visual field
	x,y,z	coordinate system crane
	u,v,w	coordinate system signalling device
10	P0	processor
	P1, P2, P3	processor
	S1, S2, S3, S4	switch
	DG1, DG2, DG3, DG4	rotary encoder
	DS1, DS2, DS3	pressure sensor
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CLAIMS

1. An operating device for a loading crane (14) comprising:
 - a crane control means (1) for controlling actuators of the loading crane (14)
 - 5 based on control commands and for evaluating sensor signals from sensors of the loading crane (14) and for generating sensor data on the basis of the sensor signals,
 - an input device (2) which is spatially separate from the crane control means (1) for the input of control commands for the crane control means (1),
 - wherein
 - 10 - the crane control means (1) has a first telecommunication device (4) for the exchange of data signals with the input device (2), wherein the data signals delivered by the crane control means (1) include sensor data,
 - the input device (2) has a second telecommunication device (5) for the exchange of data signals with the first telecommunication device (4), wherein the data
 - 15 signals delivered by the input device (2) include control commands,
 - characterised in that
 - the input device (2) has a transmitting device (6) for the delivery of data signals,
 - there is provided a signalling device (3) which is spatially separate from the
 - 20 input device (2) and which can be worn by a user (41) on the body and which has a receiving device (7) for receiving data signals delivered by the transmitting device (6) and a displaying device (9) by which audio data and/or image data can be displayed, wherein the signalling device (3) signals the audio data and/or image data to a user (41),
 - 25 and that either
 - data signals delivered by the crane control means (1) include sensor data and the input device (2) outputs said sensor data to the signalling device (3) by means of the transmitting device (6) and the signalling device (3) has a processor (P3) which generates the audio data and/or image data on the basis of said sensor data, or
 - 30 - the input device (2) has a processor (P2) which generates the audio data and/or image data on the basis of the sensor data delivered by the crane control means (1) and delivers same by means of the transmitting device (6) to the signalling (3), or

- the crane control means (1) has a processor (P1) which generates audio data and/or image data on the basis of the sensor data and outputs same by means of the first and second telecommunication devices (4, 5) to the input device (2) and the input device (2) delivers the audio data and/or image data to the signalling device (3) by means of the transmitting device (6).

2. An operating device according to claim 1 wherein the first and second telecommunication devices (4, 5) are in the form of wireless telecommunication devices, preferably short-wave telecommunication devices, particularly preferably ISM telecommunication devices, wifi telecommunication devices or Bluetooth® telecommunication devices.

3. An operating device according to at least one of the preceding claims wherein the transmitting device (6) and the receiving device (7) are in the form of wireless communication devices or wired telecommunication devices.

4. An operating device according to one of the preceding claims wherein the input device (2) is arranged in a mobile operating console (11) or in an operating station.

5. An operating device according to at least one of the preceding claims wherein the signalling device (3) is in the form of data goggles (37), a smartwatch, a smartphone, a tablet, a headset or ear buds.

6. An operating device according to at least one of the preceding claims wherein sensor data and control commands are communicated by way of different communication channels or by way of the same communication channel.

7. An operating device according to at least one of the preceding claims wherein the transmitting device (6) is formed by the second telecommunication device (5).

8. An operating device according to at least one of the preceding claims wherein the input device (2) has a power storage means (38) for the power supply of the signalling device (3).

5 9. An operating device according to at least one of the preceding claims wherein the crane control means (1) is or can be connected to a cloud computing computer unit for generating the sensor data from the sensor signals.

10 10. An operating device according to at least one of the preceding claims wherein the signalling device (3) superimposes the image data at least on a part of a visual field (43) of the user (41) or fills at least a part of a visual field (43) of the user (41) with the image data.

15 11. An operating device according to the preceding claim wherein the signalling device (3) superimposes the visualised image data only on a part of the visual field (43) of the user (41) or fills at least a part of a visual field (43) of the user (41) with the image data.

20 12. An operating device according to at least of the preceding claims wherein either

- the crane control means (1) detects the position of the signalling device (3), and/or

- the signalling device (3) detects a position of the user (41) and/or a part of the body (42) of the user (41) and/or a visual field (43) of the user (41) relative to the loading crane (14) and communicates same as data signals to the input device (2) by way of a communication device (8) and the input device (2) delivers the communicated data signals to the crane control means (1) by way of the second and first telecommunication devices (5, 4),

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and the crane control means (1) is adapted to carry out control commands of the user (41) in dependence on the detected position:

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- of the signalling device (3), and/or

- of the user (41) and/or the part of the body (42) of the user (41) and/or the visual field (43) of the user (41) relative to the loading crane (14).

13. A loading crane (14) having an operating device according to at least one of the preceding claims.

14. A vehicle (40) having a loading crane (14) according to claim 13 and an
5 operating device according to at least one of claims 1 to 12.