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INTERFACE DEVICE AND SYSTEM WITH AN INTERFACE DEVICE

The invention relates to an interface device having at least one input, which receives a sensor measurement value as an input value, at least one microprocessor, which converts the input value into an output value, and a communication means, which outputs the output value. The invention also relates to a system comprising an interface device of this kind.

A system and a method for controlling a plurality of switch devices are known from German laid-open application DE 10 2007 040 660 A1. This system proposes a system component which can communicate with a central unit via a communication network. The system component has a plurality of switch outputs and an interface for communication with an energy quantity meter.

German laid-open application DE 10 2008 030 030 A1 describes a data transmission system for detecting and storing consumption data. To this end, a transmitter and a receiver are provided. The transmitter receives measurement data from various components and transfers said data to a receiver.

A system in which data is received from energy meters via an energy meter communication interface and is transferred to a central location via a communication module is known from publication WO 2005/076240 A2.

A wide range of sensors are used to detect measurement values. Examples of sensors are weather sensors, which detect weather data, such as temperature and precipitation. Global radiation sensors are also known, which are used to detect a momentary value of global radiation. Pyranometers can be used here. With the aid of the global radiation sensors it is possible to detect the solar radiation impinging on a horizontal receiving surface, wherein, besides the direct solar radiation, diffusion radiation created by scattering at cloud, water and dust particles of the earth’s surface can also be detected.

In particular in the case of regenerative energy sources, the weather is often a key influence on energy recovery. In the case of wind turbines, wind strength and wind direction are undoubtedly relevant criteria, and in solar plants global radiation is a relevant criterion. The energy recovered by the regenerative energy recovery plants is measured by means of calibrated energy meters. The calibrated energy meters often can be read remotely. To this end, different meters, in particular electricity meters, but also consumption meters, such as gas meters or water meters, in particular via radio communication, can record a communication with an energy meter communication interface, in particular a gateway, an energy meter gateway, or a multi-utility communication controller (MUC-C) interface. Hereinafter, the terms “energy meter communication interface”, “gateway”, “energy meter gateway”, or “multi-utility communication controller (MUC-C) interface” will be used, wherein the terms can be used synonymously.

The communication between the consumption meters and the energy meter communication interface is implement in particular via the wireless meter bus protocol according to DIN 13757. The data records exchanged between the calibrated energy meters and the energy meter communication interface follow this protocol and the requirements of the Open Metering System Specification.

The energy meter communication interface is thus suitable for detecting consumption data of calibrated and non-calibrated energy meters, in particular, electricity, gas and water meters, in particular those that are installed on regenerative power recovery plants, via wired or wireless communication on the one hand and for transmitting the measurement data to an accounting centre on the other hand. Here, the energy meter communication interface is often connected to the accounting centre of the meter operator via a wide-area network. Here, communication via an Internet protocol, in particular TCP/IP is a potential option, for example.

The existing communication infrastructure formed of accounting centre, energy meter communication interface and energy meter is currently used exclusively for the transfer of the measurement values. However, due to the high investment costs for the energy meter communication interfaces and the intelligent energy meters able to communicate with said interfaces, there is the question of the further usefulness of the energy meter communication interfaces.

For this reason, the object of the invention was to make an energy meter communication interface usable in a flexible and versatile manner. This object is achieved by an interface device according to claim 1 and a system according to claim 8.

In particular the interface device comprises a communication means for communication with an energy meter communication interface by means of a measurement value transmission protocol. The interface device described here can thus communicate with an energy meter communication interface. This communication is performed by means of a measurement transmission protocol which in particular is a standardised transmission protocol.

During the transmission between the interface device and the energy meter communication interface, the communication means output the output value determined by the microprocessor in the form of a data record. The data record follows the specifications of the measurement value transmission protocol, in particular the data record contains protocol-specific headers and address bits and parity bits and a payload, in which the output value can be stored. The output value thus can be transmitted in the form of a data record of the measurement value data transmission protocol to the energy meter communication interface.

The sensor measurement values at the input of the interface device can be detected by different sensors, such as weather sensors, in particular wind and global radiation sensors. In addition, sensor values from electricity measurements, voltage measurements, pulse measurements, frequency measurements, resistance measurements and the like can be applied as input value at the input.

In particular, analogue measurement values can be applied as input measurement value at the input. These analogue measurement values are converted by the microprocessor into digital values by means of an A/D converter. The output values calculated by the microprocessor can already be converted into a format suitable for communication by means of the measurement value transmission protocol. Furthermore, the microprocessor can generate an output value representing a physical variable, in particular in digital form, from the input value, in particular the analogue input value.

As already explained at the outset, existing energy meter communication interfaces can communicate wirelessly or in a wired manner via a standardised measurement value transmission protocol. For this reason, it is proposed that the measurement value transmission protocol is the wireless meter bus interface. However, the interface protocol M-bus, which is operated in a wired manner, is also possible. The measurement value transmission protocol preferably satisfies the requirements of the open metering system specification (OMS).

The energy meter communication interface is a multi utility communication controller (MUC-C) or a gateway. With the aid of the multi utility communication controller or the gateway a meter operator or a meter-reading company can read a number of energy meters remotely. With the aid of the interface device described here, the energy meter communication interface is supplemented by a further function, specifically so as to be able to detect measurement values from a wide range of sensor and forward these to an accounting centre.

The accounting centre can be a functional unit or can be formed from various functional units. For example, a front end can be formed for receiving the data from the energy meter communication interface. A meter remote access device can comprise this front end and via said front end can remotely access the energy meter communication interface.

Here, an additional benefit can be provided for the customer, in particular the meter remote access device or a server associated therewith can provide an Internet portal, via which the sensor data can be accessed. To this end, a website can be made available by the server, via which website the measurement values detected by a user's sensors can be read out to said user. The interface device can also be remotely controlled by means of a web page of this kind. The server can provide a visualisation of the sensor data and control of the interface device via a web page which can be called up from a remote computer using a username and a password.

The measurement values detected by the meter remote access device can also be forwarded to an accounting system of the accounting centre. Here, a protocol can be implemented for example, so as to bring the detected measurement values into a format for the accounting system

At least two inputs are provided, and the microprocessor calculates an output value for each input value. Each output value is also assigned an identification number.

The energy meter communication interface receives different measurement values by means of the measurement value transmission protocol. Each individual meter and each individual interface device which communicates with an energy meter communication interface is assigned a unique identification number (ID). In addition, each individual sensor value present as an output value can be assigned an identification number with use of the measurement value transmission protocol. It is thus possible that a region in which the identification number can be entered is provided in the header or in the payload of the data record of the measurement value transmission protocol. With the aid of this identification number the energy meter communication interface can determine from which sensor the value originates. It is hereby possible that an allocation of the measurement values to a sensor is also made possible in the accounting centre.

It is also proposed that at least one control output is provided. A control output is suitable for switching switch members connected thereto, for example relays or the like. The interface device therefore cannot only detect sensor values as input value but can also switch members via the control output. To this end, the microprocessor converts a control signal received via the communication means in a data record of the measurement value transmission protocol into a control output value. The communication means can thus receive control signals from the energy meter communication interface via the measurement value transmission protocol. These control signals are for example control signals input by a user via a user interface, in particular a website.

Consumers and/or generators can be switched with the aid of the control signals. In particular, regenerative energy production plants, in particular solar panels or wind turbines, are switched on and off. A remote-controlled switching on and off for example of a solar panel or a wind turbine is thus possible via the energy meter communication interface.

The received control signal is converted by the microprocessor into the control output value, and this control output value is output at the control output. The control output value can comprise, for example, a logic on or a logic off or other control values, also analogue control values.

In accordance with an advantageous exemplary embodiment it is proposed that the communication means are designed for bidirectional communication with the energy meter communication interface by means of the measurement value transmission protocol. Information can thus be exchanged in both directions with the energy meter communication interface by means of the communication means.

In particular, the communication means are formed for receiving energy meter measurement values from consumers or generators connected to the energy meter communication interface, in particular from regenerative energy generators, preferably from photovoltaic plants (PV plants).

Besides the direct transmission of energy meter measurement values from the energy meter communication interface to the accounting centre or the meter remote access device, it is possible alternatively or additionally that an energy meter sends its measurement data, in particular relating to a PV plant, to the energy meter communication interface and this then in turn transmits this data (besides the possible transmission to the meter remote access device) to the interface device. As already explained, an energy measurement value can be originated from a photovoltaic system, however energy meter measurement values from other energy generation plants, for example wind turbines, biomass plants, hydroelectric power plants, or the like or from consumers can also be detected and/or transmitted.

So as to enable an evaluation of a degree of efficacy of an energy recovery plant, in particular a photovoltaic plant, within the interface device, in particular the microprocessor or a computer connected thereto, it is proposed that the microprocessor is formed for converting an input value of a sensor, in particular of a global radiation sensor. It is also possible to set the input value of the sensor in relation to a measured meter value of an energy meter associated with the energy recovery plant and on this basis to ascertain the degree of efficacy of the energy recovery plant. This is then also possible in particular if the measurement value of a global radiation sensor is converted into an output value. Both the energy meter measurement value and the output value of the global radiation sensor then can be called up both within and also externally of the interface device and can be used for the evaluation. In particular, the interface device can comprise a further communication device for communicating with a computer. This can be a network card for example, via which communication with a computer is made possible by means of LAN or W-LAN, such that the computer can refer back to the values of the sensor and to the measurement values of the energy meter and can perform an evaluation locally. On the other hand, the measurement value of the sensor can be transmitted to the energy meter communication interface and from there can be sent together with the energy meter measurement value to the meter operator or a central accounting station, in particular via the Internet.

In accordance with an advantageous exemplary embodiment it is also proposed that the communication means are designed for encrypted communication with the energy meter communication interface. The communication of the sensor data and the communication of control data can hereby be secured against attacks.

In accordance with an advantageous exemplary embodiment, it is also proposed that a solar-operated energy source is provided in the interface device for supplying energy to the interface device. In particular in the case of external use in the vicinity of an energy recovery plant, such as a photovoltaic plant, the interface device can operated freely form an external energy supply with the aid of the solar-operated energy supply. This increases the field of use of the interface device. A rechargeable battery can also be provided, which is charged by the solar-operated energy source and supplies the interface device with energy during darkness. Furthermore, the interface device can be provided in an encapsulated housing, such that ambient influences do not have any influence on the functionality of the device.

A further subject of the invention is a system having a previously described interface device and an energy meter communication interface, wherein the energy meter communication interface communicates with at least one energy meter by means of the measurement value transmission protocol and the energy meter communication interface communicates with the interface device by means of the measurement value transmission protocol.

In particular it is also proposed that the energy meter communication interface communicates with an accounting centre of a meter operator or meter-reading company via a wide-area network. This communication can be performed preferably via the Internet. In particular, communication by means of TCP/IP is possible.

The above-mentioned methods can also be carried out as a computer program or as a computer program stored on a storage medium. In this case, a microprocessor on the detection means side and/or on the actuator side and/or on the server side can be suitably programmed to carry out the respective method steps by means of a computer program.

The features of the methods and devices can be freely combined with one another. In particular, features of the description and/or of the dependent can be independently inventive in isolation or freely combined with one another, also by completely or partially avoiding features of the independent claims.

The subject matter of the invention will be explained in greater detail hereinafter on the basis of a

drawing showing exemplary embodiments. In the drawing:

Fig, 1 shows a system having an interface device and a multi-utility communication controller;

Fig. 2 shows a detailed view of an interface device.

Fig. 1 shows an interface device 2, which is shown in greater detail in Fig. 2.

As can be seen in Fig. 2, the interface device 2 comprises an input 4 with a connection 4a and a microcontroller 4b controlling this connection 4a. Just one single input 4 is shown, merely by way of example, but the interface device 2 is also suitable for a plurality of inputs 4.

The microcontroller 4b can be designed to ensure a series or parallel communication via a cable connected to the connection 4. The microcontroller 4b can also be designed such that a plurality of sensors can deliver their measurement values via a cable connected to the connector 4.

A microprocessor 6 is also arranged in the interface device 2, as well as a communication means 18 having a communication processor 8a and an antenna 8b.

The communication processor 8a is designed such that it can transmit and receive wireless signals via the antenna 8b. The communication processor 8a is programmed such that it sends signals emitted via the antenna 8b in accordance with a wireless meter bus interface protocol.

It can be seen in Fig, 2 that the communication with an energy meter communication interface that is formed for example as a multi-utility communication controller (MUC-C) or gateway 12 takes place via a wireless transmission path 10. To this end, the gateway 12 comprises a radio module, via which communication takes place by means of the measurement value transmission protocol. The radio module enables the wireless communication via transmission paths 10, 10’ with a plurality of communication partners. The communication via the transmission path 10 occurs via the wireless meter bus interface protocol.

The interface device 2 furthermore comprises an output 14 with a connection 14a and a microcontroller 14b. At least one switch signal can be output at the connection 14a via the microcontroller 14b.

An additional microcontroller 16a is also connected to the microcontroller 6, via which additional microcontroller a computer can be connected to a connection 16b, for example by means of a network connection, for example a W-LAN connection or also by means of an RS232 interface or another conventional interface technology.

Lastly, a rechargeable battery 18 for supplying energy to the aforementioned units is provided in the interface device 2 within the interface device 2. The rechargeable battery 18 can preferably be charged via a solar panel 20, such that a self-sufficient energy supply is ensured.

A wide range of sensors 22a, 22b can be connected to the connection 4a. It is possible that a connection 4a receives analogue values and digital values. Possible sensors 22a, 22b can be current, voltage, pulse or frequency sensors, resistance sensors, or the like. Wind meters can also be provided.

A global radiation sensor 22 can be connected to a further connection 4a’.

Lastly, at least one relay 24 can be connected to a connection 14a of the output 14.

A computer 26 of a user can be connected via the connection 16.

The gateway 12 communicates with at least one energy meter 28a-d via a second transmission path 10’, likewise by means of the wireless meter bus protocol. As already mentioned, the gateway 12 comprises a radio module for this purpose, via which the plurality of transmission paths 10, 10’ can be established. A communication module for wired communication with an energy meter 28a, preferably exactly one energy meter, can be implemented via a wired connection 11.

Lastly, the gateway 12 communicates via a wide-area connection 30 or 31 with an accounting centre 34 or the meter remote access device contained therein or connected thereto, for example via the Internet 32 by means of the TCP/IP protocol. The accounting centre 34 can communicate with a computer 36 likewise via the Internet 32. The wide-area connection 31 can be a direct connection.

The system shown in Fig. 1 can be operated as follows, by way of example.

The energy meter 28a is for example a calibrated energy meter of a photovoltaic plant. This energy meter measures the amount of energy provided by the photovoltaic plant, in particular the amount of energy fed into the network.

The measured amount of energy and/or power is transmitted via the transmission path 10c by means of the wireless meter bus protocol to the gateway 12. The gateway 12 transmits the measured values by means of the connection 30 to the accounting centre 34, such that a feed-in remuneration of the operator of the photovoltaic plant can be implemented.

The operator of the photovoltaic plant, however, might also wish to be provided with information regarding the efficacy of their plant. For this reason, the gateway 12 likewise transmits the measured values via the transmission path 10 to the interface device 2. The interface device 2 receives global radiation values from a global radiation sensor 22 via the connection 4a’, which global radiation values for example represent the radiation values at the photovoltaic plant.

The received signals can be output at the connection 16a by means of the microprocessor 6, such that a comparison of the power actually obtained with theoretically possible power values calculated on the basis of the radiation values can be made by means of a local computer 26.

The interface device 2 can additionally receive further sensor measurement values via the connection 4a. The received measurement values can be converted in the microprocessor 6 for example from an analogue value to a digital value. The measurement values can then be inserted into a data record, wherein the data record is a data record of the wireless meter bus. This data record can be transmitted via the transmission path 10 to the gateway 12, which in turn has a connection to the accounting centre 34 via the data connection 30, such that the sensor measurement values can also be transmitted thereto.

The accounting centre 34 for example can provide an Internet server, which enables an analysis of the sensor measurement values. This website can be called up for example via the computer 36 via the Internet 32. Besides energy values measured by the energy meter 28a, a user can thus also receive measurement values of the sensors 22a, 22b at the computer 36. The radiation value detected by the global radiation sensor 22 can likewise be transmitted via the aforesaid connection to the accounting centre 34. With the aid of this data an evaluation of the efficacy of the solar panel connected to the energy meter 28a can also be performed in the accounting centre 34 and provided in graph form, such that this information can be called up via the computer 36.

It is possible to intervene in the function of the solar panel or to control another actuator via the computer 36, for example in such a way that said computer transmits a control signal to the accounting centre 34. The accounting centre 34 then transmits this control signal via the connection 30 to the gateway 12, which transmits this signal via the transmission path 10 to the interface device 2 by means of the wireless meter bus protocol. The control signal can be converted in the interface device 2 by means of the microprocessor 6 into a control output value, which is applied to the connection 14a of the output 14. For example, the relay 24 can be connected with the aid of the control output value.

The shown interface device 2 extends the functional range of a gateway 12 by use of the wireless meter bus protocol.

Grænsefladeorgan og system med et grænsefladeorgan

Patentkrav

1. Grænsefladeorgan (2) med,
- mindst én indgang (4a, 4a‘), der modtager sensormåleværdier som indgangsværdi,
- mindst én mikroprocessor (6), som omformer indgangsværdien til en udgangsværdi, og
- et kommunikationsmiddel (8), som udsender udgangsværdien,
- hvor kommunikationsmidlet (8) er indrettet til kommunikation med en kommunikationsgrænseflade for energimåler (12), der er dannet som port eller kommunikationskontrolenhed for multihjælpeværktøjer, ved hjælp af en overførselsprotokol for måleværdi,
- kommunikationsmidlet (8) overfører udgangsværdien i form af en datapost fra overførselsprotokollen for måleværdi til energimåler-kommunikations-interfacet (12), og
- at der er tilvejebragt mindst to indgange (4a, 4a‘), og at mikroprocessoren (6) i hvert tilfælde beregner en udgangsværdi for en respektiv indgangsværdi og tildeler et identifikationsnummer til den respektive udgangsværdi.

2. Grænsefladeorgan ifølge krav 1, **kendetegnet ved,** at overførselsprotokollen for måleværdi er grænsefladeprotokollen for trådløs målerbus.

3. Grænsefladeorgan ifølge ét af kravene 1 til 2, **kendetegnet ved**, at der er tilvejebragt mindst én styreudgang (14),
- at mikroprocessoren (6) omformer et styresignal, der er modtaget via kommunikationsmidlerne (8) i en datapost ioverførselsprotokollen for måleværdi, til en styreudgangsværdi, og
- at styreudgangen (14) udsender styreudgangsværdien.

4. Grænsefladeorgan ifølge ét af kravene 1 til 3, **kendetegnet ved**, at kommunikationsmidlerne (8) til tovejskommunikation med kommunikationsgrænsefladen for energimåler (12) er dannet ved hjælp af overførselsprotokollen for måleværdi.

5. Grænsefladeorgan ifølge ét af kravene 1 til 4, **kendetegnet ved**, at mikroprocessoren (6) til omformning af en indgangsværdi fra en global strålingssensor (22) er dannet på

en sådan måde, at denne omformer en måleværdi fra den globale strålingssensor (22) til en udgangsværdi.

6. Grænsefladeorgan ifølge ét af kravene 1 til 5, **kendetegnet ved**, at kommunikationsmidlerne (8) er dannet med henblik på kodet kommunikation med kommunikationsgrænsefladen for energimåler (12).

7. Grænsefladeorgan ifølge ét af kravene 1 til 6, **kendetegnet ved**, at der er tilvejebragt en soldrevet energikilde til energiforsyning af grænsefladeenheden (2) i grænsefladeenheden (2).

8. System med et grænsefladeorgan ifølge ét af kravene 1 til 7 og en kommunikationsgrænseflade for energimåler (12), hvor kommunikationsgrænsefladen for energimåler (12) er forbundet med mindst én energimåler (28) ved hjælp af overførselsprotokollen for energimåler, og kommunikationsgrænsefladen for energimåler (12) er forbundet med grænsefladeorganet (2) ved hjælp af overførselsprotokollen for måleværdi.

9. System ifølge krav 8, kendetegnet ved, at kommunikationsgrænsefladen for energimåler (12) via fjernnet (30, 31), navnligt internettet, navnligt ved hjælp af TCP/IP, er forbundet med et faktureringscenter (34).

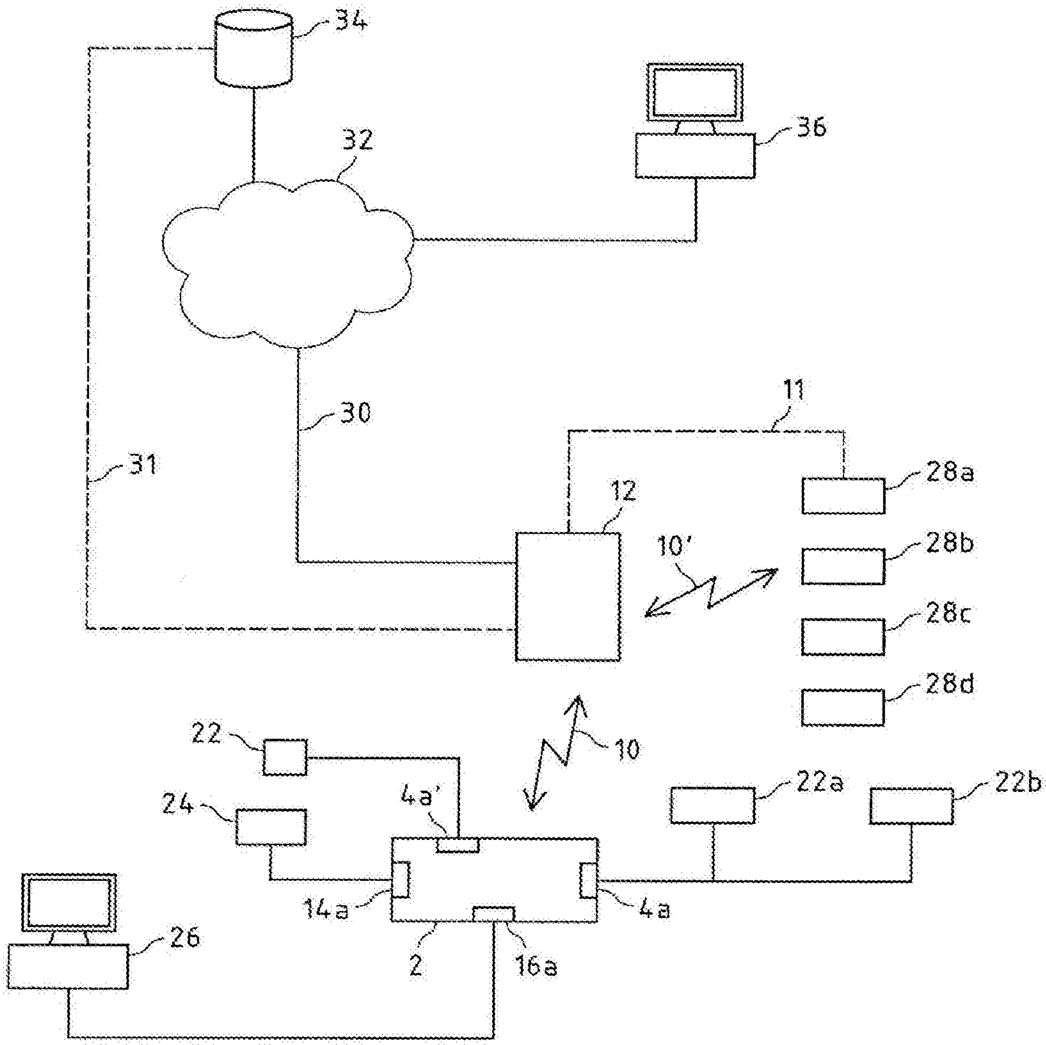
34
36
32
11
30
31
12
28a
28b
10'
28c
28d
22
10
22a
22b
4a'
24
14a
4a
26
2
16a

Fig.1

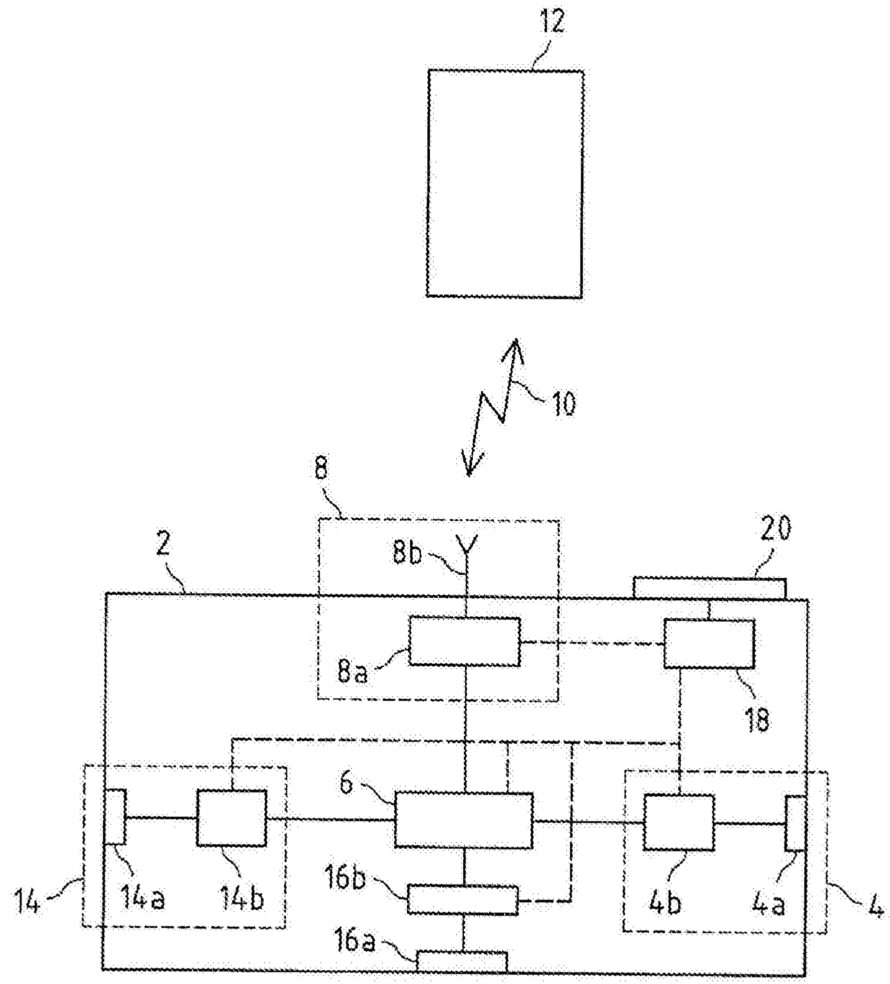

Fig.2