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(71) Applicant *(for all designated States except US)*: **KONINKLIJKE PHILIPS ELECTRONICS N.V.** [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **HE, Jie** [CN/CN]; c/o High Tech Campus, Building 44, NL-5656 AE Eindhoven (NL). **WANG, Quanguo** [CN/CN]; c/o High Tech Campus, Building 44, NL-5656 AE Eindhoven (NL). **GU, Ming Qiong** [CN/CN]; c/o High Tech Campus, Building 44, NL-5656 AE Eindhoven (NL).

(74) Agents: **VAN EEUWIJK, Alexander** et al.; c/o High Tech Campus, Building 44, NL-5656 AE Eindhoven (NL).

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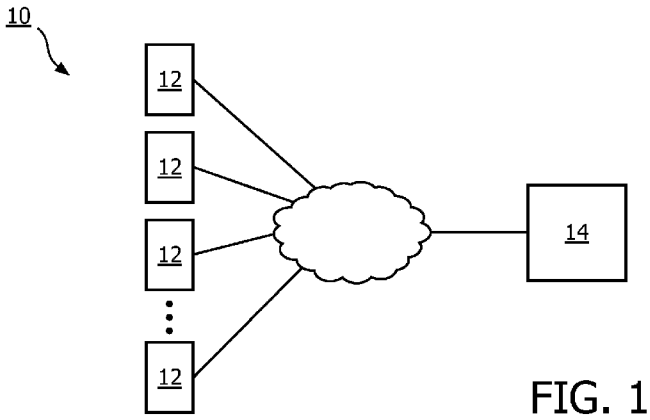

FIG. 1

(57) Abstract: The disclosure provides a charging module for use with an outdoor lighting device, the charging module comprising: an electrical connector coupled to a power supply and configured to receive a charging coupler of a target object to be charged; a switch arranged between the electrical connector and the power supply and configured to connect or disconnect the power supply to or from the electrical connector;and a controller coupled to the switch and configured to control the switch to close in response to a first trigger signal. The disclosure also provides a server comprising: a receiving unit configured to receive a charging request; a processor configured to identify, based on the charging request, a charging module corresponding to the charging request;and a sending unit configured to send a first trigger signal to the charging module to enable the charging module to charge a target object to be charged. The disclosure also provides a charging system comprising a plurality of charging modules and a server.

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A CHARGING MODULE, A SERVER, AND A CHARGING SYSTEM COMPRISING THE CHARGING MODULE AND THE SERVER

FIELD OF THE DISCLOSURE

The disclosure relates to the field of lighting, and particularly to a charging module, an outdoor lighting device comprising the charging module, a server communicatively coupled to the lighting module, and a lighting system comprising the charging module and the server.

BACKGROUND OF THE DISCLOSURE

Electric vehicles are emerging into the market and there will be a sustained electric vehicle boom in the near future in order to address issues relating to energy saving, environmental protection, etc. Unlike the gasoline-based mechanical system of the engine of traditional vehicles, the engine of the electric vehicle is an electro-mechanical system with the battery as the main energy source.

As a result of the dramatic increase in electric vehicles, a challenge to be met is that of charging the battery of electric vehicles. One approach to solve the battery charging issue is to build new charging stations to replace existing gasoline stations; the other approach is to construct new charging infrastructure in cities and country sides. However, either approach will take up planning and investigation time, and will require substantial expenditure in reconstruction.

OBJECT AND SUMMARY OF THE DISCLOSURE

It would therefore be desirable to achieve a more economical and flexible approach towards charging the battery of an electric vehicle. The inventor has recognized that the existing outdoor lighting systems, for example road lighting systems, are mature infrastructure, which are deployed everywhere both in cities and country sides to provide illumination and decoration. If a charging module for charging the battery of an electric vehicle can make use of an existing outdoor lighting device, for example by being integrated into the existing outdoor lighting device, then both planning and deployment of the charging modules will become simple and cost saving. Further, if the charging module can also be

controlled by the existing outdoor lighting control system, a saving of costs will be achieved, and the operation and management of the charging module will be more flexible.

Based on the above concerns, in a first aspect of the disclosure, there is provided a charging module used in combination with an outdoor lighting device, the charging module comprising:

an electrical connector coupled to a power supply and configured to receive a charging coupler of a target object to be charged;

a switch arranged between the electrical connector and the power supply and configured to connect or disconnect the power supply to or from the electrical connector; and

a controller coupled to the switch and configured to control the switch to close in response to a first trigger signal.

By virtue of the charging module, battery charging of a target object to be charged can be achieved. Further, as the charging module is used in combination with an existing outdoor lighting device, for example integrated into the existing outdoor lighting device, the overall planning and deployment process of the charging modules would become simple and cost saving.

In a second aspect of the disclosure, there is provided a server comprising:

a receiving unit configured to receive a charging request;

a processor configured to identify, based on the charging request, a charging module corresponding to the charging request; and

a sending unit configured to send a first trigger signal to the charging module to enable the charging module to charge a target object to be charged.

The server of the second aspect of the disclosure is communicatively coupled to a plurality of charging modules and communicates with each of the plurality of charging modules to help it charge the battery of the target object to be charged, which makes the battery charging of the target object more flexible.

In a third aspect of the disclosure, there is provided a charging system comprising a plurality of charging modules as described in the first aspect of the disclosure and a server as described in the second aspect of the disclosure.

In a fourth aspect of the disclosure, there is provided an outdoor lighting device comprising: a pole; a light source mounted on the pole; and a charging module as described in the first aspect disposed at the pole.

The above summary of the disclosure is not intended to describe each disclosed embodiment or every implementation of the disclosure. The Figures and detailed description that follow below more particularly exemplify illustrative embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

The disclosure is explained in further detail, and by way of example, with reference to the accompanying drawings, wherein:

FIG. 1 shows a schematic view of an exemplary charging system which comprises a plurality of charging modules and a server according to one embodiment of the disclosure;

FIG. 2 shows a schematic view of an exemplary outdoor lighting device at which the charging module of FIG. 1 is disposed;

FIG. 3 shows a schematic view of the charging module of FIG. 1;

FIG. 4 shows a schematic view of the interaction between the charging module and the server of FIG. 1.

Throughout the above drawings, like reference numerals will be understood to refer to like, similar or corresponding features or functions.

DETAILED DESCRIPTION

Reference will now be made to embodiments of the disclosure, one or more examples of which are illustrated in the figures. The embodiments are provided by way of explanation of the disclosure, and are not meant as a limitation of the disclosure. For example, features illustrated or described as part of one embodiment may be used with another embodiment to yield a still further embodiment. It is intended that the disclosure encompass these and other modifications and variations as come within the scope and spirit of the disclosure.

FIG. 1 shows a schematic view of an exemplary charging system according to one embodiment of the disclosure.

Referring to FIG. 1, the charging system 10 comprises a plurality of charging modules 12 and a server 14 which is communicatively coupled to the plurality of charging

modules 12. The communication between the server 14 and the plurality of charging modules 12 may be wireless or wired.

Each charging module 12 is configured to provide battery charging of a target object to be charged. The target object may be an electric vehicle, a mobile phone or any other device which is required to be charged.

The server 14 is communicatively coupled to each charging module 12, i.e. it may be configured to communicate with each charging module 12 to help it charge the battery of the target object. Furthermore, the server 14 may also be configured to monitor the charging status and/or fault status of each charging module 12 within the charging system 10 so as to achieve better management of each charging module 12.

In one embodiment, each charging module 12 within the charging system 10 may be used in combination with an outdoor lighting device, such as a road lighting device or a landscape lighting device for example.

FIG. 2 shows a schematic view of an exemplary outdoor lighting device at which the charging module of FIG. 1 is disposed.

Referring to FIG. 2, the outdoor lighting device 20 comprises a pole 22, and a light source 24 mounted to the pole 22 and configured to provide illumination and/or decoration. The charging module 12 of one embodiment of the disclosure may be disposed at the pole 22. For ease of planning and deployment, advantageously, the charging module 12 may share the same power supply with the outdoor lighting device 20, i.e., the power supply of the outdoor lighting device 20 may also power the charging module 12. Alternatively, the charging module 12 may also be powered by an individual power supply which is independent of the power supply of the outdoor lighting device 20.

Further, for the purpose of being environment - proof, for example water proof, advantageously, the charging module 12 may be provided with a cover 26 when it is not in use.

It is to be noted that, in practice, the number of charging modules disposed at the pole 22 of the outdoor lighting device 20 is not limited to one.

As the charging module 12 is used in combination with the outdoor lighting device 20, advantageously, the server 14 may also be used to monitor and control the outdoor lighting device 20.

Hereinafter, the configuration of the charging module 12 will be described

using the electric vehicle as an illustrative example of the target object to be charged.

FIG. 3 shows a schematic view of the charging module of FIG. 1.

Referring to FIG. 3, the charging module 12 comprises an electrical connector 121 coupled to a power supply S and configured to receive a charging coupler (not shown) of an electric vehicle to be charged. For example, the electrical connector 121 may be a socket and, correspondingly, the charging coupler of the electric vehicle may be a plug which is compatible with the socket, or vice versa. The socket and plug types may vary in accordance with plug/socket standards of each country.

Similarly, the voltage and frequency of the power supply S may vary according to the mains voltage/frequency standard of each country. For example, in China, the power supplied by the power supply S is 220V/50Hz; in US, the power supplied by the power supply S is 110V/60Hz.

Still referring to FIG. 3, the charging module 12 further comprises a switch 122 arranged between the electrical connector 121 and the power supply S and configured to connect or disconnect the power supply S to or from the electrical connector 121; and the charging module 12 further comprises a controller 123 coupled to the switch 122 and configured to control the switch 122 to close in response to a first trigger signal.

The first trigger signal may be generated locally or received from the server 14 (shown in FIG. 1), which will be described in detail later.

Any known switches may be used herein, such as a relay switch or an electromagnetic switch, for example.

When the switch 122 is controlled to close by the controller 123 in response to the first trigger signal, the power supply S is connected to the electrical connector 121 such that the charging module 12 is capable of providing power for the electric vehicle, i.e. charging the battery of the electric vehicle, when the charging coupler of the electric vehicle is received by the electrical connector 121 of the charging module 12.

When the switch 122 is controlled to open by the controller 123, the power supply S is disconnected from the electrical connector 121. In this manner, the electrical connector 121 carries no electricity and hence the charging module 12 cannot provide power for the electric vehicle to be charged until the switch 122 is controlled to close again.

Advantageously, the charging module 12 may further comprise a payment module 124 configured to receive payment for the charging of the electric vehicle. When said

payment for the charging of the electric vehicle is complete, a first trigger signal is sent to the controller 123. The controller 123 then controls the switch 122 to close in response to the first trigger signal so as to connect the power supply S to the electrical connector 121.

To enhance user experience, advantageously, the charging module 12 may further comprises a first presenter 125 configured to present information on payment guidelines for the payment for the charging of the electric vehicle. The user may follow the payment guidelines presented by the first presenter 125 and readily finish the payment for the charging of the electric vehicle. The first presenter 125 may be a screen or a speaker, for example. Advantageously, the screen may be a touch screen which allows user input.

Advantageously, the charging module 12 may further comprise a first indicator 126 configured to indicate the closed state of the switch 122 to the user when the switch 122 is controlled to be closed by the controller 123.

Next, with reference to FIG. 4 and in conjunction with FIG. 1 and FIG. 3, the operations of the charging module 12 and the server 14 in relation to the charging of the battery of the electric vehicle will be described.

When a user wants to charge his/her electric vehicle by using the charging module 12, a charging request is first sent to the server 14. For example, the user may send a SMS in which the ID code of the charging module 12 is included to a third party, for example a short message service center (SMSC). The ID code of the charging module 12 may be printed on the charging module 12, or may be presented to the user by the first presenter 125. After receiving the SMS from the user, the SMSC sends a charging request in which the ID code of the charging module 12 is included to the server 14.

Alternatively, a button, indicative of the charging request may be provided on the charging module 12. When the user presses the button, the controller 123 of the charging module 12 may send a charging request in which the ID code of the charging module 12 is included to the server 14.

After the server 14 has received the charging request from the SMSC or from the charging module 12 through the receiving unit 141, the processor 142 of the server 14 identifies the exact charging module requested according to the charging request. For example, the processor 142 of the server 14 may first extract the ID code from the charging request and then identify the exact charging module requested, based on the ID code. In this embodiment,

based on the extracted ID code from the charging request, the processor 142 gets to know the charging module 12 is under request.

To ensure the user is on the spot, advantageously, after the server 14 has identified that the charging module 12 is under request, the server 14 may further send identifying information, for example a dynamic confirmation code, to the charging module 12 through the sending unit 141. In this case, a second presenter (not shown) in the charging module 12 may be used. After receiving identifying information from the server 14, the controller 123 of the charging module 12 controls the second presenter to present the identifying information to the user. It will be appreciated that, in practice, the second presenter and the first presenter 125 may be the same element.

When the user obtains the identifying information, for example, he/she may send a SMS in which feedback corresponding to the identifying information is included to the server 14. It will be appreciated that the SMS is forwarded to the server 14 by a third party, for example the SMSC.

Alternatively, the feedback corresponding to the identifying information may be sent to the server 14 through the charging module 12. In this case, a touch screen (not shown) may be provided on the charging module 12. When the user inputs the feedback through the touch screen, the controller 123 of the charging module 12 sends the feedback to the server 14. It will be appreciated that the touch screen may be the same element as the first presenter 125.

After receiving the feedback from the SMSC or from the charging module 12 through the receiving unit 141, the processor 142 of the server 14 determines whether the feedback matches the identifying information. If the feedback matches the identifying information, then the server 14 sends first confirmation information to the charging module 12.

When receiving the first confirmation information from the server 14, advantageously, the controller 123 of the charging module 12 may control the first presenter 125 to present information on payment guidelines for the payment for the charging of the electric vehicle to the user. The user may follow the payment guidelines and finish the payment for the charging of the electric vehicle through the payment module 124.

Any known payment mode may be used here. For example, payment may be performed by means of a prepaid card, a credit card, etc. In this regard, the payment module

124 may comprise a card insert slot for receiving the prepaid card, the credit card, etc. In another example, payment may be performed by means of an electrical wallet. For this purpose, the payment module 124 may comprise a wireless sensor area for receiving the electrical wallet. In still another example, the payment module 124 may comprise a slot for receiving money. Of course, the payment module 124 may also comprise any combination of card insert slot, wireless sensor area and slot for receiving money.

When payment for the charging of the electric vehicle is finished, the controller 123 of the charging module 12 may further send payment information to the server 14. After receiving the payment information from the charging module 12 through the receiving unit 141, the processor 142 of the server 14 authenticates the payment information. For example, the processor 142 may authenticate the payment information with Unipay.

When the payment information has been authenticated, for example, the server 14 may send second confirmation information to the charging module 12 through the sending unit 143. The second confirmation information is then presented to the user through the first presenter 125. Alternatively, when the payment information has been authenticated, the server 14 may send the second confirmation information to the user through a SMS.

Then, the server 14 further sends a first trigger signal to the charging module 12 through the sending unit 123. In response to the first trigger signal, the controller 123 of the charging module 12 controls the switch 122 to close.

It is to be noted that, in some embodiments, the process of authentication of payment information may be omitted. For example, in the case that the user pays for the charging of the electric vehicle through the slot for receiving money, the payment module 124 may directly send a first trigger signal to the controller 123 after the payment is finished. The controller 123 then controls the switch 122 to close in response to the first trigger signal.

When the switch 122 is controlled to close by the controller 123, the power supply S is connected to the electrical connector 121. When the charging coupler of the electric vehicle is received by the electrical connector 121 of the charging module 12, the charging module 12 begins to charge the battery of the electric vehicle.

Advantageously, when the switch 122 is controlled to close, the first indicator 126 of the charging module 12 may indicate the closed state of the switch 122 to the user.

The charging mode of the charging module 12 may be one of various modes. In one example, the charging mode may be time-based. When the charging of the electric vehicle

begins, the controller 123 of the charging module 12 can start timing. When the charging time has reached a preset time duration, the controller 123 controls the switch 122 to open, thereby finishing the charging of the electric vehicle.

In another example, the charging mode may be power-based. In this case, the charging module 12 may further comprise an electric meter (not shown) coupled to the power supply S and configured to measure the amount of electric power supplied to the electric vehicle. When the charging of the electric vehicle begins, the electric meter starts to measure the amount of electric power supplied to the electric vehicle and reports the measurement results to the controller 123. Once the amount of electric power supplied to the electric vehicle has reached a preset volume, the controller 123 controls the switch 122 to open, thereby finishing the charging of the electric vehicle. It is to be noted that the preset time and preset amount are prestored in the controller 123, which may vary according to the user's selection.

When the charging module 12 is configured according to these two charging modes, i.e. time-based and power-based charging modes, advantageously, the first presenter 125 of the charging module 12 may present selection information with respect to the two charging modes to the user; and the user may select the desired charging mode according to the selection information presented by the first presenter 125.

It will be appreciated that, for the time-based charging mode, the processor 142 of the server 14 may perform timing instead of the controller 123. In this regard, when the charging time reaches the preset time, the server 14 sends a second trigger signal to the charging module 12 through the sending unit 143. The controller 123 of the charging module 12 then controls the switch 122 to open, thereby finishing the charging of the electric vehicle in response to the second trigger signal. Likewise, for the power-based charging mode, the controller 123 may report the amount of electric power supplied to the electric vehicle to the server 14 in real time. When the amount of electric power supplied to the electric vehicle reaches the preset amount, the server 14 sends a second trigger signal to the charging module 12 through the sending unit 143. The controller 123 of the charging module 12 then controls the switch 122 to open, thereby finishing the charging of the electric vehicle in response to the second trigger signal.

When the charging of the electric vehicle is finished, the server 14 may further send a notification to the charging module 12, informing the latter about the completion of the

charging of the electric vehicle. The notification is then presented to the user through the first presenter 125. Alternatively, when the charging of the electric vehicle is finished, the server 14 may send the notification to the user through a SMS.

Advantageously, a second indicator (not shown) may be provided on the charging module 12 to indicate the open state of the switch 122 to the user when the charging of the electric vehicle is finished and the switch 122 is controlled to open.

Advantageously, a third indicator (not shown) may be provided on the charging module 12 to indicate an abnormal state of the charging module 12 to the user. For example, the abnormal state may be the pulled out state of the charging coupler of the electric vehicle during the charging process. As for this abnormal state, advantageously, if the charging coupler has been pulled out from the electrical connector 121 for a predetermined duration, the controller 123 of the charging module 12 may control the switch 122 to open for the sake of safety.

Advantageously, the server 14 may further monitor the charging status of each charging module 12 within the charging system 10 in real time. When the number of charging modules used for charging the batteries of electric vehicles exceeds the maximum limit, the server 14 may send notifications to idle charging modules within the charging system 10 to inform them of the power shortage at that moment in time. In this case, a fourth indicator (not shown) may be provided on each charging module 12 within the charging system 10. When an idle charging module receives said notification from the server 14, the controller of the idle charging module controls the third indicator to indicate the shortage of power to the user.

The first indicator 126, the second indicator, the third indicator and the fourth indicator may be LEDs for example.

Although the embodiments of the disclosure have been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive; the disclosure is not limited to the disclosed embodiments.

For example, in another embodiment, the charging module 12 may perform the battery charging for the electric vehicle all by itself, i.e. without interaction with the server 14.

In this embodiment, the user may first press the button on the charging module 12, which is indicative of a charging request. In response to the charging request, the controller 123 may control the first presenter 125 to present information to the user on

payment guidelines for the payment for the charging of the electric vehicle. Following the payment guidelines, the user makes a payment for the charging of electric vehicles through the payment module 124. After the payment is finished, the payment module 124 sends a first trigger signal to the controller 123. The controller 123 then controls the switch 122 to close in response to the first trigger signal. Advantageously, the first indicator 126 of the charging module 12 may indicate the closed state of the switch 122 to the user. When the charging of the electric vehicle is finished, the controller 123 of the charging module 12 controls the switch 122 to open. Advantageously, the second indicator of the charging module 12 may indicate the open state of the switch 122 to the user.

Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed disclosure, from a study of the drawings, the disclosure, and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. A single processor or other unit may fulfill the functions of several items recited in the claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. A computer program may be stored/distributed on a suitable medium, such as an optical storage medium or a solid-state medium supplied together with or as part of other hardware, but may also be distributed in other forms, such as via the Internet or other wired or wireless telecommunication systems. Any reference signs in the claims should not be construed as limiting the scope.

CLAIMS:

1. A charging module (12) for use with an outdoor lighting device (20), the charging module (12) comprising:

an electrical connector (121) coupled to a power supply (S) and configured to receive a charging coupler of a target object to be charged;

a switch (122) arranged between the electrical connector (121) and the power supply (S) and configured to connect or disconnect the power supply (S) to or from the electrical connector (121) ; and

a controller (123) coupled to the switch (122) and configured to control the switch (122) to close in response to a first trigger signal.

2. The charging module (12) of claim 1, further comprising a first indicator (126) configured to indicate that the switch (122) is in the closed state.

3. The charging module (12) of claim 1, further comprising a payment module (124) configured to receive payment for the charging of the target object.

4. The charging module (12) of claim 3, wherein the controller (123) is further configured to send payment information to a server (14) after the payment for the charging of the target object is finished and to receive the first trigger signal from the server (14).

5. The charging module (12) of claim 3, wherein the payment module (124) is further configured to generate the first trigger signal after the payment for the charging of the target object is finished and to provide the first trigger signal to the controller (123).

6. The charging module (12) of claim 3, wherein the charging module (12) further includes a first presenter (125) coupled to the controller (123) and configured to present information on payment guidelines for the payment for the charging of the target object.

7. The charging module (12) of claim 1, wherein the charging module (12) further includes a second presenter coupled to the controller (123) and configured to present identifying information from a server (14).

8. The charging module (12) of claim 1, wherein the controller (123) is further configured to control the switch (122) to open if the charging time of the target object exceeds a preset time.

9. The charging module (12) of claim 1, further comprising an electric meter coupled to the power supply (S) and configured to measure the amount of electric power supplied to the target object,

wherein the controller (123) is further configured to control the switch (122) to open if the amount of electric power supplied to the target object is larger than a preset amount.

10. The charging module (12) of claim 8 or 9, further including a second indicator configured to indicate that the switch (122) is in the open state.

11. An outdoor lighting device (20), comprising:

a pole (22);

a light source (24) mounted on the pole (22); and

a charging module (12), as claimed in any one of claims 1 to 10, disposed at the pole (22).

12. A server (14) comprising:

a receiving unit (141) configured to receive a charging request;

a processor (142) configured to identify, based on the charging request, a charging module (12) corresponding to the charging request; and

a sending unit (143) configured to send a first trigger signal to the charging module (12) to enable the charging module (12) to charge a target object to be charged.

13. The server (14) of claim 12, wherein the sending unit (143) is further configured to send identifying information to the charging module (12) after the charging module (12) associated with the charging request has been identified;

the receiving unit (141) is further configured to receive feedback corresponding to the identifying information;

the processor (142) is further configured to determine whether the feedback matches the identifying information; and

the sending unit (143) is further configured to send the first trigger signal to the charging module (12) if the feedback matches the identifying information.

14. The server (14) of claim 12, wherein the receiving unit (141) is further configured to receive payment information from the charging module (12);

the processor (142) is further configured to authenticate the payment information; and

the sending unit (143) is further configured to send the first trigger signal to the charging module (12) after the payment information has been authenticated.

15. A charging system (10) comprising a plurality of charging modules (12) as claimed in any one of claims 1 to 10 and a server (14) as claimed in any one of claims 12 to 14.

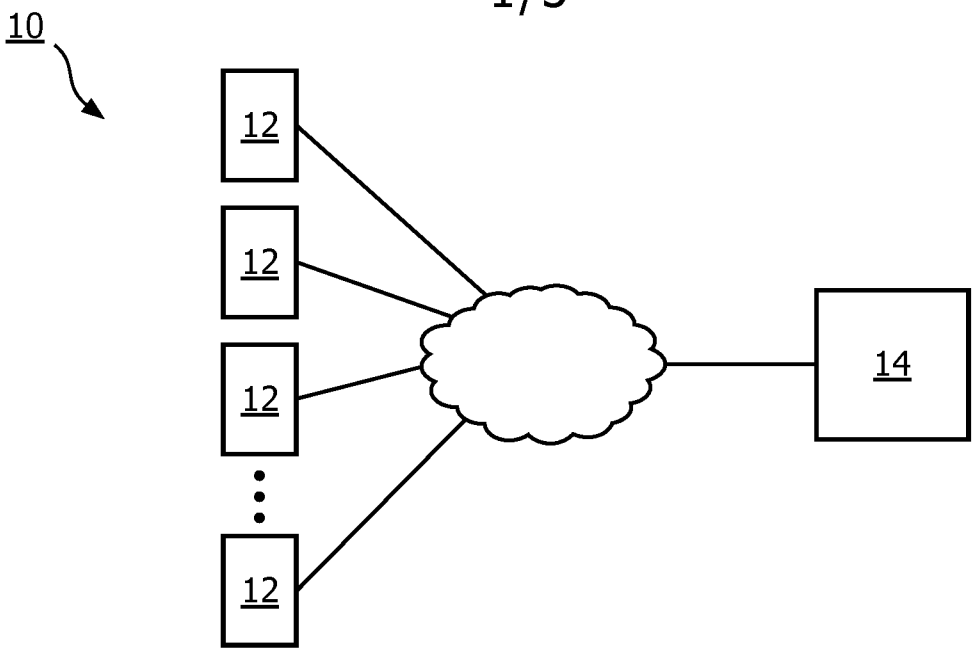

FIG. 1

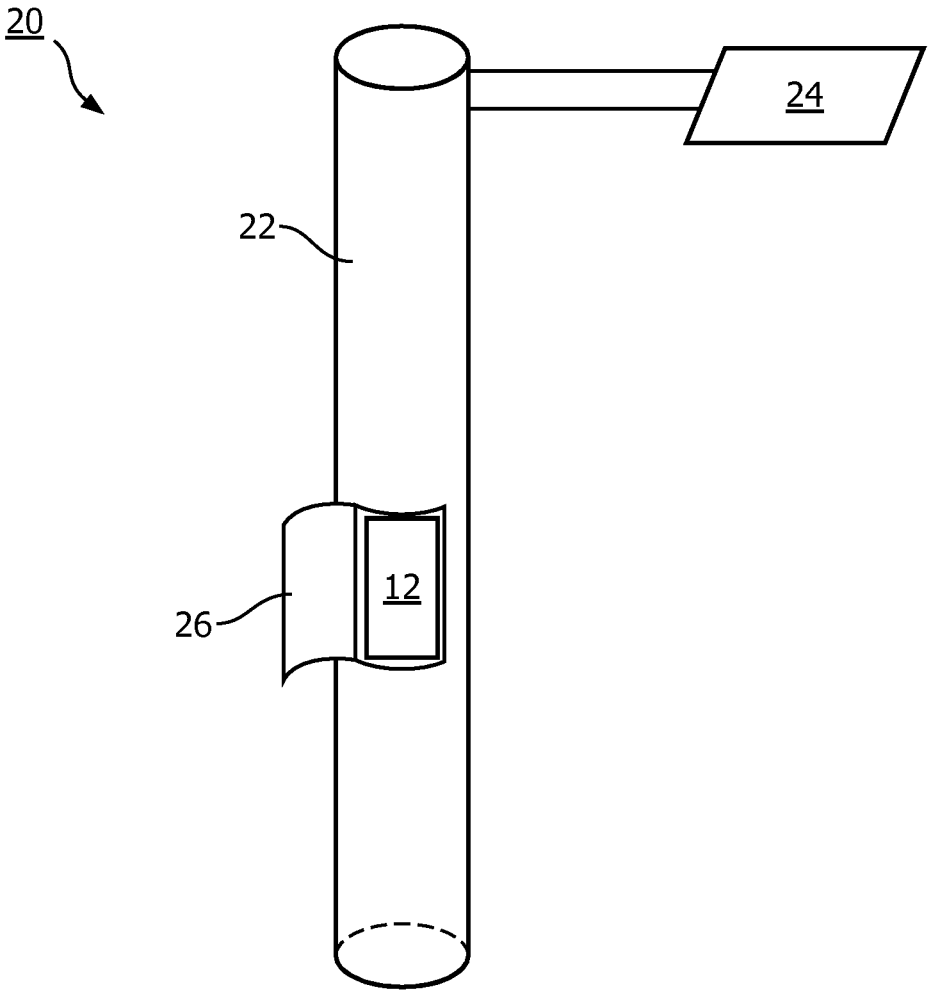

FIG. 2

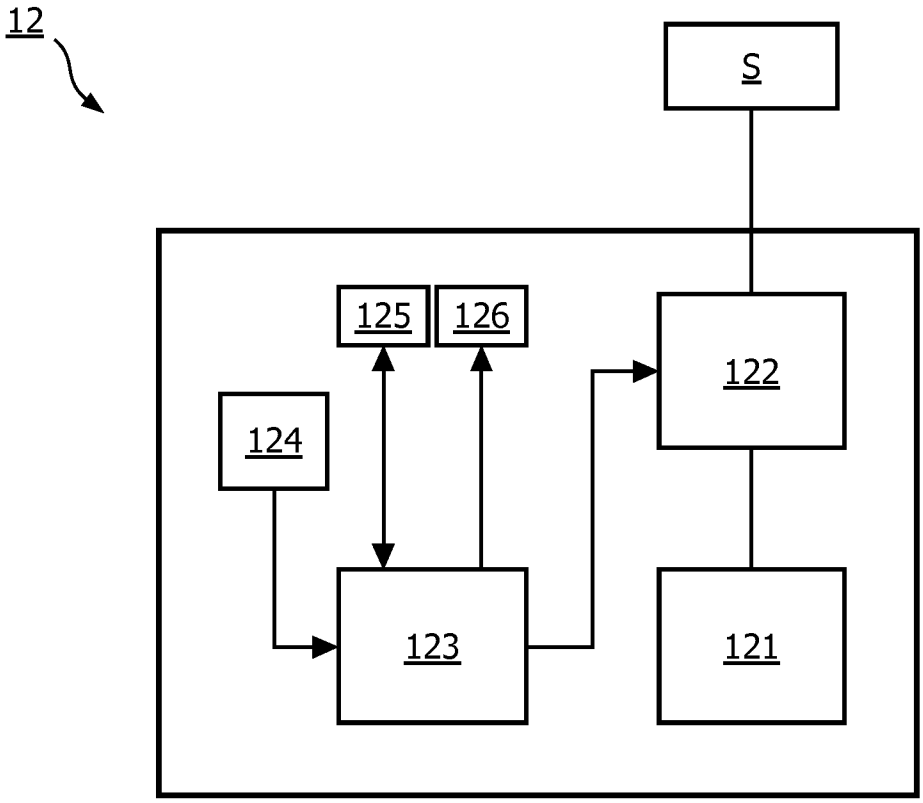

FIG. 3

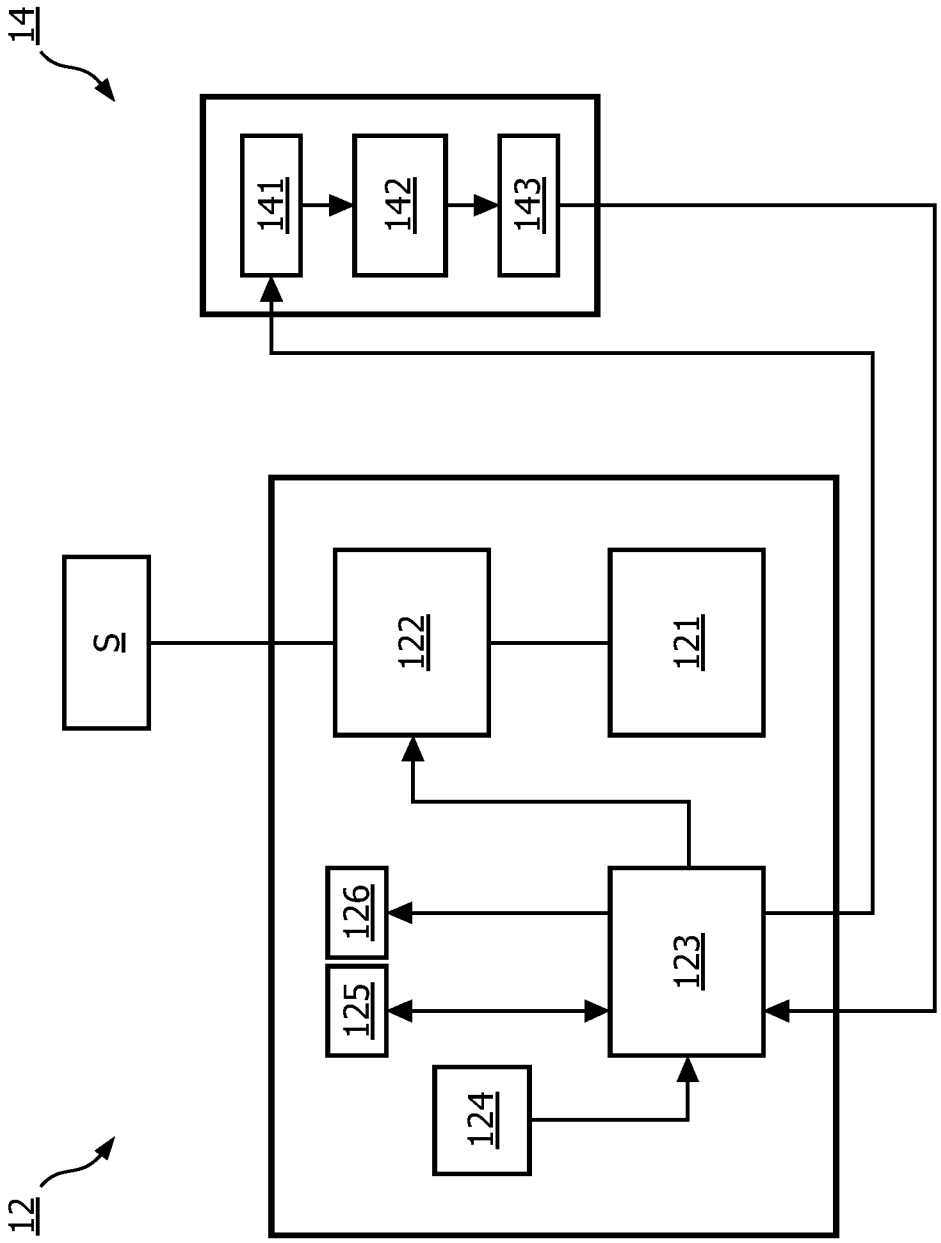

FIG. 4