

Device for accessing an underground or overground civil engineering infrastructure having a multi-protocol communication module, and system for managing a fleet of access devices

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The present invention concerns the field of solutions for accessing underground or overground civil engineering infrastructures of any type. The access to the infrastructures is generally made via an access door also called
10 access cover or plug.

A door in particular enables access to the underground or overground civil engineering infrastructures for their inspection or checking. By civil engineering is meant in particular public or private networks (hydraulic, electrical, gas, communication, etc.), with the exception of domestic applications
15 such as homes. The infrastructures concerned are thus, non-exhaustively:

- public infrastructure networks, such as networks for accessing natural resources or public energy: water networks (in particular reservoirs of drinking water or storage towers of water tower type, purification networks dedicated to rain water and waste water, fire service outlets – also called fire
20 hydrants – and the corresponding networks), electrical energy networks, including electric cabinets (which may be installed overground, or be underground, buried or partly buried), networks for passage of communication cables (telephone, optic fiber, etc.)

- private infrastructure networks: water, energy, underground
25 communication infrastructures (cabled) or aerial communication infrastructures (antenna networks for example).

A complete access solution generally comprises an access cover (door, or plug), a frame to which the access cover is linked and which is for example sealed into the ground or on a fixed infrastructure, and a chamber
30 located under (or behind) the access cover.

It is important to ensure the checking of the resources distributed by these infrastructures (natural resources, energy or information sources). This constitutes a matter of public and economic concern. For some applications, it is important to be able to check the infrastructures at any time, that is to say to
5 ensure continuity in the availability of the information concerning them.

It is thus important to be able to check and supervise the networks reliably and in real-time in order to intervene at any time and in targeted manner within the shortest possible time, whether it be in case of anomaly or problem or preventively, to anticipate and correct any risk of interruption.

10 The conventional solution for checking, diagnostic, supervision and correction of the networks consists in periodic human intervention in "manholes" (that is to say at the location of the infrastructure access chambers). This solution is costly in that it mobilizes human resources on a recurrent basis to inspect the networks, and requires transport onto the site of the maintenance
15 personnel and tools. A human intervention furthermore inherently presents certain risks, whether it be on opening the accesses or in the networks.

Furthermore, in particular when an entity (enterprise, public authority of a geographical area, etc.) has to manage a set of numerous accesses to the networks, this solution has the drawback of requiring the definition of inspection
20 rounds which cannot be optimal from a preventive point of view, and which cannot answer to the issue of the occurrence of an unexpected event on the network.

From the state of the art there is known the general idea of providing doors with means enabling communication with a wireless network. For
25 example, document CA2862457 relates to the combination of a door with an integrated antenna in a ventilation area, in order to be able to transmit and receive a signal.

The communicating door may, for example, enable the remote control of environmental parameters in a chamber formed under the door. For
30 example, document US8258977 provides a solution making it possible to control environmental parameters in the enclosed space of a chamber.

Nevertheless, the solutions known from the state of the art are not optimal, and do not meet a certain number of needs in terms of reliability and safety. In particular, the doors known from the state of the art are dependent on the conditions in which they are installed, in particular of availability of the communication networks. Furthermore, although a door enabling the sending and receiving of signals may be remotely controlled, the question of the control of a large set of doors is not solved in the state of the art.

The invention seeks to provide an access solution and a management system solving all or some of the aforementioned issues.

Thus, the invention relates to an access device for accessing an underground or overground civil engineering infrastructure, comprising an access door having a closed position in which it shuts a chamber and an open position in which it gives access to said chamber. The door comprises a communication module comprising at least one antenna enabling the emission of a signal over at least one wireless communication network. The communication module is of multi-protocol type so as to be able to emit a signal in accordance with at least two wireless communication protocols or in accordance with at least one wired communication protocol and at least one wireless communication protocol.

The association with the access device of a multi-protocol communication module provides the advantage of ensuring continuity of data transmission. It enables the installation of access devices, potentially constituting a same set of access devices, in variant zones and to adapt them to the wireless communication networks available in those zones. In certain variants of the invention, even if a wireless communication network were to be unavailable, the use of another network enables the transmission of the data to be ensured. The transmission over two networks may be simultaneous, but, advantageously, the communication module can enable the change from one network to another for example according to the availability of the networks. The invention thus in particular enables the reliable transmission of data coming from access devices for accessing an underground or overground civil

engineering infrastructure for sensitive infrastructures and/or that have a geographical location making transmissions complex.

The protocols implemented may be chosen from:

- 5 - wired communication protocols,
 - short-range wireless communication protocols, and
 - medium-range or long-range communication protocols.

In particular, the wired communication protocols may be adapted to communication by optic fiber or cable, the short-range wireless communication
10 protocols may be chosen from: NFC, RFID, Bluetooth, in particular Bluetooth Low Energy, Lifi, Zigbee LoRa (registered trademarks); and the medium-range or long-range communication protocols may be chosen from 4G, 5G, LoRa, Sigfox, NB-IoT, LTE-M, GPRS (registered trademarks).

15 The communication module may be adapted to bi-directional communication.

 The communication module may be adapted to evaluate the availability of the communication networks respectively employing the different protocols in accordance with which said communication module is configured to communicate, and to select the communication protocol for the sending and/or
20 the receiving of data according to the evaluated availability.

 The communication module communicating over a first network may be adapted to change its communication to a second network at the time of a rupture in communication over the first wireless network.

 The access device may comprise at least one sensor chosen from: a
25 sensor of opening or closing of the door, a sensor of at least one environmental parameter of the chamber, a sensor of intrusion in the vicinity of the door, a sensor of intrusion or attempted intrusion into the chamber, each sensor being configured to deliver a signal to the communication module, the communication module being configured to transmit the signal or the signals, or information
30 derived from said signal or from said signals.

The sensor of opening or of closing of the door may be chosen from: a contact sensor, a sensor of angular position of the door, an accelerometer, an optical sensor.

5 The access device may comprise at least one sensor of at least one environmental parameter of the chamber from: a sensor of temperature, humidity, particle presence or concentration, water level or presence, gas concentration or presence.

10 The access device may comprise at least one sensor of intrusion in the vicinity of the door from: a vibration sensor, a heat sensor, an optical sensor, an audio sensor and/or at least one sensor of intrusion or of attempted intrusion into the chamber, from: a shock sensor, a vibration sensor, a temperature sensor, an audio sensor.

 The communication module may comprise an antenna integrated indissociably with the door.

15 The access device may comprise a battery enabling the supply, as main supply or in the event of a fault in a main electric source, of the communication module.

20 The door of the access device may comprise a rigid outer skin under which is provided a set of ribs substantially at right angles to said outer skin, the ribs being disposed so as to form at least one compartment in which is installed the communication module, with the exception, as may be appropriate, of the antenna of said communication module, the compartment being closed by a rigid inner skin providing the mechanical protection of said communication module.

25 The invention also relates to a system for managing a set of access devices for accessing one or more underground or overground civil engineering infrastructures, the system comprising a group of access devices as defined above and a server, each access device being configured to communicate with the server via at least two communication networks.

30 In such a management system, each access device may be associated with an identifier communicated at the time of any communication

between the access device and the server, said server being configured to retrieve geolocation information on said access device from a memory.

The management system may comprise at least one computer accessing system for accessing said server, the accessing system executing a computer program referred to as management platform, said management platform being configured to provide information on the state of each of the access devices or on environmental data coming from the sensors equipping the access devices. Said platform may comprise a differentiated access to the information coming from said access devices according to at least two user profiles.

Still other particularities and advantages of the invention will appear in the following description.

In the accompanying drawings, given by way of non-limiting example:

- Figure 1 represents an access device in accordance with an embodiment of the invention according to a first aspect of the invention;
- Figure 2 represents an access device in accordance with another example embodiment;
- Figure 3 is a diagrammatic representation of an equipped communication module able to be implemented in the invention;
- Figure 4 is a diagrammatic representation of a management system for a set of access devices in accordance with another aspect of the invention;
- Figure 5 is a diagrammatic representation, by way of example, of an aspect of a management system according to Figure 4.

Figure 1 represents a door 1 and the frame 2 to which it is connected, which are provided to shut a chamber (not shown in Figure 1) or to enable access thereto.

The door 1 is represented in an open position, enabling access to the chamber via the opening 21 formed by the frame 2.

The door 1 may have various constitutions. In the example shown in Figure 1, the door is formed from galvanized steel. According to other possible

constitutions, the door 1 may be of cast iron (ductile, grey), of stainless steel, of composite material. The door may thus be constituted from a single material, or may combine different constituent materials. Thus, part of the surface of the plug may be made from a first material and the complementary surface may be made from another material. In particular, the plug may combine a galvanized steel with a part comprising a particular coating or for instance be of cast iron having an insert of another material. This may in particular assist in enabling the transmission of electromagnetic waves through the door 1, as detailed below.

In the example of Figure 1, the door comprises a rigid outer skin 11, for example of galvanized steel. The outer skin corresponds to the visible part of the door 1 when this is in closed position. The outer skin 11 covers or provides surface continuity with the frame 2. Of course, the door 1 may be slightly proud relative to the frame 2, and/or have a non-planar surface which is wholly or partly proud relative to the frame 2.

Under the outer skin 11, ribs 12 form compartments 13, 13'. The ribs 12 are substantially at right angles to the outer skin 11.

The frame 2 may also be formed from steel. The other aforementioned constituent materials may alternatively be employed. The frame 2 may in particular be of the same material as the door 1.

It has sealing members 21 for its definitive fastening by sealing at the opening of a chamber (not shown in Figure 1). The chamber may, for example, for infrastructures for which security is to be provided, be formed from reinforced concrete or from mortar with a fiber filler. The chamber may be of composite material or any other material used in the field of civil engineering.

The door 1 has a seat, that is to say a zone of contact in closed position, which may simply be laid on the frame 2 or be held in the frame 2.

The door 1 is linked to the frame so as to be able to take an open position and a closed position. For example, the door 1 may be pivotally mounted relative to the frame 2, by a pivot 15. The door 1 may have simple opening, that is to say that the door 1 may be opened using a simple lifting key, or it may have a locking system of higher or lower complexity (for example only allowing the opening of the door 1 with use of a specific key). The locking

system 16 may comprise two locking latches which can be turned so as to bear under the frame 2, preventing the opening of the door 1.

The door 1 is equipped in the invention with a communication module 3.

5 The communication module 3 may comprise in particular one or more electronic units 31 provided with at least one antenna 32 enabling the emission of a signal over a wireless network.

 The communication module 3 may be disposed in a compartment 13 formed under the outer skin 11 by the ribs 12. The compartment 13 receiving
10 the communication module 3 is closed by an inner skin 14. The inner skin 14 is rigid. The inner skin 14 may be of inorganic or organic material (for example of plastic, of composite material) which may be reinforced to withstand attacks that are mechanical (for example using cutting tools), thermal (for example with a blow-torch) or chemical. It may, by way of non-exhaustive example, be of metal,
15 for example be of hot-galvanized steel, stainless steel, cast iron (ductile, grey), of composite material. Numerous materials, organic or inorganic, may thus be employed.

 It provides protection for the communication module 3. One, several or all the compartments 13, 13' formed by the ribs 12 may be closed by an inner
20 rigid skin 14.

 The antenna 32 of the communication module 3 may be positioned in the same compartment as the rest of the communication module 3. Alternatively, the antenna may be positioned in another compartment. The positioning of the antenna is important in order to enable the transmission of
25 waves from the plate 1. The antenna 32 (or one or more of the antennas of the communication module) may be disposed in a compartment other than that of the electronic unit 31.

 The position of the antenna is advantageously optimized so as to have the best possible transmission of the electromagnetic waves through the
30 door 1. Nevertheless, in certain applications the constraint of protecting the antenna against external action (attempt to break in through the door, for example) may be taken into account. The configuration and the position of the

antenna may in particular take into account the configuration of the ribs 12, as well as the presence on the door 1 of zones of lesser damping for the electromagnetic waves: zones of smaller thickness than the rest of the door 1, or constituted by a material different from the rest of the door enabling better
5 passage of the waves, the presence of a key-hole in the door, etc.

In general terms, the communication module is integrated (positioned) in fixed or adjustable manner, to ensure the best transmission performance of the signal and, as a corollary, the lowest possible energy consumption.

10 Figure 2 represents another example embodiment of an access device in accordance with the invention. Figure 2 represents an access door 1 which, contrary to the door of the device of Figure 1, is substantially circular.

The frame 2 is substantially circular to match. It gives access to a chamber 4.

15 In the example represented here, the plug or door 2 is typically of cast iron (for example of ductile cast iron). The frame 2 is formed from the same material. The door 1 is hinged by a pivot 15 to the frame 2. A locking means 16 may enable the door 1 to be held in closed position.

Ribs 12 form compartments 13, 13' under the upper skin 11 of the
20 door 1. The compartments may be open or closed by an inner skin. In one of the compartments, the communication module is installed, fastened to the inside face of the upper skin 11 of the door 1. The fastening of the communication module 3 may be by conventional mechanical fasteners, for example with screw fasteners. Other fastening means, for example by magnetic
25 members, may be employed.

More specifically, the electronic unit 31 of the communication module and the antenna 32 may be fastened into a same compartment 13.

In general terms in the invention, the communication module is of multi-protocols type. The switching from one protocol to another may be manual
30 or automatic. This means that the communication module is capable of communicating, and in particular of sending data via at least two networks, comprising at least one wireless communication network and respectively using

different communication protocols. For example, the communication module may be configured to communicate, alternatively or simultaneously, over two wireless networks or over a wired network and a wireless network.

5 An example of a communication module 3 which may be employed in the invention is represented diagrammatically in Figure 3.

The communication module represented comprises an electronic unit 31 and at least one antenna 32. The unit 32 incorporates a microprocessor 33 configured to receive the signals coming from a group of sensors 34.

10 The sensors 34 are incorporated into the electronic unit 31 or are linked to said unit, as in the represented example, by sensor ports 35. The electronic unit 31 may advantageously be fluid-tight. It may comprise a casing of plastic material or of steel. The ports of the electronic unit 31, whether they be the ports of the sensor 35 or, as described below, the ports for connection of a source of electrical supply, or for instance for the connection of an antenna,
15 may be advantageously fluid-tight. The ports not used may be covered by a fluid-tight plug.

The sensors 34 may have various functions of detection or characterization. The sensors 34 may comprise a sensor of open or closed position of the door, an environmental sensor configured to capture an
20 environmental parameter typically in the chamber 4 or in the vicinity of the chamber of the access device considered, a sensor making it possible to detect a presence or an intrusion in the vicinity of the access device or an intrusion or attempted intrusion into the chamber 4.

Each sensor 34 may be of various types, with contact or contactless.
25 The sensors 34 may comprise a touch sensor, a sensor of angular position of the door, an accelerometer, an optical sensor, a sensor of temperature, humidity, particle concentration or presence, water level or presence, gas concentration or presence, a shock sensor, a vibration sensor, an audio sensor.

The communication module comprises a source of electrical supply.
30 This source of electrical supply may be a connection to an electrical supply network (for example a national distribution network) and/or a local source (hydro-electric turbine, wind turbine, solar panel, etc.) and/or comprise a battery

36 used as a main supply or as backup in case of rupture in supply by the network or local source. The battery may be of different types, in particular of lithium-ion type. It makes it possible to ensure sufficient autonomy to the communication module 3, for example several months and possibly several
5 years in normal conditions of use.

The battery 36 may be integrated into the electronic unit 31, or be external to that unit as in the example shown in Figure 3. Other energy sources, that are complementary or alternative may be employed: photovoltaic cells, connection to an electrical network, etc.

10 The communication module is configured to emit in accordance with at least two wireless communication protocols, alternatively or simultaneously.

For this, the communication module 3 comprises at least one radio frequency module that can emit in accordance with at least two protocols, or at least two modules respectively that can emit in accordance with at least one
15 protocol. In the example represented here, the communication module 3 comprises a first radio frequency module 37 and a second radio frequency module 38.

The communication module may comprise a means for encrypting the data transmitted.

20 It should be noted that in the example represented here, two radio frequency modules are integrated into a same electronic unit 31. It is not however excluded of the invention for the communication module 3 to be constituted by several units connected together, for example each unit managing a different communication protocol.

25 The protocols employed may in general terms be chosen from the protocols of the Internet of things.

The protocols that may be implemented in the invention can be categorized as follows.

The protocols employed may comprise one or more wired
30 communication protocols. For example, these wired communication protocols may be configured for communication by optic fiber or cable.

The protocols employed comprise at least one wireless communication protocol. The wireless communication protocols may be short-range communication protocols, and/or medium-range or long-range communication protocols.

5 The wired networks and the short-range communication networks are mainly non-operated, that is to say independent of an antenna network deployed by an operator.

 In particular, the short-range wireless communication protocols may be chosen from: NFC, RFID, Bluetooth, in particular Bluetooth Low Energy, Lifi, 10 and Zigbee (registered trademarks). The use of alternative protocols of this type, known or to come, may be envisioned.

 The medium-range or long-range communication protocols may be chosen from 4G, 5G, LoRa, Sigfox, NB-IoT, LTE-M, GPRS, GSM (registered 15 trademarks). The use of alternative protocols of this type, known or to come, may be envisioned.

 The medium-range or long-range communication networks may be of operated or non-operated type. Currently, most of the networks providing at the same time a very long range, portability and optimum coverage whatever the geographical position, are operated. They give rise to charging by the operator.

20 Generally, preference is given to low-consumption, long-distance transmission technologies. They may in particular employ the 868Mhz-914Mhz band. In certain cases of use, short-distance or medium-distance transmission technologies may be used. These technologies may employ the 433Mhz band for example. A relay is then provided for the transmission of the data over a 25 long-distance network to enable the control of the access device from a remote platform.

 Cellular communication protocols (GSM, GPRS, EDGE, UMTS/HSPA, LTE) have the advantage of good network availability.

 The protocols supported by the communication module may for 30 example be at least two of the protocols cited earlier.

The protocols employed may be modified, for example for a particular application or further to a development of a protocol or further to the creation of a new protocol.

5 When a hardware development is required for a protocol change, the communication module 3 may be updated, via a physical communication port, or remotely.

When a hardware upgrade is required, a modular design of the communication module may allow its upgrade, for example by replacement of a radio frequency module.

10 For example, the communication module may be configured to select the protocol to employ according to the availability of the corresponding networks. For example, the communication module may be configured to communicate preferentially in accordance with one of the aforementioned protocols of the Internet of things, and change to the GSM network in case of
15 unavailability of the preferential network.

According to an advantageous embodiment, the communication module is configured to be able to communicate over three networks, in accordance with three protocols. The module automatically changes from a first protocol to a second then to the third in case of successive communication
20 failures. Each of the three protocols may employ different communication means. Alternatively, they may implement the same communication devices (for example the same module, the same antenna). Alternatively, two of the three protocols may implement the same communication devices and the third protocol implement different communication devices from those implemented by
25 the other two protocols.

The communication module is employed to transmit a certain number of items of data over a wireless communication network, but naturally, according to certain configurations of the invention, may receive information
30 intended for the access means. The transmitted data may naturally come from the sensors 34, but may also be relative to the actual operation of the

communication module. They may for example include an indication of the charge level of the battery 36.

5 The access device may, in certain embodiments of the invention, be able to conduct certain diagnostics of its state and transmit the corresponding information. For example, the access device can ensure that the sensors it comprises are in operation (or, at least, supply a measurement which is not incoherent or improbable). The level of connection to a wireless network may be determined, as well as the bandwidth available for the transfer of the data.

10 According to the protocols employed, and in particular the frequencies employed, one or more antennas 32 may be required.

In the example represented, a single antenna is directly linked to the electronic unit 31 by a suitable antenna plug. The antenna may, according to other embodiments, be integrated into the electronic unit 31. The antenna 32 may have various forms, it may be rigid or wired, and have a diagram
15 configured for the frequencies employed by one or more protocols employed.

The transmission power may be configured on installation of a given access device, according to the availability of the communication networks at the location of the place of installation of the access device. The lowest possible power enables lower electrical consumption, but the power must be sufficient to
20 ensure reliable transmission of the data. In order to optimize the energy, the communication module may be designed and programmed so as to transmit data only when a signal coming from a sensor corresponds to given information (for example, the opening of the door) or exceeds a predefined threshold of a measured value (for example, the exceeding of a given water level in the
25 chamber).

Alternatively or in addition, the communication module may be configured to transmit data periodically, for example at regular intervals. The non-reception of the expected data, to the extent that the transmission instants are predetermined or determinable, may lead to a warning or a request for
30 intervention on the access device concerned.

Nevertheless, the communication module may be provided with a device, for example a button 39, giving rise through its actuation to the emission

of a test signal over the communication network or networks. This test signal makes it possible to check whether the access device, once installed, is capable of correctly transmitting data.

5 According to another aspect, the invention relates to a system for managing a set of devices for accessing one or more underground or overground civil engineering infrastructure as described above. Such a system is represented diagrammatically in Figure 4. The system comprises access devices for accessing at least one underground or overground civil engineering
10 infrastructure. In the example represented, a first access device A1 constitutes a plug enabling the access to an underground infrastructure, and a second access device A2 constitutes an access device for accessing a surface infrastructure, for example an electrical cabinet.

 The first and the second access device A1, A2 (and more generally
15 each access device of the system) constitute communicating devices as described above, and thus each comprise a multi-protocol communication module.

 By way of example, the first access device A1 is configured to communicate via a wireless network using the Sigfox (registered trademark)
20 protocol, with a first station B1, and over a wireless network using a GSM protocol with a second station B2. The second device is configured to communicate by a wireless network using the LoRa (registered trademark) protocol with a third station B3, and with the second station B2 in accordance with a GSM protocol.

25 The data are next transmitted to a server S, in a conventional manner via one or more networks, after wired or wireless transmission to relays. The final transmission may be provided by Internet I.

 The server s is able to receive, process and interpret data received in accordance with various transmission protocols. In particular, the server s is
30 configured to process signals emitted by all the access devices communicating with the server s (it being possible for each of these access devices to employ different communication protocols).

The server is accessible to an operator by a platform P. The management platform P is a computer program which is executed by a computer system.

5 The platform P enables the remote control of the access devices of the management system. The control may comprise viewing the data coming from each access device. Said data may comprise information coming from measurements carried out by the sensors, or from status data of the communication module that is associated with the access device.

10 To enable the management of the different access devices, each access device of the system can be associated with an identifier. When an access device communicates with the server, it sends its identifier to enable its identification. In a manner that is known per se, recognition algorithms may be used at the time of the communication between the access device and the server, in order to enable respective authentication to provide security for the
15 communication.

The identification of the access device makes it possible to access information concerning it. In particular, the access device may be geolocated, for example by loading position information associated with said access device at the time of its installation. This position information (for example the
20 coordinates of latitude and longitude of the access device) may be recorded in a computer memory on installing the access device. This memory may be comprised at the location of the server S or be remote from it.

Alternatively, position information may be recorded in a memory located at the access device (for example in the communication module 3), this
25 position information being attached with the data transmitted by the access device.

Figure 5 represents, by way of illustration, an example of information that can be delivered by the platform. In particular, Figure 5 represents an example of a management screen that can be displayed to an operator
30 controlling a set of access devices for accessing underground or overground civil engineering infrastructures.

The management screen of Figure 5 is dynamic, in that it presents a certain number of areas constituting computer links making it possible, at the time of an action on those areas, to access certain detailed information or to interact with one or more access devices.

5 In the example represented, a card 51 makes it possible to view the different access devices of the management system, over the whole of the system or over a given area. The access devices of the management system are represented on the map 51 by logos 52 which advantageously can make it possible to differentiate between different types of access device, and/or the
10 devices emitting a warning relating to their state or to a parameter controlled by sensors of said device concerned. The management system enables data relative to the different access devices to be displayed. For example, it makes it possible to display the latest information known as to the state of a given access device, and as to the data it has sent.

15 In the example shown, an area of graphical objects 53 enables the display of an overview of the state of the access devices of the management system. Graphical objects 531 to 534 are described below by way of non-limiting example.

 A network graphical object 531 indicates the number of access
20 devices able to communicate with the server, and respectively the number of access devices encountering communication problems (either not being able to communicate with the server, or operating in accordance with a communication protocol used as a backup further to communication rupture over the network employing a default protocol). The detail of the access devices concerned and,
25 if applicable, the nature of the problems encountered, can be viewed.

 A battery graphical object 532 makes it possible to view the number of access devices of which the battery is at a satisfactory level of charge, and respectively the number of access devices of which the battery is at an insufficient level of charge. The detail of the access devices concerned as well
30 as the precise level of charge of the batteries of the access devices concerned may for example be displayed.

A connection graphical object 533 makes it possible to view the number of access devices connected to the server. The detail of the access devices connected can be viewed.

5 A user graphical object 534 makes it possible to view the number of users connected. Typically, their identity can be viewed.

In the management screen example shown, a warning area 54 indicates the different access devices for which a warning has been issued, relating to their state or to a parameter controlled by sensors of said device concerned.

10 A menu 55 enables the display of detailed information on said warnings, on data coming from the different access devices, in particular statistical information on those data, and on the state of the access devices.

The platform can manage different levels of access to the data and different levels of interaction with the remote systems (that is to say with the
15 access devices of the management system), according to different user profiles.

For example, one or more administrators (corresponding to a first user profile) may have access to a set of functionalities of the management system, for all the access devices of the management system). Local administrators, corresponding to a second user profile, can have access to all or
20 some of the functionalities, but only for the access devices located in a given geographical area, or for a given nature of access device. Other profiles can be defined with a limited access to certain functions. For example, a control operator user profile can make it possible to temporarily prevent the sending of warnings associated with the opening of the door of one or more given access
25 devices, in order to enable their physical control without triggering any warning, for example for programmed maintenance (visual inspection, replacement of a battery, etc.).

The invention thus developed provides an access device for
30 accessing an underground or overground civil engineering infrastructure, providing a reliable connection and which is particularly suitable for being employed in the context of a system for managing a set of access devices. The

features developed make it possible to adapt the different accesses to the locally available networks, but also if required, to ensure transmission of data in all circumstances by changing the transmission from one wireless network to another.

- 5 The management system for a set of access devices of which the constitution is possible by virtue of the technologies developed in the invention enables simple and efficient management of said set, without requiring the organization of repetitive rounds for verifying the access devices. Furthermore, the management system makes it possible to intervene very fast as soon as
- 10 required on any of the devices of the set.

CLAIMS

1. Access device for accessing an underground or overground civil engineering infrastructure, comprising an access door (1) having a closed position in which it shuts a chamber (4) and an open position in which it gives access to said chamber (4),

the access device comprising at least one sensor (34) chosen from: a sensor of opening or closing of the door, a sensor of at least one environmental parameter of the chamber, a sensor of intrusion in the vicinity of the door, a sensor of intrusion or attempted intrusion into the chamber said door (1) comprising a communication module (3) comprising at least one antenna (32) enabling the emission of a signal over at least one wireless communication network, each sensor being configured to deliver a signal to the communication module, characterized in that the communication module (3) is of multi-protocol type so as to be able to emit the signal or the signals, or information derived from said signal or from said signals in accordance with at least two wireless communication protocols or in accordance with at least one wired communication protocol and at least one wireless communication protocol, and in that the communication module (3) is adapted to evaluate the availability of the communication networks respectively employing the different protocols in accordance with which said communication module is configured to communicate, and to select the communication protocol for the sending and/or the receiving of data according to the evaluated availability.

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2. Access device according to claim 1, wherein the protocols are chosen from:

- wired communication protocols,
- short-range wireless communication protocols, and
- medium-range or long-range communication protocols.

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3. Access device according to claim 2, wherein
the wired communication protocols are configured for communication
by optic fiber or cable,
the short-range wireless communication protocols are chosen from:
5 NFC, RFID, Bluetooth, in particular Bluetooth Low Energy, Lifi, Zigbee; and
the medium-range or long-range communication protocols are
chosen from 4G, 5G, LoRa, Sigfox, NB-IoT, LTE-M, GPRS, GSM.
4. Access device according to one of the preceding claims, wherein
10 the communication module (3) is adapted to bi-directional communication.
5. Access device according to one of the preceding claims, wherein
the communication module (3) communicating over a first network is adapted to
change its communication to a second network at the time of a rupture in
15 communication over the first network.
6. Access device according to one of the preceding claims,
comprising at least one sensor of opening or of closing of the door (1) from: a
contact sensor, a sensor of angular position of the door, an accelerometer, an
20 optical sensor.
7. Access device according to one of the preceding claims,
comprising at least one sensor of at least one environmental parameter of the
chamber from: a sensor of temperature, humidity, particle presence or
25 concentration, water level or presence, gas concentration or presence.
8. Access device according to one of the preceding claims,
comprising at least one sensor of intrusion in the vicinity of the door from: a
vibration sensor, a heat sensor, an optical sensor, an audio sensor and/or at
30 least one sensor of intrusion or of attempted intrusion into the chamber, from: a
shock sensor, a vibration sensor, a temperature sensor, an audio sensor.

9. Access device according to one of the preceding claims, wherein the communication module (3) comprises an antenna (32) integrated indissociably with the door.

5 10. Access device according to one of the preceding claims, comprising a battery (36) enabling the supply, as main supply or in the event of a fault in a main electric source, of the communication module.

10 11. Access device according to one of the preceding claims, wherein the door comprises a rigid outer skin (11) under which is provided a set of ribs (12) substantially at right angles to said outer skin (11), the ribs (12) being disposed so as to form at least one compartment (13) in which is installed the communication module (3), with the exception, as may be appropriate, of the antenna (32) of said communication module (3), the compartment (13) being
15 closed by a rigid inner skin (14) providing the mechanical protection of said communication module (3).

20 12. System for managing a set of access devices for accessing one or more underground or overground civil engineering infrastructures, the system comprising a group of access devices (A1, A2) according to one of the preceding claims and a server, each access device (A1, A2) being configured to communicate with the server (S) via at least two communication networks.

25 13. System for managing a set of access devices according to claim 12, wherein each access device (A1,A2) is associated with an identifier communicated at the time of any communication between the access device and the server (S), said server (S) being configured to retrieve geolocation information on said access device from a memory.

30 14. System for managing a set of access devices according to claim 12, or claim 13, comprising at least one computer accessing system for accessing said server (S), the accessing system executing a computer program

referred to as management platform (P), said management platform being configured to provide information on the state of each of the access devices (P) or on environmental data coming from the sensors equipping the access devices (A1, A2).

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15. System for managing a set of access devices according to claim 14, wherein said platform (P) comprises a differentiated access to the information coming from said access devices according to at least two user profiles.