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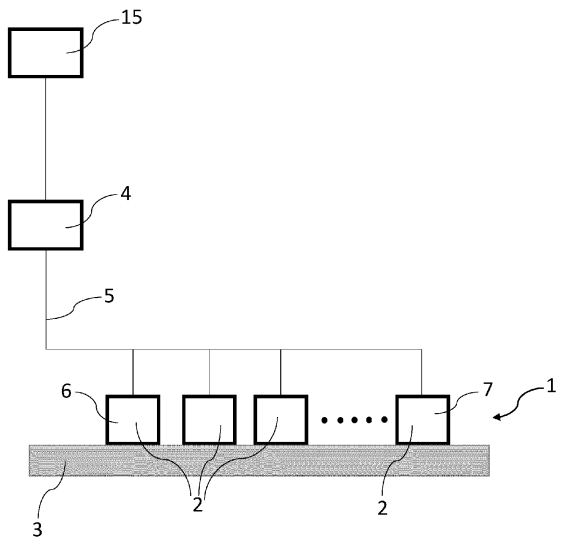
(54) METHOD OF ASSIGNING A PLURALITY OF UNIQUE IDENTIFIERS TO A PLURALITY OF SENSORS OF AN ARRAY

(57) A method of assigning a plurality of unique identifiers to a plurality of sensors (2) of an array (1) of sensors (2) in signal communication with one another and with a control unit (4) via a predetermined connection (5), the sensors (2) being connected to each other according to a sequential order starting from the control unit (4);
said method comprising the steps of:
- temporarily setting a first identifier (A) in each sensor (2) of the array (1);
- generating a trigger signal on the connection (5) by the control unit (4);
- cyclically repeating the steps of:
- receiving said trigger signal by a receiving sensor (2) of the array (1), said receiving sensor (2) being the sensor (2) closest to the control unit (4) according to the sequential order among the sensors set with the first identifier (A);
- temporarily setting a second identifier (B) in said receiving sensor (2);
- sending on the connection by the control unit (4) a setting signal containing a unique identifier directed to a sensor (2) of the array (1) set with the second identifier (B);
- receiving by the sensor (2) of the array (1) set with the second identifier (B) the setting signal containing the unique identifier and changing the corresponding identifier from the second identifier (B) to the unique identifier;
- propagating the trigger signal on the connection (5) by the sensor (2) that has received the setting signal containing the unique identifier.

FIG. 1



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Description

Field of the invention

[0001] The present invention relates to a method of assigning a plurality of unique identifiers to a plurality of sensors of an array. This method finds useful application, for example, in intrusion preventing systems applied to fences to recognize attempted climbing thereof. In such intrusion preventing system at least one array of sensors is installed on a fence. In particular, the system can identify climbing attempts using a special algorithm that recognizes the type of oscillation that acts on the fence. These sensors are in signal communication with one another and with a control unit. For proper operation of the oscillation recognizing algorithm, each sensor of the array must be assigned a respective unique identifier.

Background art

[0002] A sensor sorting mode may be identified in the Italian patent 141508. In particular, this document discloses a perimetric security system adapted for association with a wire fencing. This system comprises a common acquisition control unit and first and second arrays of sensors. Each array of sensors comprises a plurality of sensors, a power bus and a communication bus, which are both shared. Each sensor in turn comprises a transducer and a circuit board comprising a local processing unit.

[0003] This local unit of processing reads a power supply voltage value of the sensor and sends an electric signal to the acquisition control unit. Considering that such power supply value decreases from the first sensor the last sensor of the array, the absolute positions of the sensors in the array are recognized by the acquisition control unit: by reading the value of the power supply voltage of all the sensors of the array, the acquisition control unit approximately sorts the sensors.

[0004] In an attempt to address this technical problem, IT 141508 document suggests equipping the control board with a voltage control device. In order to sort sensors with greater accuracy, the supply voltage control device of each sensor should be selectively adjusted. Thus, as the voltage control device of a particular sensor is actuated, all the readings of the sensors that precede it from the control unit should not exhibit variations, unlike what is expected for the succeeding sensors. Activating the supply control devices, time after time, the sensors may be sorted.

[0005] A method and a system as defined in the preambles of claim 1 and claim 12 respectively are disclosed in EP 1 182 630 A2.

Problem of the prior art

[0006] One drawback of the sorting arrangement provided by Italian Patent 141508 is its high complexity and the high cost of the sensors that must be used for oscillation detection. In fact, for non-approximate sorting of the sensors of the array, each sensor must be equipped with a circuit board comprising a local processing unit and a voltage control device. By selective adjustment of the voltage of each sensor it is possible to determine its position in the array.

Summary of the invention

[0007] Therefore, the technical purpose of the present invention is to provide a method of assigning a plurality of unique identifiers to a plurality of sensors of an array of sensors that can obviate the aforementioned prior art drawbacks.

[0008] In particular, the object of the present invention is to provide a method that allows assignment of a respective unique identifier to each sensor of the array and, at the same time, does not require high-complexity sensors.

[0009] The aforementioned technical purpose and objects are substantially achieved by a method of assigning a plurality of unique identifiers to a plurality of sensors of an array of sensors, or by an intrusion preventing system, comprising the technical features as disclosed in one or more of the accompanying claims.

[0010] The method and system of the present invention define a procedure for assigning a plurality of unique identifiers to a plurality of sensors of the array, which are initially all set with a first identifier. By temporarily assignment of a second identifier to one sensor of the array at a time, the control unit can assign a unique identifier to the sensor that has been set with the second identifier. By repeating the same procedure, with the setting of the second identifier in different sensors each time, a unique identifier can be assigned to each sensor of the array.

[0011] Advantageously, this procedure simplifies assignment of the unique identifier, as it does not require the use of sensors with high expensive and complex technical characteristics.

Brief description of figures

[0012] Further features and advantages of the present invention will result more clearly from the illustrative, non-limiting description of a method of assigning a plurality of unique identifiers to a plurality of sensors of an array of sensors, as shown in the annexed drawings, in which:

- Figure 1 schematically shows an intrusion preventing system according to one embodiment of the invention,
- Figure 2 shows a further embodiment of the intrusion preventing system.

Detailed description

[0013] Particularly referring to Figure 1, an intrusion

preventing system, applied to a fence 3 for oscillation detection in the same fence 3, comprises a control unit 4 and an array 1 comprising a plurality of sensors 2. In addition, the intrusion preventing system comprises a predetermined connection 5 which provides signal communication among the sensors 2 and the control unit 4 according to a sequential order starting from the control unit 4.

[0014] The control unit 4 is in turn connected to a network card 15. This network card 15 is configured to power the control unit 4 and the sensors 2 of the array 1. Also, the network card 15 is configured to indicate the presence of an alarm signal to a remote system that is not part of the intrusion preventing system and is not shown in the accompanying figures.

[0015] The connection 5 between each sensor 2 and the control unit 4 is based on a master-slave logic. In this connection the control unit 4 acts as a master, and each sensor 2 of the array 1 acts as a slave. In other words, each sensor 2 of the array 1 only responds to the requests it receives from the control unit 4.

[0016] As mentioned hereinabove, the sensors 2 are connected to each other in a sequential order from the control unit 4. Preferably, the sensors 2 of the array 1 are connected in series. In particular, the sequential order defines a first sensor 6, a last sensor 7 and a series of sensors 2 interposed between the first sensor 6 and the last sensor 7. In addition, for each sensor 2 of the array 1, the sequential order defines a preceding sensor 2 and a succeeding sensor 2. In particular, the first sensor 6 has only one succeeding sensor 2, and the last sensor 7 has only one preceding sensor 2.

[0017] These sensors 2 have an increasing distance from the control unit 4 from the first sensor 6 to the last sensor 7. This distance is measured in terms of a path that a signal from the control unit 4 must follow to reach the sensor 2 along the connection 5. In other words, a signal from the control unit 4 travels a first distance to reach the first sensor 6. This first distance is also traveled by a signal that comes from the first sensor 6 and is directed to the control unit 4. On the other hand, a signal from the control unit 4 travels a last distance to reach the last sensor 7. This last distance is also traveled by a signal that comes from the last sensor 7 and is directed to the control unit 4. The first distance is shorter than the last distance.

[0018] The distance between the sensors 2 of the series of interposed sensors 2 progressively increases from the first distance to the last distance. In other words, the distance that a signal must travel to reach each sensor 2 of the series of interposed sensors 2, is such that it is longer than the distance of the sensor 2 that precedes such sensor 2 and is shorter than the distance of the sensor 2 that follows such sensor 2. In addition, the distance of each sensor 2 of the series of interposed sensors 2 is always longer than the first distance and always shorter than the last distance.

[0019] Proper detection of the oscillations in the fence 3 requires assignment of a unique identifier to each sensor 2 of the array 1, using the method of the present invention. In particular, this method is a method of assigning a plurality of unique identifiers to a plurality of sensors 2 of an array 1 of sensors 2 in signal communication with one another and with a control unit 4 via a predetermined connection 5. This method will be referred to hereinafter as an association method.

[0020] Such association method includes the steps that will be discussed below. A skilled person will also determine from the following description which components of the intrusion preventing system are configured to carry out these steps.

[0021] The first step includes temporarily setting a first identifier A in each sensor 2 of the array 1. By sending by the control unit 4 a setting signal of the first identifier A, each sensor 2 of the array 1 assumes the same first identifier A. Once the first identifier A has been set, the method 1 comprises the step of generating a trigger signal on the connection 5 by the control unit 4. This trigger signal has the purpose to progressively change the first identifier A of the sensors 2. In fact, the trigger signal is received by the sensors 2 of the array 1 according to the sequential order, one at a time, as more clearly explained hereinbelow.

[0022] In order to progressively assign a unique identifier to each sensor 2 of the array 1 the following steps must be cyclically repeated. The first cyclic step of the method includes receiving the trigger signal by a receiving sensor 2 of the array 1. As described in greater detail below, in the preferred embodiment the trigger signal is received by only one sensor 2 of the array 1, thanks to a series communication line of the connection 5 which carries the trigger signal from the control unit 4 to the first sensor 6, and time after time from each sensor 2 to the succeeding sensor 2.

[0023] It shall be noted that, at each cycle, the receiving sensor 2 corresponds to the sensor 2 that is closest to the control unit 4 according to the sequential order, among the sensors 2 that have been set with the first identifier A. In other words, the trigger signal will be received by the sensor 2, among all those having the first identifier A, that is at the shortest distance from the control unit 4.

[0024] In fact, at the beginning of the method, the sensor 2 with the identifier A that is closest to the control unit 4 is the first sensor 6. Therefore, the first sensor 6 is the first to receive the trigger signal. Furthermore, as described below, at each cycle the receiving sensor 2 loses the first temporary identifier A, and in the next cyclical repetitions, progressively succeeding sensors 2, different from the first sensor 6, will become receiving sensors 2 for receiving the trigger signal.

[0025] The next cyclical step comprises temporarily setting a second identifier B for the receiving sensor 2, to replace the first identifier A. As a result, the receiving sensor 2 is the only sensor 2 to be set with the identifier B.

[0026] The next cyclic step includes sending, by the

control unit 4, a setting signal containing a unique identifier directed to a sensor 2 of the array 1 set with the second identifier B. At each cyclic repetition a setting signal is sent, which contains a different unique identifier of the plurality of unique identifiers. This setting signal containing the unique identifier is only accepted by the receiving sensor 2, as this is the only sensor 2 that is set with the second identifier B.

[0027] After such sending step, the method includes receiving, by the sensor 2 of the array 1 set with the second identifier B, the setting signal containing the unique identifier and changing the corresponding identifier from the second identifier B to the unique identifier. In other words, with the setting signal containing the unique identifier, the unique identifier can be selectively assigned to the sensor 2 having the second identifier B. In particular, in the case of the first sensor 6, upon assignment of unique identifier, such first sensor 6 is the only sensor 2 that does not have the first identifier A.

[0028] Now, in order to assign the unique identifier to each sensor 2 of the array 1, the trigger signal has to be propagated on the connection 5 by the sensor 2 that has received the setting signal containing the unique identifier. Such propagation of the trigger signal on the connection 5 is followed by a cyclic step repetition from the step of receiving the trigger signal. Still with reference to the case of the first sensor 6, once the unique identifier has been assigned to the first sensor 6, the trigger signal propagated from the first sensor 6 is received by the sensor 2 succeeding the first sensor 6. At each cycle a different receiving sensor 2 passes from the first identifier A to the second identifier B to its own unique identifier, and propagates the trigger signal to the succeeding sensor 2, which corresponds to the sensor 2 with the shortest distance from the control unit 4 among all the sensors 2 that are still set with the first identifier A. The method ends when no sensor 2 of the array 1 is set with the second identifier B. In other words, cyclic step repetition ends when all the sensors 2 have been set with the unique identifier.

[0029] It shall be noted that the setting signal containing the unique identifier is received at each cycle by one sensor 2 only, i.e. the sensor 2 set with the second identifier B. The sensors 2 that precede it according to the sequential order have already been set with respective unique identifiers in the previous cycles, whereas the succeeding sensors 2 are still set with the first identifier A.

[0030] In a possible application of the association method, the unique identifier is a number that ranges from a minimum value, preferably one, to a maximum value, preferably equal to the number of sensors 2 of the array 1. It shall be noted that each of the unique identifiers, that will be retained by the sensors 2 even after completion of the assignment method, is different from the first and second identifiers A, B which are employed temporarily and only during the assignment method. Furthermore, such unique identifier is assigned sequentially, such that the first sensor 6 is assigned the minimum value as a unique identifier, whereas the last sensor 7 is assigned the maximum value as a unique identifier.

[0031] In other words, assuming an array 1 composed of one hundred twenty sensors 2, the first sensor 6 is assigned the number one as a unique identifier, whereas the last sensor 7 is assigned the number one hundred twenty as a unique identifier. More in detail, each sensor 2 of the array 1 is assigned the unique identifier according to its distance from the control unit 4. The longer the distance of the particular sensor 2 from the control unit 4, the greater is the number assigned thereto as a unique identifier. Conversely, the shorter the distance of the particular sensor 2 from the control unit 4, the smaller is the number assigned thereto as a unique identifier. Still assuming an array 1 composed of one hundred twenty sensors 2, the sensor 2 with the shortest distance from the control unit 4 receives the number one as a unique identifier. Conversely, the sensor 2 with the longest distance from the control unit 4 receives the number one hundred twenty as a unique identifier.

[0032] As discussed above, the sensors 2 of the array 1 are connected to each other by means of the connection 5. In detail, this predetermined connection 5 comprises a series communication line and a common communication line.

[0033] The series communication line is, for example, a daisy chain, whereas the common communication line is, for example, a common communication bus.

[0034] The series communication line is configured to carry signals between the control unit 4 and the first sensor 6 of the array 1, and to carry signals between each sensor 2 and a respective succeeding sensor 2 according to the sequential order, up to the last sensor 7 that has no succeeding sensors 2.

[0035] Each sensor 2 is configured to receive and block signals carried on the series communication line from the control unit 4 or from a respective succeeding sensor 2 according to the sequential order. Each sensor 2 may also be configured to propagate a signal on the series communication line. Therefore, generally, all the sensors 2 of the array 1 may receive a signal initially transmitted from the control unit 4 on the series communication line, once the latter has been received, blocked and propagated by all the preceding sensors 2. Nevertheless, the sensors 2 do not receive the signals transmitted on the series communication line at the same time, but sequentially.

[0036] The trigger signal is transmitted on the series communication line. In other words, the trigger signal received by the receiving sensor 2 is blocked by such receiving sensor 2. Only once the identifier of the receiving sensor 2 has been changed from the second identifier B to the unique identifier, the trigger signal is propagated from the receiving sensor 2 on the series communication line. Now, the trigger signal is received by the sensor 2 succeeding the receiving sensor 2. Once again, this trigger signal does not proceed on the series communication line, but is blocked by the new receiving sensor 2. Once

this new receiving sensor 2 has been set with the unique identifier, the trigger signal is transmitted again on the series communication line.

[0037] On the other hand, the common communication line is configured to carry signals between the control unit 4 and all the sensors 2 of the array 1 at the same time. The setting signal containing the unique identifier is transmitted on the common communication line. In other words, each sensor 2 of the array 1 cannot block the setting signal containing the unique identifier.

[0038] The setting signal containing the unique identifier is received by all the sensors 2 of the array 1. However, only the sensor 2 set with the second identifier B will change its identifier to the unique identifier. The setting signal of the first identifier A is also transmitted on the common communication line. In other words, a signal that is transmitted on the common communication line can be accompanied by a given unique identifier. In this case only the sensor 2 that is set with that particular unique identifier will accept the signal transmitted on the common communication line. This is the case of the setting signal containing the unique identifier.

[0039] Advantageously, the provision of a series communication line and a common communication line allows progressive assignment of the plurality of unique identifiers to the plurality of sensors 2.

[0040] In addition, each sensor 2 is connected to the series communication line via a first communication port for receiving the trigger signal and a second communication port for propagating the trigger signal. Preferably, the first and second communication ports of each sensor 2 have a hardware architecture that allows a two-way communication. More in detail, the first and the second communication ports may be alternatively set to an "input" configuration to receive a signal and to an "output" configuration to transmit a signal.

[0041] Advantageously, during connection of the sensors 2 by the predetermined connection 5, there will be no need to pay attention to the distinction between ports that can be only used for signal input and ports that can be only used for signal output for each sensor 2. Nevertheless, signal transmission on the series communication line will not occur from one sensor 2 to the preceding sensor 2, but only to the succeeding sensor 2.

[0042] A further characteristic of the association method is that communication between each sensor 2 of the array 1 and the control unit 4 can be mutually authenticated. More in detail, in this case, the control unit 4 is configured to indicate an authentication key to the sensors 2 of the array 1, during the step of sending the setting signal containing the unique identifier. In other words, the control unit 4 sends the authentication key to the sensor 2 that also receives at the same time the setting signal containing the unique identifier, i.e. the sensor that has been temporarily set with the second identifier B.

[0043] Thus, such sensor 2 is configured to receive and store the authentication key. Furthermore, the control unit 4 and the sensors 2 are configured to send each other signals containing respective authentication codes, determined for each signal from the authentication key, and to reject signals having no respective authentication code or containing a wrong authentication code. Advantageously, once this authentication key has been sent during assignment of the unique identifier to each sensor 2 of the array 1, a sensor 2 that is not part of the array 1 when the association method is executed but has a valid identifier, is prevented from being seen as a valid sensor 2.

[0044] More in detail, whenever the control unit 4 sends a signal to a sensor 2 of the array 1, or a sensor 2 sends a signal to the control unit 4, this signal is accompanied by a respective authentication code. Preferably, the authentication code is different for each sensor 2, and is different for each signal sent by the sensor 2 or by the control unit 4. The control unit 4 is configured to check, during communication with each sensor 2 of the array 1, the presence of the respective authentication code. At the same time, each sensor 2 of the array 1 is configured to check, during communication with the control unit 4, the presence of the respective authentication code. The check and calculation of the presence and correctness of the authentication code by the sensor 2 or the control unit 4 is based on the stored authentication key.

[0045] In the preferred embodiment, each sensor 2 of the array 1 is fabricated using the MEMS technology. In addition, each sensor 2 is designed to detect a magnetic field. Preferably, each sensor 2 comprises a Hall sensor adapted to be triggered by a magnet. In response to the detection of a magnetic field by the sensor 2, such sensor 2 will be able to temporarily change its identifier. At the same time, the unique identifier assigned to such sensor 2 is still stored.

[0046] Considering the magnetic field detection ability of the sensors 2, a method of identifying a sensor 2 of the array 1 of sensors 2 may be defined. This method will be referred to hereinafter as an identification method. The identification method comprises the following steps. The first step consists in assigning a plurality of unique identifiers to the sensors 2 according to the association method. This is because the use of the identification method requires each sensor 2 of the array 1 to be set with its respective unique identifier.

[0047] Proper use of the identification method requires an initialization step in each sensor 2 of the array 1 for initializing a magnet-based identification mode by the control unit 4. Initialization is carried out when the control unit 4 sends an initialization signal on the connection 5, and particularly on the common communication line.

[0048] The next step consists in moving a magnet toward a sensor 2 to be identified. Such movement is followed by a step of detecting a magnetic field produced by the magnet by the sensor 2 to be identified. Consequently, a third additional identifier C is temporarily activated in the sensor 2 to be identified that has detected the magnetic field. In other words, the sensor 2 to be identified has assumed the third identifier C after the mag-

net has moved toward it. At the same time the sensor 2 to be identified has stored its respective unique identifier. It shall be noted that each of the unique identifiers is different from the third identifier C, as well as from the first and second identifiers A, B.

[0049] Now, the following step consists in sending, by the control unit 4, an identifier requesting signal. This identifier requesting signal is directed to a sensor 2 of the array 1 temporarily having the third identifier C. This identifier requesting signal travels on the common communication line, to thereby simultaneously reach all the sensors 2 of the array 1.

[0050] Now, the final step includes receiving the unique identifier requesting signal by the sensor 2 of the array 1 temporarily having the third identifier C. In other words, this identifier requesting signal is only accepted by the sensor 2 that temporarily has the third identifier C. Since the sensor 2 that temporarily has the third identifier C also stores the corresponding unique identifier, such sensor 2 indicates the corresponding unique identifier to the control unit 4. The identifier of the sensor 2 is indicated by the control unit 4 to the relevant user.

[0051] Particularly referring to Figure 2, a first array 10 and a second array 11 of sensors 2 may be used in a further embodiment of the intrusion preventing system. The first array 10 and the second array 11 have the same characteristics of the array 1 described hereinbefore. Therefore, a method may be defined to assign a plurality of unique identifiers to a plurality of sensors 2 of a first array 10 and a second array 11. The sensors 2 of the first array 10 of sensors 2 are in signal communication with one another and with a control unit 12 via a first predetermined connection 13. At the same time, the sensors 2 of the second array 11 of sensors 2 are in signal communication with one another and with the control unit 12 via a second predetermined connection 14. In addition, the sensors 2 of each array 10, 11 are connected to each other according to respective sequential orders. It has to be noted that the two arrays 10, 11 are connected to the same control unit, 12. The control unit 12 has the same characteristics of the unit 4 that has been described hereinbefore. At the same time, for both the first array 10 and the second array 11 of sensors 2 the above described sequential order may be defined. This method will be referred to hereinafter as a multiple association method. The multiple association method comprises the steps of:

- assigning a plurality of first unique identifiers, each to a respective sensor 2 of the first array 10 of sensors 2, according to the association method. More in detail, the first unique identifiers are numbers ranging from a first minimum value to a first maximum value. The first minimum value is smaller than the first maximum value;
- assigning a plurality of second unique identifiers, each to a respective sensor 2 of the second array 11 of sensors 2, according to the association method. Preferably the second unique identifiers are different from the first unique identifiers. In one embodiment, the second unique identifiers are numbers ranging from a second minimum value, greater than the first maximum value, to a second maximum value. The second minimum value is smaller than the second maximum value; In any case, even if the second identifiers were identical to the first identifiers, the control unit 4 is configured to distinguish the sensors 2 of the first array 10 from the sensors 2 of the second array 11.

[0052] In other words, the multiple association method consists in applying the association method to the first array 10 of sensors 2 and the second array 11 of sensors 2. In one embodiment, assuming that the first array 10 and the second array 11 are composed of one hundred twenty sensors 2 each, with the application of the association method to the first array 10 of sensors 2 the first unique identifiers are assigned to the sensors 2 of the first array 10. Preferably, the first unique identifiers are numbers ranging from one and one hundred twenty. Once again, the longer the distance of the sensor 2 from the control unit 12 the greater is the number that the sensor 2 receives as its first unique identifier. With the application of the association method to the second array 11 of sensors 2 the second unique identifiers are assigned to the sensors 2 of the second array 11. These second unique identifiers range from a second minimum value to a second maximum value. The second minimum value is, for example, greater than the first maximum value, which in this case is equal to one hundred twenty. As a result, in the case of a first array 10 and a second array 11 composed of one hundred twenty sensors 2, the second unique identifiers range, for example, from one hundred twenty-one to two hundred forty, i.e. from the number the sensors 2 of the first array 10 plus one and the sum of the numbers the sensors 2 of the first array 10 and the second array 11.

[0053] It shall be noted that the identification method may be applied to intrusion preventing systems comprising a single array 1 or to intrusion preventing systems comprising the first array 10 and the second array 11, or any number of arrays.

Claims

1. A method of assigning a plurality of unique identifiers to a plurality of sensors (2) of an array (1) of sensors (2) in signal communication with one another and with a control unit (4) via a predetermined connection (5), the sensors (2) being connected to each other according to a sequential order starting from the control unit (4);
said method comprising the steps of:

- temporarily setting a first identifier (A) in each sensor (2) of the array (1);

- generating a trigger signal on the connection (5) by the control unit (4);
- cyclically repeating the steps of:

  • receiving said trigger signal by a receiving sensor (2) of the array (1), said receiving sensor (2) being the sensor (2) closest to the control unit (4) according to the sequential order among the sensors set with the first identifier (A);
  • temporarily setting a second identifier (B) in said receiving sensor (2);
  • sending on the connection (5) by the control unit (4) a setting signal containing a unique identifier directed to a sensor (2) of the array (1) set with the second identifier (B);
  • receiving by the sensor (2) of the array (1) set with the second identifier (B) the setting signal containing the unique identifier and changing the corresponding identifier from the second identifier (B) to the unique identifier;
  • propagating the trigger signal on the connection (5) by the sensor (2) that has received the setting signal containing the unique identifier.

characterized in that said predetermined connection (5) comprises a series communication line and a common communication line, each sensor (2) being configured to receive and block signals carried on the series communication line from the control unit or from a respective sensor (2) consecutive according to the sequential order, the common communication line being configured to simultaneously carry signals between the control unit (4) and all the sensors (2) of the array (1), the trigger signal being transmitted on said series communication line, the setting signal being transmitted on said common communication line.

2. The method of claims 1, wherein:

- each sensor (2) is connected to the series communication line via a first communication port for receiving the trigger signal and a second communication port for propagating the trigger signal, and
- the first and second communication port of each sensor (2) have a hardware architecture that allows a two-way communication.

3. A method as claimed in any of the preceding claims, wherein:

- the step of sending the setting signal comprises communicating an authentication key by the control unit (4);
- the step of receiving the setting signal containing the unique identifier comprises receiving and storing the authentication key by the sensor (2) set with the second identifier (B), and
- the control unit (4) and the sensors (2) are configured to send each other signals containing respective authentication codes, determined for each signal from the authentication key, and to reject signals having no respective authentication code or containing a wrong authentication code.

4. A method as claimed in claim 3, wherein the control unit (4) is configured to check the presence of the respective authentication code in each communication with each sensor (2) of the array (1), and each sensor (2) of the array (1) is configured to check the presence of the respective authentication code in each communication with the control unit (4).

5. A method as claimed in any of the preceding claims, wherein said sequential order defines a first sensor (6), a last sensor (7) and a series of sensors (2) interposed between the first (6) and the last (7) sensors, the sensors (2) having a distance from the control unit (4) increasing from said first sensor (6) to said last sensor (7), said distance being measured in terms of a path that a signal from the control unit (4) has to cover to reach the sensor (2).

6. A method as claimed in claim 5, wherein:

- said unique identifier is a number ranging from a minimum value to a maximum value, and
- said unique identifier is assigned sequentially, such that the first sensor (6) is assigned the minimum value as a unique identifier, whereas the last sensor (7) is assigned the maximum value as a unique identifier.

7. A method as claimed in claim 7, wherein the minimum value is equal to one and the maximum value is equal to the number of sensors (2) of the array (1).

8. A method as claimed in any of the preceding claims, wherein each sensor (2) of the array (1) is designed to detect a magnetic field.

9. A method as claimed in claim 8, wherein each sensor (2) comprises a Hall sensor adapted to be triggered by a magnet.

10. A method of assigning a plurality of unique identifiers to a plurality of sensors (2) of a first (10) and a second (11) arrays of sensors (2), the sensors (2) of the first array (10) of sensors (2) being in signal communi-

cation with one another and with a control unit (12) via a predetermined first connection (13), the sensors (2) of the second array (11) of sensors (2) being in signal communication with one another and with the control unit (12) via a predetermined second connection (14), the sensors (2) of each array (10, 11) being connected to each other according to respective sequential orders starting from the control unit (12), comprising the steps of:

- assigning a plurality of first unique identifiers, each to a respective sensor (2) of the first array (10) of sensors (2), according to the method as claimed in any of the preceding claims, wherein the first unique identifiers are numbers ranging from a first minimum value to a first maximum value,
- assigning a plurality of second unique identifiers, each to a respective sensor (2) of the second array (11) of sensors (2), according to the method as claimed in any of the preceding claims, the control unit (4) being configured to distinguish the sensors (2) of the first array (10) and the second array (11).

11. A method of identifying a sensor (2) of an array (1) of sensors (2) in signal communication with one another and with a control unit (4) via a predetermined connection (5), the sensors (2) being connected to each other according to a sequential order starting from the control unit (4), comprising the steps of:

- assigning a plurality of unique identifiers to the sensors (2) of the array (1) using the method as claimed in claim 9;
- initializing an identification mode through a magnet, in each sensor (2) of the array (1), by the control unit (4);
- moving a magnet toward a sensor (2) to be identified;
- detecting a magnetic field produced by the magnet by the sensor (2) to be identified;
- temporarily enabling a third identifier (C) in the sensor (2) to be identified that has detected the magnetic field;
- sending a unique identifier requesting signal by the control unit (4) to a sensor (2) of the array (1) temporarily having the third identifier (C);
- receiving the unique identifier requesting signal by the sensor (2) of the array (1) temporarily having the third identifier (C) and communicating the corresponding unique identifier to the control unit (4).

12. An intrusion detection system, comprising:

- a control unit (4),
- an array (1) of sensors (2) comprising a plurality of sensors (2),
- a predetermined connection (5) which provides signal communication among the sensors (2) and the control unit (4) according to a sequential order starting from the control unit (4);

wherein:

- each sensor (2) of the array (1) is configured to be temporarily set with a first identifier (A);
- the control unit (4) is configured to generate a trigger signal on the connection (5);
- the connection (5) is configured, each time that it receives a trigger signal, to carry the trigger signal to a sensor (2) closest to the control unit (4) according to the sequential order among the sensors (2) set with the first identifier (A);
- each sensor is configured, in case of receiving the trigger signal, to be temporarily set with a second identifier (B);
- whenever a sensor (2) is set with the second identifier (B), the control unit (4) is configured to send a setting signal containing a unique identifier on the connection (5) to the sensor (2) of the array (1) set with the second identifier (B);

• each sensor (2) is configured, while it is set with the second identifier (B), to receive the setting signal containing the unique identifier, to change its identifier from the second identifier (B) to the unique identifier, and to propagate the trigger signal on the connection (5), **characterized in that:**
• said predetermined connection (5) comprises a series communication line and a common communication line,
• each sensor (2) is configured to receive and block signals carried on the series communication line from the control unit (4) or from a respective sensor (2) consecutive according to the sequential order,
• the common communication line is configured to carry signals between the control unit (4) and all the sensors (2) of the array (1) at the same time,
• the trigger signal is transmitted on said series communication line and the setting signal is transmitted on said common communication line.

FIG. 1

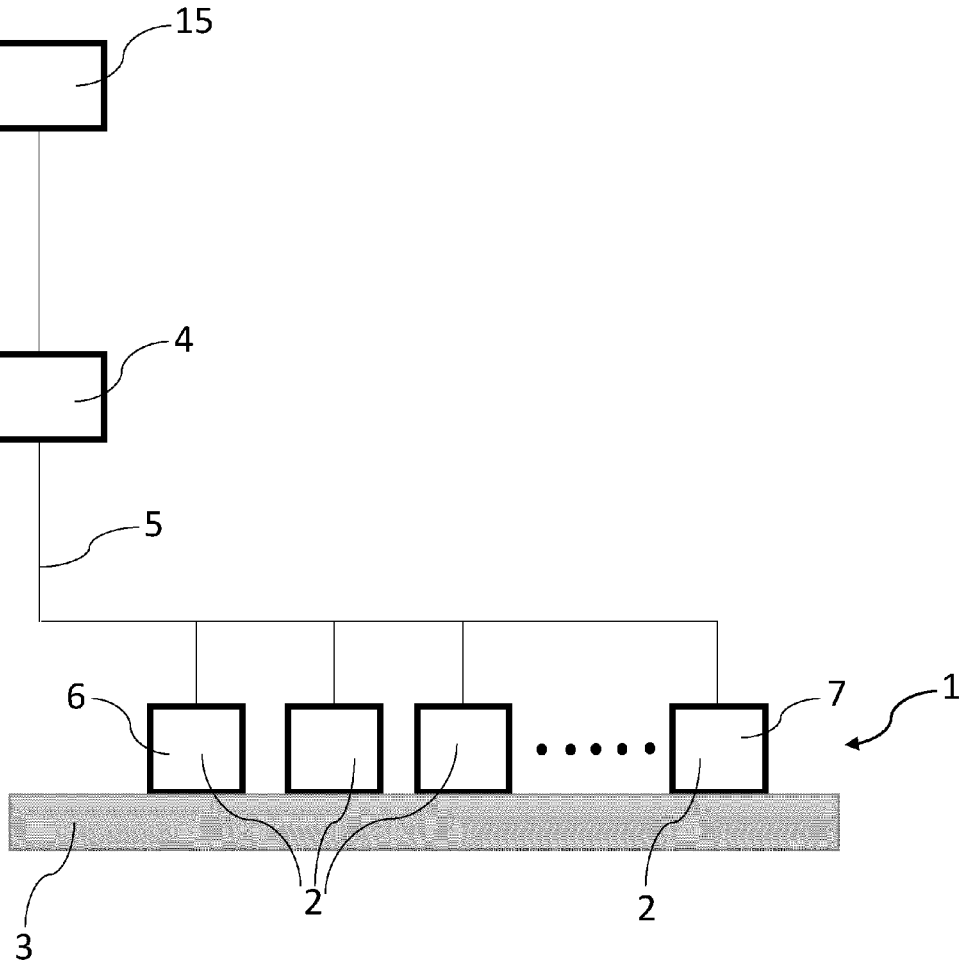
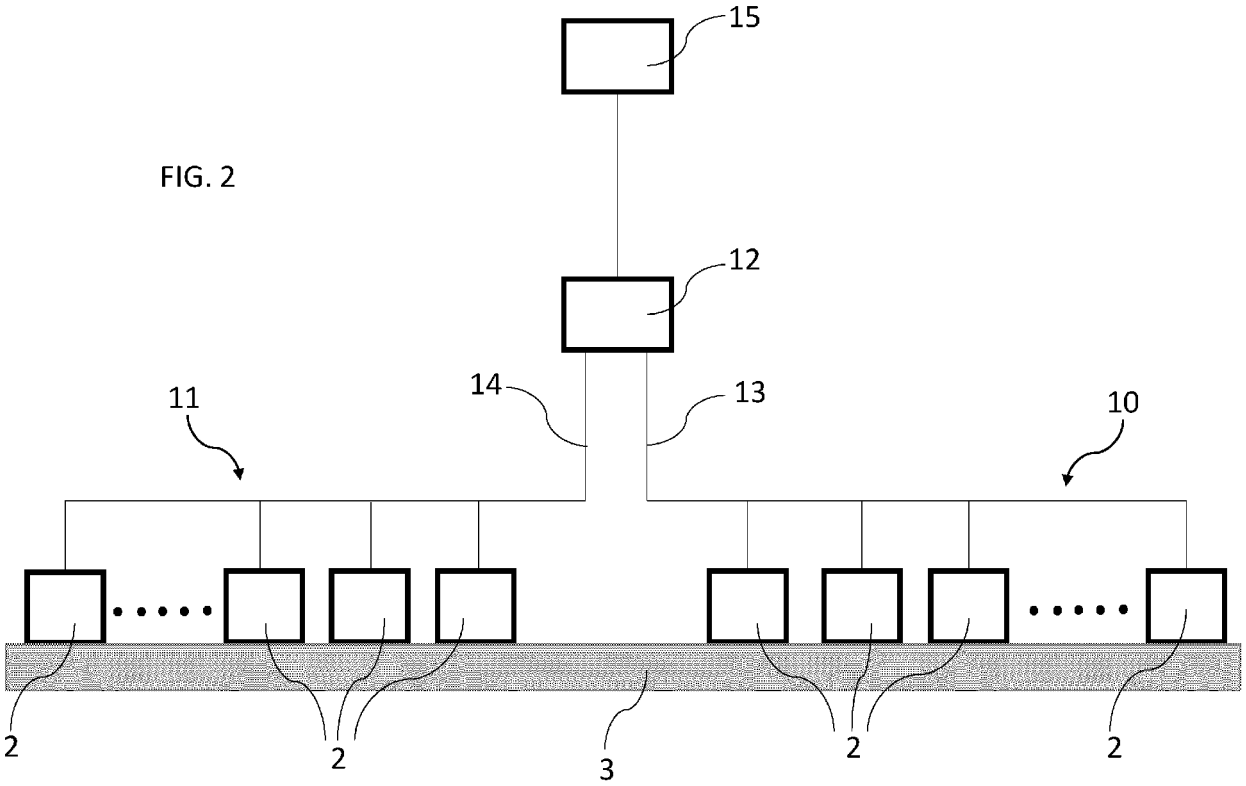


FIG. 2



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EUROPEAN SEARCH REPORT

Application Number
EP 19 19 9010

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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