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(54) Method and control system for power consumption control of electromechanical locks

(57) A method for controlling the power consumption of an electromechanical lock is presented herein. The method increases reliability in a security system comprising an access system and one or more electromechanical lock installations. The method comprises the steps of: a) obtaining the supply voltage level of the electromechanical lock, b) comparing the supply voltage level with a lower threshold supply voltage level and, if the supply voltage level is below the threshold supply voltage level, c) adjusting the current of the electromechanical lock such that the supply voltage level is raised at least to the threshold supply voltage level. In addition, a control system for controlling the power consumption of an electromechanical lock is presented.

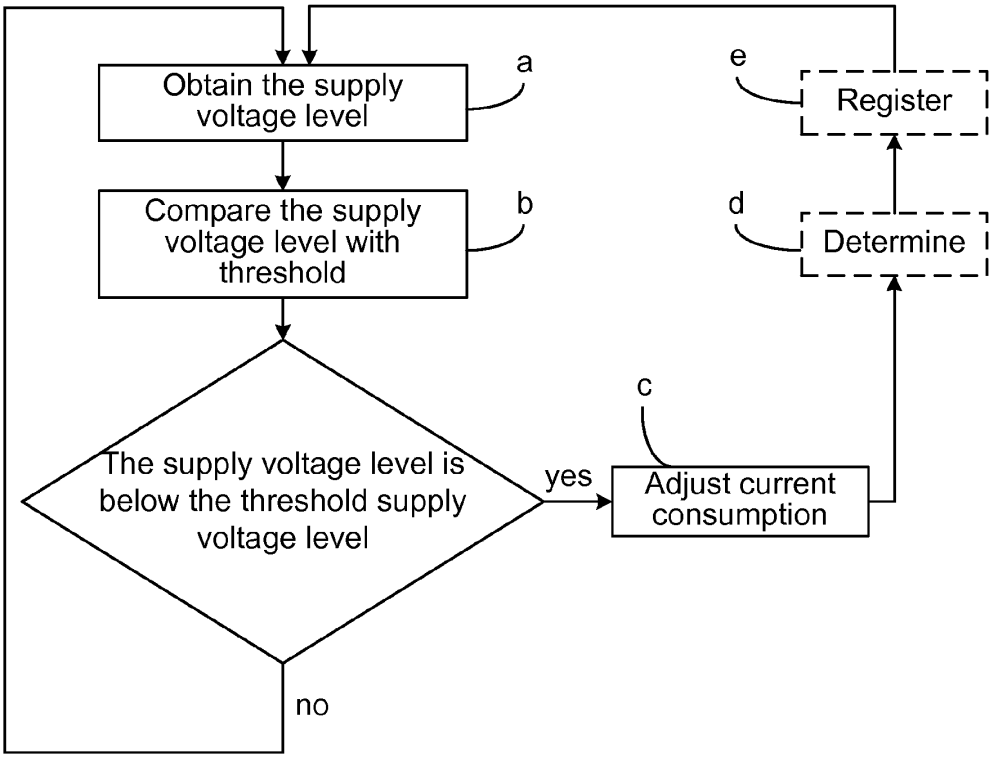

Fig. 2

EP 2 775 459 A2

Description

TECHNICAL FIELD

[0001] The present inventive concept relates in general to security systems in a property and, in particular, to a method and a control system for controlling the power consumption of electromechanical locks in a security system.

BACKGROUND

[0002] A security system in a property is made up of a few typical sub-systems, namely an access system or access control system, alarm system and one or more electromechanical lock installations. Of these, the access system and the lock installation are often electrically connected, both with respect to control and with respect to power supply. The single largest power consuming apparatus is the electromechanical lock. The power consumption over time is negligible, but, during operation, a lot of power is momentarily required. User demands for stronger and more rapidly operated electromechanical locks are resulting in an ever increasing power load upon the security system, which in the worst case leads to breakdowns in the security system.

[0003] A security system is dimensioned to handle normal disruptions of the electricity network, power failures, and is therefore equipped with reserve power/battery back-up. In order to obtain good capacity and economy in the reserve power, it is often centralized into one per floor or per building, depending on the number of doors and the distances between the doors. This means that the cabling can be extensive and thus costly, since it is necessary to dimension for maximum simultaneous power take-off.

[0004] There is a driving force to make use of common cable networks in a property. It is commonplace, for example, for different parts of the access system to communicate via the existing data traffic network. To this must be added the possibility of also now supplying power to units via the network, so-called "Power over Ethernet" (POE).

[0005] POE exists in different variations, in which the difference is the amount of power with which they can supply the connected unit. There are limits, which must be added to the effects of voltage drops in long cabling.

[0006] When an electromechanical lock is to be operated, it is desirable to run the lock at full strength and speed. A known method for trying to achieve this, including in situations with varying supply voltage level, is to adapt the current in the motor of the electromechanical lock with the aid of pulse width modulation (PWM) of the supply voltage, in order thus to provide a correct current in the motor so that the lock will be able to be run at full strength and speed irrespective of the supply voltage level. This solution increases the current in the motor when the voltage diminishes, which aggravates the situation; the power available from the power supply is insufficient to maintain the voltage level. This affects not only the lock installation in question, but also other electrical/electronic equipment in that part of the security system which has common power supply.

SUMMARY

[0007] In the light of that which has been stated above, a general object of the present invention is to provide a method and control system which increases reliability in a security system comprising an access system and one or more electromechanical lock installations.

[0008] Thus, according to a first aspect of the inventive concept, a method of controlling the power consumption of an electromechanical lock is provided, wherein the method comprises the steps of:

a) obtaining the supply voltage level of the electromechanical lock,

b) comparing the supply voltage level with a lower threshold supply voltage level and, if the supply voltage level is below the threshold supply voltage level,

c) adjusting the power consumption of the electromechanical lock such that the supply voltage level is raised at least to the threshold supply voltage level.

[0009] By maintaining the power consumption at such a level that the supply voltage level does not fall below the lower threshold supply voltage level, the power consumption can be controlled in a controlled manner so that no more power than is available is drawn from the power supply system. The reliability of both the electromechanical lock and other electrical/electronic equipment, such as other electromechanical locks, in an power system can thus be improved.

[0010] According to one embodiment, step a) comprises measuring the supply voltage level.

[0011] According to one embodiment, steps a) to c) are performed continuously. The method therefore provides real-time control of the power supply to the electromechanical lock.

[0012] According to one embodiment, the adjustment of the power consumption in step c) comprises adjusting the current to the electromechanical lock.

[0013] According to one embodiment, step d) comprises determining whether the current adjusted in step c) is sufficient to run the electromechanical lock at full strength and speed.

[0014] According to one embodiment, step d) comprises determining how much more current, in relation to the adjusted power consumption, is required to run the electromechanical lock at full strength and speed.

[0015] According to one embodiment, step e) comprises registering the determination in step d).

[0016] According to a second aspect of the present

inventive concept, a computer program, comprising computer-executable components which, upon execution in a processor, performs the method according to the first aspect presented herein, is provided. Such a computer program or software can be stored on a computer-readable medium, such as a semi-conductor memory, a disk memory or the like.

[0017] According to a third aspect of the present inventive concept, a computer program product, comprising a computer-readable medium which comprises a computer program according to the second aspect presented herein, is provided.

[0018] According to a fourth aspect of the present inventive concept, a control system for controlling the power consumption of an electromechanical lock is provided, wherein the control system comprises: a sensor arranged to measure the supply voltage level for an electromechanical lock, a processor arranged to compare the supply voltage level measured by the sensor with a lower threshold supply voltage level and, if the supply voltage level is below the threshold supply voltage level, to adjust the power consumption of the electromechanical lock such that the supply voltage level is raised at least to the threshold supply voltage level.

[0019] According to one embodiment, the processor is arranged to adjust the current to the electromechanical lock.

[0020] According to one embodiment, the processor is arranged to determine whether the adjusted current is sufficient to run the electromechanical lock at full strength and speed.

[0021] According to one embodiment, the processor is arranged to determine how much more current, in relation to the adjusted power consumption, is required to run the electromechanical lock at full strength and speed.

[0022] According to one embodiment, the processor is arranged to register the determination of the extent to which the adjusted current is sufficient to run the electromechanical lock at full strength and power.

[0023] According to one embodiment, the processor is arranged to register the determination of how much more current, in relation to the adjusted power consumption, is required to run the electromechanical lock at full strength and speed.

[0024] According to a fifth aspect of the present inventive concept there is provided a security system comprising: at least one access control unit, at least one electromechanical lock in electrical connection with the access system, and a control system according to the fourth aspect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] Illustrative embodiments of the inventive concept will be described in detail below with reference to the figures, of which:

Figures 1a-b show schematic block diagrams of examples of a control system for controlling the current of an electromechanical lock;

Figure 2 shows a flowchart of a method for controlling the power consumption of an electromechanical lock;

Fig. 3 shows an example of an access control system with which the control system in Figure 1 can be used.

DETAILED DESCRIPTION

[0026] A security system can comprise an access system, i.e. an access control system, and one or more electromechanical locks. The access system and the one or more electromechanical locks can be electrically connected, both with respect to control and with respect to power supply. Herein an electromechanical lock comprises parts having both mechanical and electrical functions. The operation of the mechanical parts is realized via electrical power. Electromechanical locks or electromechanical lock installations thus have a motor which, via conversion of electrical power into mechanical power, can operate the mechanical parts of the electromechanical lock.

[0027] An electromechanical lock, or equally an electromechanical lock installation, is herein defined as an electromechanical system comprising a lock housing having mechanical components, such as a rower and a locking bolt, arranged to conduct operation of the lock, and an electric motor arranged to drive the mechanical components, so that the locking bolt shall be able to be manoeuvred between a state in which the lock is bolted and a state in which the lock is unbolted, and vice versa.

[0028] A control system for controlling the power consumption of an electromechanical lock in a security system shall be described below with reference to Figs 1a and 1b. By a security system is meant a system comprising at least one electromechanical lock and an access system in electrical connection with the said at least one electromechanical lock.

[0029] Fig. 1a shows an example of a realization of a control system for controlling the power consumption of an electromechanical lock in a security system. The control system 1-1 comprises one or more sensors 3 arranged to measure an electrical parameter, such as the supply voltage level, for a respective electromechanical lock. For example, the supply voltage level to the motor of the electromechanical lock, which motor drives the locking mechanism of the electromechanical lock, is measured by a sensor 3.

[0030] The control system 1-1 further comprises a processor 5, to which one or more sensors 3 can be coupled. The processor 5 can be coupled to a computer-readable medium, here exemplified by a memory 7. The processor 5 is arranged to compare a supply voltage level which is measured by the sensor 3 with a lower threshold

supply voltage level. The lower threshold supply voltage level can be stored, for example, in the memory 7 and be retrieved from there for comparison with the supply voltage level measured by the sensor 3.

[0031] If it is shown in the comparison that the supply voltage level is below the threshold supply voltage level, then the processor 5 is arranged to adjust the power consumption of the electromechanical lock such that the supply voltage level is raised at least to the threshold supply voltage level. The processor 7 thus provides control signals to a power source for control thereof based on the difference between the measured supply voltage level and the lower threshold supply voltage level if the measured supply voltage level is below the lower threshold supply voltage level.

[0032] In this manner, the control system can ensure that, even if the power which the power source supplies to the electromechanical lock is not always sufficient to run it at full strength and power, there are sufficient resources to drive the security system in a stable and reliable manner on all occasions.

[0033] The memory 7 can be integrated in the processor or, alternatively, be a component separate from the processor. Likewise, the sensor and the processor can be arranged in the same unit, or else the sensor and the processor can be physically separate units for distributed placement in a security system, as shown schematically in Fig. 1b.

[0034] According to one variation of the inventive concept, the lower threshold supply voltage level can be related to the overall available power output in access systems and electromechanical locks in a security system.

[0035] According to another variation, the lower threshold supply voltage level can be the momentary available power output in access systems and electromechanical lock installations in a security system. According to this variation, the lower threshold supply voltage level can be dynamic, that is to say can alter, depending on how much power is momentarily deemed to be available from the power supply of the security system.

[0036] According to one variation of the inventive concept, the lower threshold supply voltage level is the same for each electromechanical lock in the security system.

[0037] With reference to Fig. 2, the method of controlling the power consumption of an electromechanical lock is described. In a step a), the supply voltage level of the electromechanical lock is obtained by the processor 5. The supply voltage level can be obtained by the processor 5 from a sensor 3, for example, which is arranged to measure the supply voltage level of the electromechanical lock.

[0038] In a step b), the processor 5 compares the obtained supply voltage level with a lower threshold supply voltage level. If the supply voltage level is below the threshold supply voltage level, in a step c) the power consumption of the electromechanical lock is adjusted such that the supply voltage level is raised at least to the threshold supply voltage level. According to one variation, step c) for adjusting the power consumption can comprise adjusting the current to the electromagnetic lock. The current level can be adjusted, for example, by means of pulse width modulation (PWM).

[0039] Steps a) of obtaining and b) of comparing are performed continuously, wherein real-time control of the power consumption of the electromagnetic lock is enabled. A security system which is reliable and stable at all times can hence be realized.

[0040] One variation of the inventive concept comprises a further step d) of determining whether the power consumption adjusted in step c) is sufficient to run the electromechanical lock at full strength and speed. This can be done, for example, by a comparison in the processor 5 between a lowest power, which is a reference power, stored in the memory 7, at which the electromagnetic lock is run at full strength and speed, and the power which is provided by the adjusted power consumption. This power can be determined, for example, by means of a sensor 3, via measurement of supply voltage level and current feed level to the electromagnetic lock. Alternatively, the sensor 3 can measure the supply voltage level and another sensor can measure the current.

[0041] According to one variation, step d) also comprises determining how much more power consumption, in relation to the adjusted power consumption, is required to run the electromagnetic lock at full strength and speed. This can be determined, for example, by the measure between the difference in the magnitude of the power produced by means of the adjusted power consumption and the magnitude of the reference power.

[0042] One variation of the inventive concept further comprises step e) of registering the determination in step d) of whether the power consumption adjusted in step c) is sufficient to run the electromagnetic lock at full strength and speed, and/or the determination of how much more power consumption is required in relation to the adjusted power consumption.

[0043] As a result of the registration or registrations in step e), diagnostics can be performed with respect to the extent to which the available power is insufficient to run the electromagnetic lock at full strength and power. This information can be stored in the memory 5 and made available to, for example, service personnel who have to look at and attend to the security system in which the electromechanical lock is installed and which is unable to deliver full performance.

[0044] According to one variation of the inventive concept, the abovementioned diagnostic function can directly raise an alarm if the momentary available power is insufficient to ensure full function, that is to say full strength and speed, in the electromechanical lock.

[0045] Fig. 3 shows a simplified block diagram of an example of a security system 9. The security system 9 comprises a first sub-system 9-1, a second sub-system 9-2, and a central computer C, which administers the security system 9. Each of the first sub-system 9-1 and the second sub-system 9-2 comprises a plurality of doors

D, electromechanical locks 11, sensors 3 associated with a respective electromechanical lock 11, and access control units 13, which constitute parts of an access system. The access control units 13 can comprise, for example, access card readers or biometric identification units. In addition, the security system 9 comprises a plurality of controllers R comprising a respective processor 5, and one or more power sources intended to supply power to the electromechanical locks 11 and the access system. According to the example, a control system comprises at least one controller R, comprising a processor 5 and a plurality of sensors 3. The control system could also comprise the central computer C to which the controllers R are connected.

[0046] According to the example, each sensor 3 measures the supply voltage level in the respective electromechanical lock 11 and delivers the measurement results in the form of analog or digital signals to the controller R which is associated with the sensor 3 in question. As has earlier been described in more detail, the processor 5 compares the measured supply voltage level with a lower threshold supply voltage level. The processor 5 adjusts, via the controller R, the power consumption of the electromechanical lock or locks 11, the sensor 3 or sensors 3 of which have measured supply voltage levels which are below the lower threshold supply voltage level, such that the supply voltage level is raised at least to the lower threshold supply voltage level.

[0047] According to one variation, for which registration is made of whether the current adjusted in step c) is sufficient to run the electromagnetic lock at full strength and speed, and/or of the determination of how much more current is required in relation to the adjusted power consumption, this information can be forwarded and stored in the central computer C.

[0048] Many different security system topologies are possible, of which only one example has been shown in Fig. 3. For example, according to one variation of the inventive concept, the processor can be arranged in the central computer and, according to another variation, each electromagnetic lock can be associated with a controller which is not shared with any other electromechanical lock.

[0049] The control system which has been described herein is suitable, for example, for installation in a security system such as a security system in a property and might be used with electromechanical locks both indoors and outdoors.

[0050] Above, illustrative embodiments of the inventive concept have been described. The inventive concept is not limited to these embodiments but can be freely varied within the scope of the following claims.

Claims

1. A method of controlling the power consumption of an electromechanical lock (11), wherein the method comprises the steps of:

   a) obtaining the supply voltage level of the electromechanical lock (11),
   b) comparing the supply voltage level with a lower threshold supply voltage level and, if the supply voltage level is below the threshold supply voltage level,
   c) adjusting the power consumption of the electromechanical lock (11) such that the supply voltage level is raised at least to the threshold supply voltage level.

2. The method according to claim 1, wherein step a) comprises measuring the supply voltage level.

3. The method according to claim 1 or 2, wherein steps a) to c) are performed continuously.

4. The method according to any one of the preceding claims, wherein the adjustment of the power consumption in step c) comprises adjusting the current to the electromechanical lock.

5. The method according to any one of the preceding claims, comprising step d) of determining whether the power consumption adjusted in step c) is sufficient to run the electromechanical lock (11) at full strength and speed.

6. The method according to claim 5, wherein step d) comprises determining how much more current, in relation to the adjusted power consumption, is required to run the electromechanical lock at full strength and speed.

7. The method according to claim 5 or 6, comprising step e) of registering the determination in step d).

8. A computer program comprising computer-executable components which, upon execution in a processor, implement the method according any one of claims 1-7.

9. A computer program product comprising a computer-readable medium which comprises a computer program according to claim 8.

10. A control system (1-1; 1-2) for controlling the power consumption of an electromechanical lock (11), wherein the control system (1-1; 1-2) comprises:

    a sensor (3) arranged to measure the supply voltage level for an electromechanical lock (11),
    a processor (5) arranged to compare the supply voltage level measured by the sensor (3) with a lower threshold supply voltage level and, if the supply voltage level is below the threshold sup-

ply voltage level, to adjust the power consumption of the electromechanical lock (11) such that the supply voltage level is raised at least to the threshold supply voltage level.

11. The control system (1-1; 1-2) according to claim 10, wherein the processor (5) is arranged to adjust the current to the electromechanical lock (11).

12. The control system (1-1; 1-2) according to claim 10 or 11, wherein the processor (5) is arranged to determine whether the adjusted power consumption is sufficient to run the electromechanical lock (11) at full strength and speed.

13. The control system (1-1; 1-2) according to any one of claims 10-12, wherein the processor (5) is arranged to determine how much more current, in relation to the adjusted power consumption, is required to run the electromechanical lock (11) at full strength and speed.

14. The control system (1-1; 1-2) according to claim 12 or 13, wherein the processor (5) is arranged to register the determination of the extent to which the adjusted current is sufficient to run the electromechanical lock (11) at full strength and power.

15. The control system (1-1; 1-2) according to any one of claims 12-14, wherein the processor (5) is arranged to register the determination of how much more current, in relation to the adjusted power consumption, is required to run the electromechanical lock at full strength and speed.

16. A security system (9) comprising:

at least one access control unit (13),
at least one electromechanical lock (11) in electrical connection with the access system, and
a control system (1-1; 1-2) according to any one of claims 10-15.

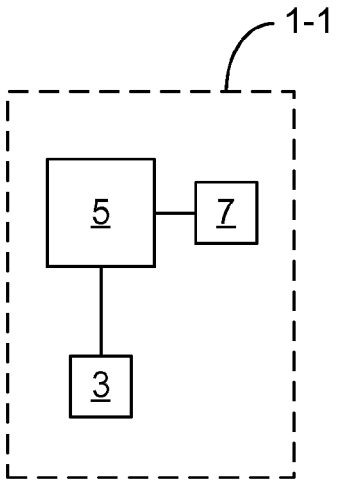

Fig. 1a

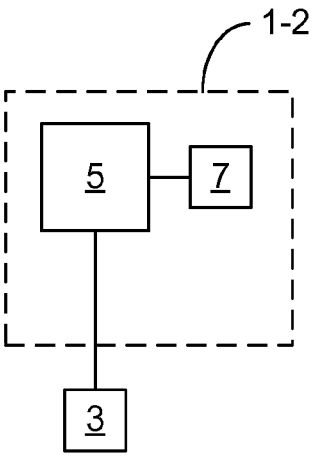

Fig. 1b

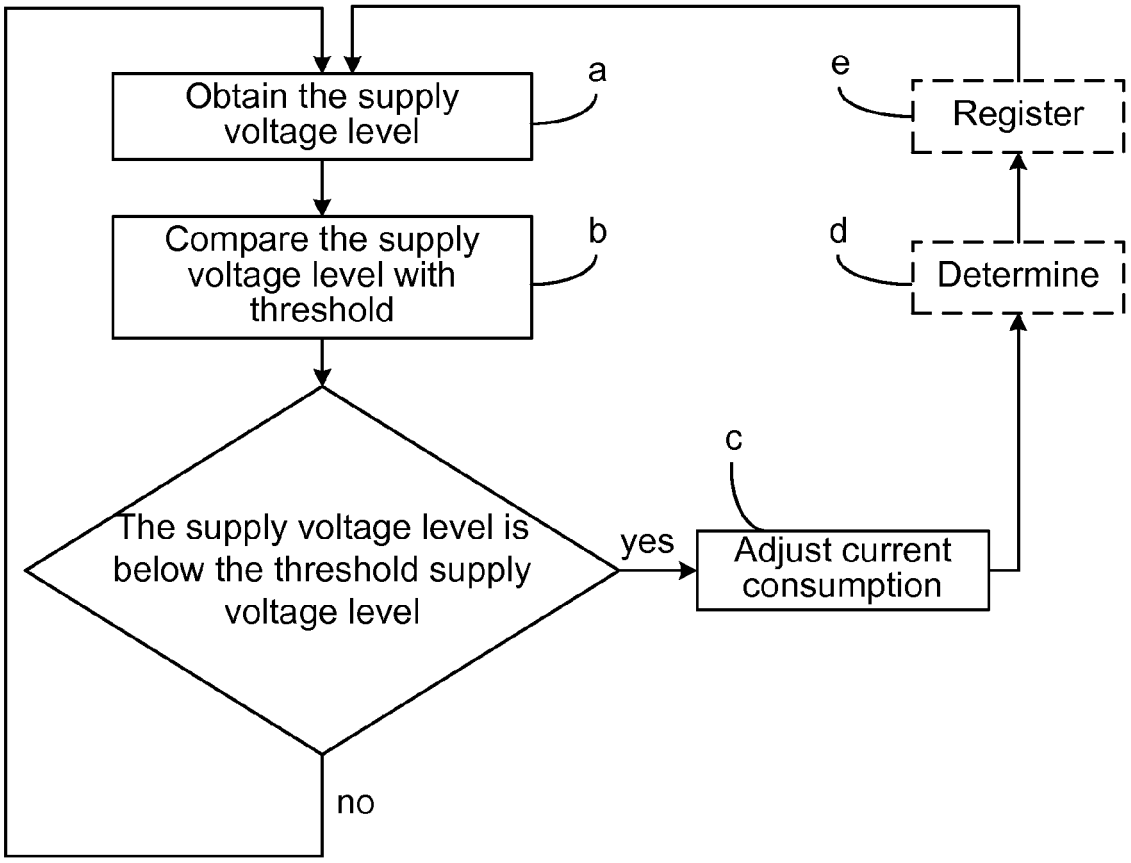

Fig. 2

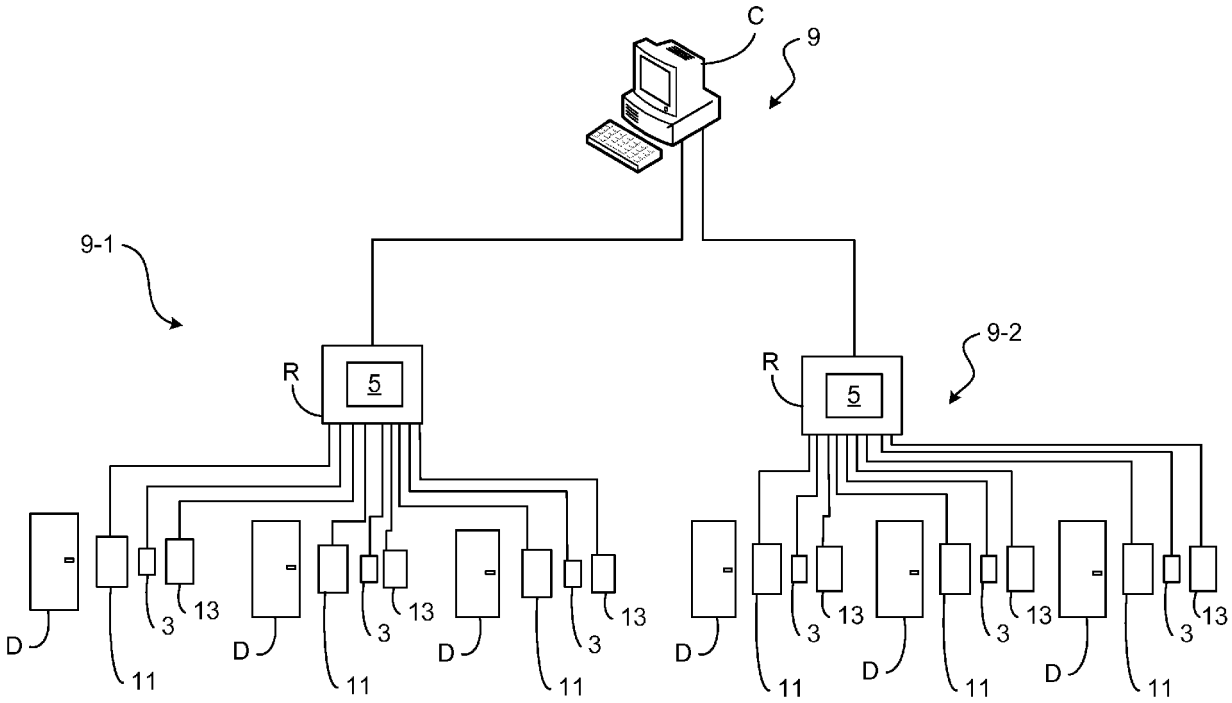
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Fig. 3