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(54) **CONDITIONAL EXPRESSION-BASED ALARM-SOUNDING METHOD AND APPARATUS FOR RAILWAY MONITORING SYSTEM**

(57) The present disclosure relates to an alarming method and apparatus for a railway monitoring system based on conditional expressions, the method including: normalizing a monitoring value, and acquiring a device configuration file; forming an alarm conditional expression and a restoration conditional expression according to the device configuration file, and inputting the same into an alarm configuration file; loading the alarm configuration file into a railway monitoring system, and checking whether an alarm condition is satisfied; if the alarm condition is satisfied, exhibiting an alarm in a monitoring system; then checking whether alarm exhibition satisfies a restoration condition; if the restoration condition is satisfied, cancelling alarm exhibition in the monitoring system. The method and the apparatus may solve more and more software branch problems caused by continuous differentiation of intelligent analysis alarms in respective regions, and implement software unification.

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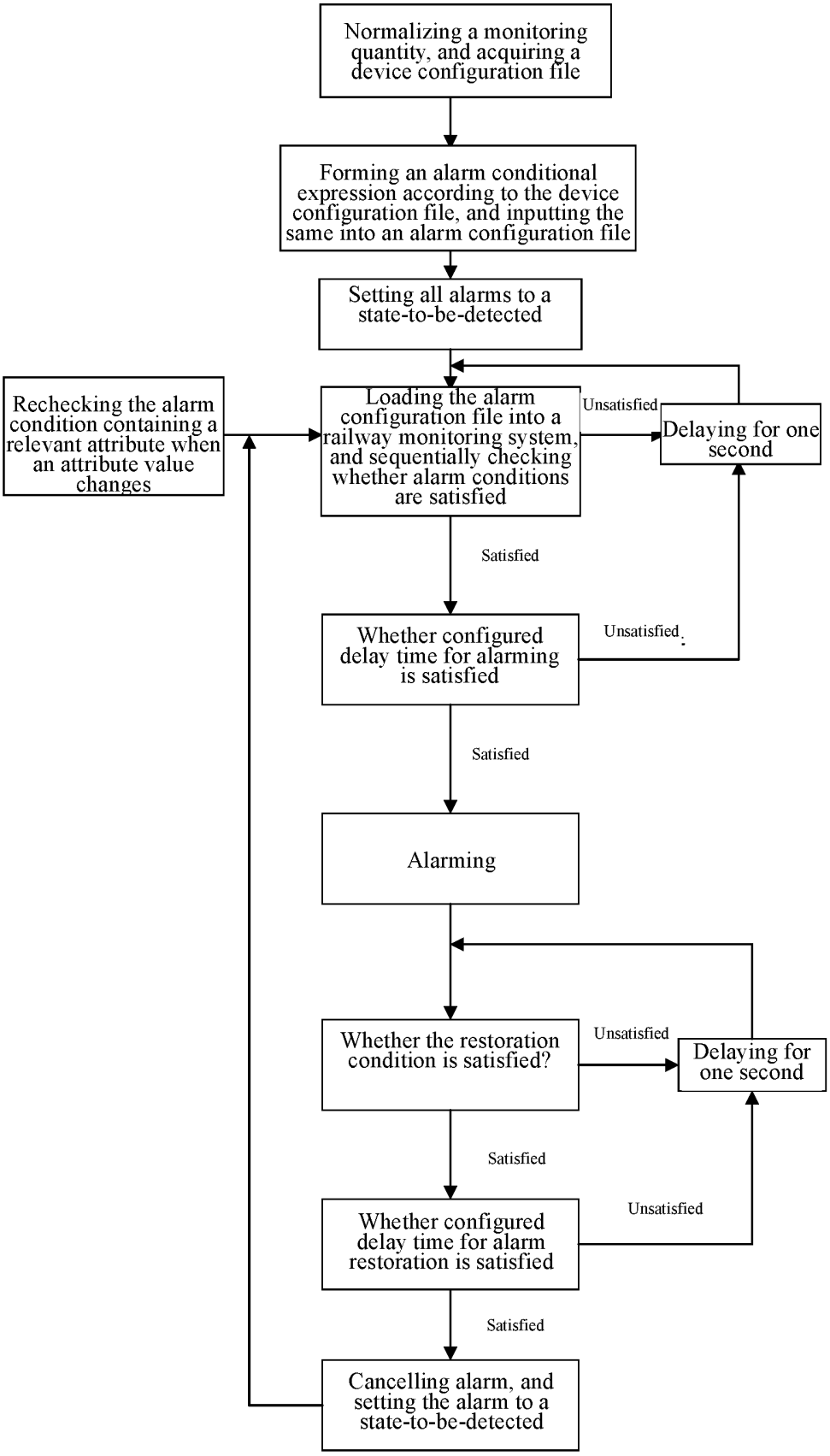
Normalizing a monitoring quantity, and acquiring a device configuration file
Forming an alarm conditional expression according to the device configuration file, and inputting the same into an alarm configuration file
Setting all alarms to a state-to-be-detected
Rechecking the alarm condition containing a relevant attribute when an attribute value changes
Loading the alarm configuration file into a railway monitoring system, and sequentially checking whether alarm conditions are satisfied
Unsatisfied
Delaying for one second
Satisfied
Whether configured delay time for alarming is satisfied
Unsatisfied
Satisfied
Alarming
Whether the restoration condition is satisfied?
Unsatisfied
Delaying for one second
Satisfied
Whether configured delay time for alarm restoration is satisfied
Unsatisfied
Satisfied
Cancelling alarm, and setting the alarm to a state-to-be-detected

FIG. 1

Description

TECHNICAL FIELD

[0001] The present disclosure belongs to a field of railway signal technologies and railway signal centralized monitoring system technologies, and more particularly, relates to an alarming method and apparatus for a railway monitoring system based on conditional expressions.

BACKGROUND

[0002] With development of the railway industry, the number of railway lines continues to increase, more and more various devices are used to ensure safety of railway operations, and more and more data indicators requires attention from on-site operators. Therefore, requirements for intellectualization of centralized monitoring of railway signals are becoming more and more urgent. In order to implement intellectualization, respective railway bureaus have introduced relevant technical conditions. Each railway bureau will issue intelligent analysis alarm technical files suitable for the railway bureau itself according to its own intelligence needs and understanding of various indicators. Electric affair departments and electric affair sections of the respective railway bureaus will further refine and supplement the technical files according to their own jurisdictions, resulting in different intelligent analysis alarms in respective regions.

[0003] A conventional mode is compiling a plurality of software branches according to intelligent analysis alarm needs of respective regions; a disadvantage of such mode is that a plurality of branches will be generated, so continuous maintenance of these branches is needed, which is time-consuming, labor-intensive, and prone to confusion. When there are commonality problems in software, the plurality of software branches also need to be modified, resulting in heavy workload. Meanwhile, in the conventional method, since alarm logic of intelligent analysis alarms is all in the software, it is difficult to find errors therein, which is not favorable for maintenance.

SUMMARY

[0004] With respect to the above-described problems, the present disclosure provides an alarming method for a railway monitoring system based on conditional expressions, which includes:

[0005] Normalizing a monitoring value, and acquiring a device configuration file;

[0006] Forming an alarm conditional expression and a restoration conditional expression according to the device configuration file, and inputting the alarm conditional expression and the restoration conditional expression into an alarm configuration file;

[0007] Loading the alarm configuration file into a railway monitoring system, and checking whether an alarm condition is satisfied;

[0008] If the alarm condition is satisfied, exhibiting an alarm in the monitoring system; then checking whether alarm exhibition satisfies a restoration condition; if the restoration condition is satisfied, cancelling alarm exhibition in the monitoring system.

[0009] Further, the monitoring value includes a monitoring value self-collected by the monitoring system and all monitoring values received by system interfaces corresponding to respective device types.

[0010] Further, the normalizing includes classifying the monitoring values displayed in the monitoring system; the monitoring values are classified according to a first level, a second level, and a third level; the first level is device type; the second level is device; the third level is attribute.

[0011] Further, the device type includes frequency-shift track circuit, 25 Hz track circuit, turnout, signal, external power grid, switch machine, interlock, train control, axle counter, and air conditioner; the device is defined as respective specific devices under the device type; the attribute is defined as a collection quantity contained under each device, the collection quantity is a switch quantity or an analog quantity, the switch quantity is a quantity having a finite number of states; and the analog quantity represents a quantity having a continuous value.

[0012] Further, the alarm conditional expression contains one or more of analog quantity, switch quantity and historical alarm.

[0013] Further, the checking the alarm condition includes: rechecking the alarm condition containing an attribute when an attribute value changes.

[0014] Further, if the alarm condition is not satisfied, delaying for a certain period of time, and returning to recheck whether the alarm condition is satisfied.

[0015] Further, the checking whether an alarm condition is satisfied includes checking whether the alarm condition is continuously satisfied within configured delay time. If the alarm condition is continuously satisfied within the configured time, exhibiting an alarm in the monitoring system; if the alarm condition is not satisfied within the configured time, then returning to recheck whether the alarm condition is satisfied.

[0016] Further, if the restoration condition is not satisfied, delaying for a certain period of time, and returning to recheck whether the restoration condition is satisfied.

[0017] Further, the checking whether alarm exhibition satisfies the restoration condition includes checking whether the restoration condition is continuously satisfied within the configured delay time. The checking whether the restoration condition is continuously satisfied within the configured delay time includes: judging, after starting alarm exhibition in the monitoring system, whether the restoration condition is continuously satisfied within the configured delay time; if the restoration condition is satisfied within the configured delay time, then cancelling alarm exhibition in the monitoring system and returning to recheck whether the alarm condition is satisfied; if the restoration condition is not satisfied within the configured delay time, then returning to recheck whether the restoration condition is satisfied within the configured delay time.

[0018] The present disclosure further provides an alarming apparatus for a railway monitoring system based on conditional expressions, the alarming apparatus including modules below:

[0019] A normalization processing module: configured to normalize a monitoring value, and acquire a device configuration file;

[0020] An alarm conditional expression generating module: configured to form an alarm conditional expression and a restoration conditional expression according to the device configuration file, and input the alarm conditional expression and the restoration conditional expression into an alarm configuration file;

[0021] An alarm operating module: configured to load the alarm configuration file into a monitoring system, and sequentially check whether an alarm condition and a restoration condition are satisfied;

[0022] An alarm processing module: configured to exhibit an alarm in the monitoring system based on an operation result of the alarm operating module; and cancel alarm exhibition in the monitoring system when alarm exhibition satisfies the restoration condition.

[0023] Further, the normalization processing module is configured to process a monitoring value self-collected by the monitoring system and all monitoring values received by system interfaces corresponding to respective device types.

[0024] Further, the alarm conditional expression generating module is configured to form an alarm conditional expression containing one or more of analog quantity, switch quantity and historical alarm according to the configuration file.

[0025] Further, the alarm operating module is configured to check the alarm condition including an attribute when an attribute value changes.

[0026] Further, the alarm processing module is further configured to process whether the alarm condition is continuously satisfied within configured delay time; and whether the restoration condition is continuously satisfied within the configured delay time.

[0027] The present disclosure further provides a computer-readable storage medium; the computer-readable storage medium has a computer program stored therein; and when executed by a processor in a monitoring system, the computer program implements the steps of the above-described railway monitoring system alarming method based on conditional expressions.

[0028] The railway monitoring system alarming method and apparatus based on conditional expressions according to the present disclosure may solve more and more software branch problems caused by continuous differentiation of intelligent analysis alarms in respective regions, and implement software unification. Meanwhile, software may be streamlined; in the software, there is no analysis logic of intelligent analysis alarms, but only a simple framework is provided, and all the analysis logic of intelligent analysis alarms is placed in a configuration file with clear logic, which is convenient for on-site maintenance personnel to view intelligent analysis alarm logic and correct errors in time. With respect to newly added on-site intelligent analysis alarm needs, it is only necessary to modify the configuration file to implement a variety of intelligent analysis alarms.

[0029] Other features and advantages of the present disclosure will be further explained in the following description, and partly become self-evident therefrom, or be understood through implementation of the present disclosure. The objectives and other advantages of the present disclosure will be achieved through the structure specifically pointed out in the description, claims, and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] In order to clearly illustrate the technical solution of the embodiments of the present disclosure or in the prior art, the drawings that need to be used in description of the embodiments or the prior art will be briefly described in the following; it is obvious that the described drawings are only related to some embodiments of the present disclosure; based on the drawings, those ordinarily skilled in the art can acquire other drawings, without any inventive work.

FIG. 1 shows a flow chart of an alarming method for a railway monitoring system based on conditional expressions according to an embodiment of the present disclosure;

FIG. 2 shows a schematic diagram of an alarming apparatus for a railway monitoring system based on conditional

expressions according to an embodiment of the present disclosure; and
FIG. 3 shows a structural schematic diagram of a railway monitoring system based on conditional expressions according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0031] In order to make objectives, technical details and advantages of the embodiments of the present disclosure apparent, the technical solutions of the embodiment will be described in a clearly and fully understandable way in connection with the drawings related to the embodiments of the present disclosure. It is obvious that the described embodiments are just a part but not all of the embodiments of the present disclosure. Based on the described embodiments herein, those ordinarily skilled in the art can acquire other embodiment(s), without any inventive work, which should be within the scope of the present disclosure.

[0032] Monitoring values of railway signal devices are diverse; the monitoring values include monitoring values self-collected by the monitoring system and all monitoring values received by system interfaces corresponding to respective device types, which may basically be classified into switch quantities and analog quantities. A specific manifestation form of the switch quantity is real-time value of the switch quantity, change moment, change sequence or the number of changes. The switch quantity is a quantity having a finite number of states, and different states are usually denoted by numbers 0, 1, 2...n. For example, with respect to a track on a railway, states thereof include occupied by vehicle, idle without vehicle, uncollected, etc.; the occupied-by-vehicle state may be denoted by 0, the idle-without-vehicle state may be denoted by 1, and the uncollected state may be denoted by 3. An analog quantity is a quantity having a continuous value, for example, a voltage of a power supply screen, a track current, etc., and a specific manifestation form thereof is real-time value, average value, maximum value or minimum value.

[0033] Regardless of whether the switch quantity or the analog quantity, they may be collectively classified as an attribute, and the attribute is a numerical value. And each attribute belongs to one or several devices; and each device belongs to devices of one or several device types. According to systems to which the devices belong, the devices may be classified into different device types. For example, a device type of 25 Hz track contains many devices, for example, IG, IIG, 1705G, etc. And each device contains various attributes, for example, track occupancy state, track voltage, track circuit, etc. In use, it may be flexibly configured according to needs, and it is not fixed and unique. Thus, all the monitoring values displayed in the railway monitoring system may finally each come down to a certain attribute in a certain device in a certain device type, that is, classified according to the first level as device type, the second level as device and the third level as attribute, and these classified monitoring values are normalized; wherein, the device type includes, but not is limited to, frequency-shift track circuit, 25 Hz track circuit, turnout, signal, external power grid, switch machine and air conditioner; the device is defined as respective specific devices under the device type; the attribute is defined as a collection quantity contained under each device (specifically including a switch quantity or an analog quantity), and has a numerical value as a manifestation form thereof.

[0034] Through the above-described process of normalizing the monitoring values, various seemingly irrelevant data are integrated, so that the program in the centralized monitoring system does not need to care about a specific meaning of each collection quantity; regardless of whether each collection quantity is a switch quantity or an analog quantity, it may be classified as a certain attribute in a certain device of a certain device type. Therefore, in a subsequent use process, the operator may directly perform operations on attributes, such as taking value, taking change time, and taking upper and lower limits, etc., without worrying about whether the attribute is a switch quantity or an analog quantity, which lays a foundation for unification of the program.

[0035] According to a first aspect of the embodiment of the present disclosure, there is provided an alarming method for a railway monitoring system based on conditional expressions. Referring to FIG. 1, the method includes:

[0036] Normalizing a monitoring value, and acquiring a device configuration file;

[0037] Forming an alarm conditional expression and a restoration conditional expression according to the device configuration file, and inputting the same into an alarm configuration file;

[0038] Loading the alarm configuration file into a railway monitoring system, and checking whether an alarm condition is satisfied;

[0039] If the alarm condition is satisfied, exhibiting an alarm in a monitoring system; then checking whether alarm exhibition satisfies a restoration condition; if the restoration condition is satisfied, cancelling alarm exhibition in the monitoring system.

[0040] If the alarm condition is not satisfied, delaying for one second and returning to recheck whether the alarm condition is satisfied.

[0041] The alarm conditional expression contains one or more of analog quantity, switch quantity and historical alarm.

[0042] The checking an alarm condition includes: rechecking the alarm condition containing an attribute when an attribute value changes.

[0043] The checking whether an alarm condition is satisfied includes checking whether the alarm condition is contin-

uously satisfied within configured delay time. If the alarm condition is continuously satisfied within the configured time, exhibiting an alarm in the monitoring system; if the alarm condition is not satisfied within the configured time, delaying for one second, and returning to recheck whether the alarm condition is satisfied.

[0044] If the restoration condition is not satisfied, delaying for one second, and returning to recheck whether the restoration condition is satisfied.

[0045] That the checking whether alarm exhibition satisfies the restoration condition includes checking whether the restoration condition is continuously satisfied within configured delay time, includes: judging, after starting alarm exhibition in the monitoring system, whether the restoration condition is continuously satisfied within the configured delay time; if the restoration condition is satisfied within the configured delay time, then cancelling alarm exhibition in the monitoring system and returning to recheck whether the alarm condition is satisfied; if the restoration condition is not satisfied within the configured delay time, delaying for one second, and returning to recheck whether the restoration condition is satisfied.

[0046] In an embodiment of the present disclosure, configuration file 1 is used to represent devices contained under a device type "25 Hz track circuit" and attributes contained under each device, and to point out a name of a switch quantity or an analog quantity corresponding to each attribute. Contents and the number of attributes under each device may be changed according to actual needs.

[0047] Configuration file 1:

```
DevType name="25Hz track circuit">
<Devs>
<Dev name="3G" >
<Prop name="track state" data="3GH switch quantity"/>
<Prop name="track voltage" data="3G track voltage"/>
</Dev>
<Dev name="IG">
<Prop name="track state" data="IGH switch quantity"/>
<Prop name="track voltage" data="IG track voltage"/>
</Dev>
</DevType>
```

[0048] The device configuration file 1 indicates that the 25 Hz track circuit has two devices 3G and IG, and each device contains two attributes of track state and track voltage.

[0049] According to the configuration file of the above-described 25 Hz track circuit, an alarm conditional expression is designed to implement track voltage analog quantity over-limit alarming, where, a symbol "." is used for separation to ensure clear meaning; each attribute is represented in a three-stage mode "device type. device name. attribute name" to uniquely determine an attribute; "device type. attribute name" is used to indicate that alarm conditions are checked respectively with respect to all devices under the device type.

[0050] The alarm conditional expression is:

[0051] (25 Hz track circuit. track voltage. value > 25 Hz track circuit. track voltage. upper adjustment limit) & (25 Hz track circuit. track state. value = 1)

[0052] Where, "25 Hz track circuit. track voltage" represents the attribute of "track voltage" under each device under the device type of "25 Hz track circuit". The symbol "&" represents an "and" operation.

[0053] The meaning of the alarm conditional expression is "checking each 25 Hz track circuit device, whether the track voltage is greater than an upper adjustment limit and a current track state is 1 (when the attribute is 1, it indicates that there is no vehicle pressing the track)".

[0054] When the above-described alarm conditional expression is loaded into the monitoring system program, it will start to detect each device under the "25 Hz track circuit", and take values for operation according to requirements in the alarm conditional expression; when an operation result is true, give an alarm; and when it is false, give no alarm.

[0055] It should be further noted that, in the present disclosure, when the alarm conditional expression operation result is true, before exhibiting an alarm to the monitoring system, it is necessary to further judge whether the configured delay time for alarming is satisfied, if it is satisfied, give an alarm; if it is not satisfied, delay for one second, and return to recheck the alarm condition.

[0056] After alarm exhibition, it is further judged whether the restoration condition is satisfied, so as to judge whether to cancel the alarm, and the restoration condition is set as:

[0057] (25 Hz track circuit. track voltage <= 25 Hz track circuit. track voltage. upper adjustment limit) & (25 Hz track circuit. track state. value = 1)

[0058] The meaning of the restoration condition is "checking each 25 Hz track circuit device, whether the track voltage is less than or equal to the upper adjustment limit, and the current track state is 1 (when the attribute is 1, it indicates that there is no vehicle pressing the track)".

[0059] At this time, if the track voltage in the 25 Hz track circuit device is less than or equal to the upper adjustment limit, cancel the alarm and return again to check the alarm condition.

[0060] It should be further noted that, in the present disclosure, when the restoration conditional expression operation result is true, before the monitoring system cancels alarm exhibition, it is necessary to further judge whether the configured delay time for alarm restoration is satisfied; if it is satisfied, cancel alarm exhibition; if it is not satisfied, delay for one second and return to recheck the restoration condition.

[0061] If the track voltage in the 25 Hz track circuit device does not satisfy the condition of being less than or equal to the upper adjustment limit, delay for one second and continue to judge whether the restoration condition is satisfied.

[0062] In another embodiment of the present disclosure, configuration file 2 is used to represent devices contained in the device type "external power grid", and attributes contained under each device, and to point out a name of a switch quantity or an analog quantity corresponding to each attribute.

[0063] Configuration file 2:

```
<DevType name="extemal power grid">
<Devs>
<Dev name="line I phase A" id="0">
<Prop name="voltage" datatype="external power grid" data="line-I phase-A voltage" />
<Prop name="current" datatype="external power grid" data="line-I phase-A current" />
<Prop name="frequency" datatype="external power grid" data="line-I phase-A frequency"
/>
<Prop name="active power" datatype="external power grid" data="line-I phase-A active
power" />
<Prop name="reactive power" datatype="external power grid" data="line-I phase-A reactive
power" />
<Prop name="apparent power" datatype="external power grid" data="line-I phase-A
apparent power" />
<Prop name="power factor" datatype=" external power grid" data="line-I phase-A power
factor" />
<Prop name="phase-A voltage" datatype="external power grid" data="line-I phase-A
voltage" visible="0" />
<Prop name="voltage curve" datatype="external power grid instant power outage curve"
data="line-I phase-A voltage curve" />
</Dev>
<Dev name="line-I phase-B" id="1">
<Prop name="voltage" datatype="external power grid" data="line-I phase-B voltage" />
<Prop name="current" datatype="external power grid" data="line-I phase-B current" />
<Prop name="frequency" datatype="external power grid" data="line-I phase-B frequency"
/>
<Prop name="active power" datatype="external power grid" data="line-I phase-B active
power" />
<Prop name="reactive power" datatype="external power grid" data="line-I phase-B reactive
power" />
<Prop name="apparent power" datatype="external power grid" data="line-I phase-B
apparent power" />
<Prop name="power factor" datatype="external power grid" data="line-I phase-B power
factor" />
<Prop name="phase-A voltage" datatype="external power grid" data="line-I phase-B
voltage" visible="0" />
<Prop name="voltage curve" datatype="external power grid instant power outage curve"
data="line-I phase-B voltage curve" />
</Dev>
<Dev name="line-I phase-C" id="2">
<Prop name="voltage" datatype="external power grid" data="line-I phase-C voltage" />
<Prop name="current" datatype="external power grid" data="line-I phase-C current" />
<Prop name="frequency" datatype="external power grid" data="line-I phase-C frequency"
/>
<Prop name="active power" datatype="external power grid" data="line-I phase-C active
power" />
<Prop name="reactive power" datatype="external power grid" data="line-I phase-C reactive
power" />
<Prop name="apparent power" datatype="external power grid" data="line-I phase-C
apparent power" />
```

```
<Prop name="power factor" datatype="external power grid" data="line-I phase-C power
factor" />
</Dev>
</DevType>
```

[0064] The configuration file 2 indicates that there are three devices in the external power grid: line I phase A, line I phase B, and line I phase A; each device contains seven attributes, i.e., voltage, current, frequency, active power, reactive power, apparent power, and power factor.

[0065] According to the above-described configuration file of the external power grid, an alarm conditional expression is designed to implement external power grid power outage alarming. The external power grid line-I phase-A power outage alarm conditional expression is configured as:

[0066] External power grid. line I phase A. voltage. value <= 143 & external power grid. line I phase B. voltage. value > 143 & external power grid. line I phase C. voltage. value > 143

[0067] Where, "external power grid. line I phase A. voltage." represents an attribute "voltage" of the device "line I phase A" under the device type "external power grid". The meaning of the alarm conditional expression is "checking whether a voltage attribute value of the line I phase A device under the device type of external power grid is less than or equal to 143 and whether voltage attribute values of two devices, i.e., line I phase B and line I phase C, are greater than 143."

[0068] When the above-described external power grid alarm conditional expression is loaded into the monitoring system program, it will start to detect each device under the "external power grid", and take values for operation according to requirements in the external power grid alarm conditional expression; when an operation result is true, give an alarm; and when it is false, give no alarm.

[0069] It should be further noted that, in the present disclosure, when the alarm conditional expression operation result is true, before exhibition an alarm to the monitoring system, it is necessary to further judge whether the configured delay time for alarming is satisfied, if it is satisfied, give an alarm; if it is not satisfied, delay for one second, and return to recheck the alarm condition.

[0070] After alarming, it is further judged whether the restoration condition is satisfied, so as to judge whether to restore alarming, and the restoration conditional expression is set as:

[0071] External power grid. line I phase A. voltage. value > 143

[0072] The meaning of the restoration condition is "checking whether the voltage attribute value of line I phase A under the device type of external power grid is greater than 143".

[0073] At this time, if the voltage attribute value of line I phase A under the device type of external power grid is greater than 143, restore alarming and return again to check the alarm condition;

[0074] If the voltage attribute value of line I phase A under the device type of external power grid does not satisfy the restoration condition of being greater than 143, then delay for one second and continue to judge whether the restoration condition is satisfied.

[0075] In another embodiment of the present disclosure, configuration file 3 is used to represent devices contained under the device type "switch machine", and attributes contained under each device, and to point out a name of a switch quantity or an analog quantity corresponding to each attribute.

[0076] Configuration file 3:

```
<DevType name="switch machine" id="1" >
<Devs>
<Dev name="3-J" id="0">
<Prop name="normal position indication switch quantity" data="3-J-DB" />
<Prop name="reverse position indication switch quantity" data="3-J-FB" />
<Prop name="normal position direct-current voltage" datatype="turnout indication voltage"
data="3-J-normal position direct-current voltage" />
<Prop name="normal position alternating-current voltage" datatype="turnout indication
voltage" data="3-J-normal position alternating-current voltage" />
<Prop name="reverse position direct-current voltage" datatype="turnout indication voltage"
data="3-J-reverse position direct-current voltage" />
<Prop name="reverse position alternating-current voltage" datatype="turnout indication
voltage" data="3-J-reverse position alternating-current voltage"/>
<Prop name="1DQ relay switch quantity" data="3-J-1DQJ" />
<Prop name="pre-furcation red light strip switch quantity" data="3-5DGH" />
<Prop name="pre-furcation white light strip switch quantity" data="3-5DGB" />
<Prop name="single operation button" data="1/3CA" />
<Prop name="total normal button" data="total normal position" />
```

```
<Prop name="total reverse button" data="total reverse position" />
<Prop name="normal operation relay" data="1/3DCJ" />
<Prop name="reverse operation relay" data="1/3FCJ" />
<Prop name="allow operation relay" data="1/3YCJ" />
<Prop name="fuse switch quantity" data=" 11" />
</Dev>
<Dev name="3-X" id="4">
<Prop name="normal position indication switch quantity" data="3-X-DB" />
<Prop name="reverse position indication switch quantity" data="3-X-FB" />
<Prop name="normal position direct-current voltage" datatype="turnout indication voltage"
data="3-X-normal position direct-current voltage" />
<Prop name="normal position alternating-current voltage" datatype="turnout indication
voltage" data="3-X-normal position alternating-current voltage" />
<Prop name="reverse position direct-current voltage" datatype="turnout indication voltage"
data="3-X-reverse position direct-current voltage" />
<Prop name="reverse position alternating-current voltage" datatype="turnout indication
voltage" data="3-X-reverse position alternating-current voltage" />
<Prop name="1DQ relay switch quantity" data="3-X-1DQJ" />
<Prop name="pre-furcation red light strip switch quantity" data="3-5DGH" />
<Prop name="pre-furcation white light strip switch quantity" data="3-5DGB" />
<Prop name="single operation button" data="1/3CA" />
<Prop name="total normal button" data="total normal position" />
<Prop name="total reverse button" data="total reverse position" />
<Prop name="normal operation relay" data=" 1/3DCJ" />
<Prop name="reverse operation relay" data=" 1/3FCJ" />
<Prop name="allow operation relay" data="1/3YCJ" />
<Prop name="fuse switch quantity" data=" 11" />
</Dev>
</DevType>
```

[0077] The above-described configuration indicates that there are two switch machine devices, 3-J and 3-X in the switch machine; and each device contains a plurality of pieces of attribute information related to the device, such as normal position indication switch quantity, reverse position indication switch quantity, and normal position direct-current voltage.

[0078] According to the configuration file of the above-described switch machine, the alarm conditional expression is designed to implement turnout non-indication alarming; and the alarm conditional expression is configured as:

[0079] Switch machine. 1DQ relay switch quantity. value = 0 & switch machine. normal position indication switch quantity. value = 0 & switch machine, reverse position indication switch quantity. value = 0

[0080] Where, "switch machine. 1DQ relay switch quantity" represents the attribute of "1DQ relay switch quantity" under each device under the device type of "switch machine"; "switch machine. normal position indication switch quantity" represents the attribute of "normal position indication switch quantity" under each device under the device type of "switch machine"; and "switch machine. reverse position indication switch quantity" represents the attribute of "reverse position indication switch quantity" under each device under the device type of "switch machine".

[0081] The meaning of above-described switch machine alarm conditional expression is "checking each switch machine device, the 1DQ relay switch quantity has a value of 0, and the normal position indication switch quantity has a value of 0, and the reverse position indication switch quantity has a value of 0".

[0082] When the above-described switch machine alarm conditional expression is loaded into the centralized monitoring program, it will start to detect devices under each "special switch machine", take values for operation according to requirements in the alarm conditional expression, and alarm according to an operation result.

[0083] It should be further noted that, in the present disclosure, when the alarm conditional expression operation result is true, before exhibiting an alarm to the monitoring system, it is necessary to further judge whether the configured delay time for alarming is satisfied, if it is satisfied, exhibit the alarm; if it is not satisfied, for delay one second, and return to recheck the alarm condition.

[0084] After alarming, it is further judged whether the restoration condition is satisfied, so as to judge whether to restore alarming, and the restoration conditional expression is set as:

[0085] Switch machine. normal position indication switch quantity. value = 1 (switch machine, reverse position indication switch quantity. value = 1; where, "|" represents an "or" condition;

[0086] The meaning of the restoration conditional expression is "checking each switch machine device, the value of the normal position indication switch quantity is 1 or the value of the reverse position indication switch quantity is 1".

[0087] At this time, if under the switch machine device type, the normal position indication switch quantity value is 1,

and the reverse position indication switch quantity value is 1, then restore alarming and return again to check the alarm condition;

[0088] If the normal position indication switch quantity value and the reverse position indication switch quantity under the switch machine device type do not satisfy the restoration condition, then delay for one second, and continue to judge whether the restoration condition is satisfied.

[0089] In addition, contents in the alarm conditional expression may be varied, and secondary alarm may be performed according to other existing alarm results, which may implement more complex alarm logic while simplifying a logic expression. For example: the secondary alarm of the switch machine may be configured by using an alarm conditional expression below:

[0090] "Turnout. turnout non-indication. alarm state = 1 & turnout. turnout occupancy state, value = 1", which expresses that the current turnout is in a turnout non-indication alarm state and the turnout is in an occupancy state, and at this time, a new alarm, i.e., splitting switch alarm, may be generated.

[0091] By setting judgment of whether the configured delay time is satisfied in the entire alarming method, it may effectively prevent false alarms and repeated alarms of unrestored alarms, and avoid negative effects of asynchrony and instantaneous fluctuations in the analog quantity caused by inconsistency of alarm collection time of the switch quantity and the analog quantity that are interrelated. Meanwhile, by setting judgment of whether the restoration condition is satisfied, users may no longer be disturbed after restoring alarming, so that current device problems that need to be solved urgently may be paid attention to.

[0092] According to a second aspect of the embodiment of the present disclosure, there is provided an alarming apparatus for a railway monitoring system based on conditional expressions; the alarming apparatus includes modules below:

[0093] A normalization processing module: configured to normalize a monitoring value, and acquire a device configuration file;

[0094] An alarm conditional expression generating module: configured to form an alarm conditional expression and a restoration conditional expression according to the device configuration file, and input the alarm conditional expression and the restoration conditional expression into an alarm configuration file;

[0095] An alarm operating module: configured to load the alarm configuration file into a monitoring system, and sequentially check whether an alarm condition and a restoration condition are satisfied;

[0096] An alarm processing module: configured to exhibit an alarm in the monitoring system based on an operation result of the alarm operating module; and cancel alarm exhibition in the monitoring system when alarm exhibition satisfies the restoration condition.

[0097] The normalization processing module is configured to process a monitoring value self-collected by the monitoring system and all monitoring values received by system interfaces corresponding to respective device types.

[0098] The alarm conditional expression generating module is configured to form an alarm conditional expression containing one or more of analog quantity, switch quantity and historical alarm according to the configuration file.

[0099] The alarm operating module is configured to check the alarm condition including an attribute when an attribute value changes.

[0100] The alarm processing module is further configured to process whether the alarm condition is continuously satisfied within configured delay time; and whether the restoration condition is continuously satisfied within the configured delay time.

[0101] According to a third aspect of the embodiment of the present disclosure, there is provided a computer-readable storage medium; the computer-readable storage medium has a computer program stored therein; and when executed by a processor in a monitoring system, the computer program implements the steps of the above-described railway monitoring system alarming method based on conditional expressions.

[0102] The computer program includes program instructions; and when executed by the processor, the program instructions implement all or part of the processes in method according to the above-described embodiment, which may also be completed as the computer program instructs relevant hardware; the computer program may be stored in a computer-readable storage medium; when executed by the processor, the computer program may implement the steps of the above-described respective method embodiments. Wherein, the computer program includes a computer program code; and the computer program code may be in a form of source code, object code, executable file, or some intermediate forms. The computer-readable medium may include: any entity or apparatus that can carry a computer program code, a record medium, a U disk, a mobile hard disk, a magnetic disk, an optical disk, a computer memory, a Read-Only Memory (ROM), a Random Access Memory (RAM), an electric carrier signal, a telecommunication signal, a software distribution medium, etc.

[0103] The computer-readable storage medium may be an internal storage unit of a terminal according to any one of the foregoing embodiments, for example, hard disk or memory of the terminal. The computer-readable storage medium may also be an external storage device of the terminal, for example, a plug-in hard disk, a Smart Memory Card (SMC), a Secure Digital (SD) card, a Flash Card, etc., equipped on the terminal. Further, the computer-readable storage medium

may also include both an internal storage unit and an external storage device of the terminal. The computer-readable storage medium is configured to store the computer programs as well as other programs and data required by the terminal. The computer-readable storage medium may also be configured to temporarily store data that has been output or will be output.

[0104] In summary, the railway monitoring system alarming method and apparatus based on conditional expressions according to the present disclosure provide a simple framework to put all the analysis logic of intelligent analysis alarms into the configuration file with clear logic, which is convenient for on-site maintenance personnel to view intelligent analysis alarm logic and correct errors in time. With respect to newly added on-site intelligent analysis alarm needs, it is only necessary to modify the configuration file to implement a variety of intelligent analysis alarms.

[0105] Although the present disclosure has been described in detail with reference to the foregoing embodiments, those ordinarily skilled in the art will readily appreciate that they can still modify the technical solutions described in the foregoing embodiments, or equivalent substitutions can be made to some of technical features; however, these modifications or substitutions are not intended to make the essence of the corresponding technical solutions depart from the spirit and the scope of the technical solutions of the embodiments of the present disclosure.

Claims

1. An alarming method for a railway monitoring system based on conditional expressions, comprising:

   normalizing a monitoring value, and acquiring a device configuration file;
   forming an alarm conditional expression and a restoration conditional expression according to the device configuration file, and inputting the alarm conditional expression and the restoration conditional expression into an alarm configuration file;
   loading the alarm configuration file into a monitoring system, and checking whether an alarm condition is satisfied; if the alarm condition is satisfied, exhibiting an alarm in the monitoring system; then checking whether alarm exhibition satisfies a restoration condition; if the restoration condition is satisfied, cancelling alarm exhibition in the monitoring system.

2. The alarming method according to claim 1, wherein, the monitoring value comprises a monitoring value self-collected by the monitoring system and all monitoring values received by system interfaces corresponding to respective device types.

3. The alarming method according to claim 1, wherein, the normalizing comprises classifying the monitoring values displayed in the monitoring system; the monitoring values are classified according to a first level, a second level, and a third level; the first level is device type; the second level is device; the third level is attribute.

4. The alarming method according to claim 3, wherein, the device type comprises frequency-shift track circuit, 25Hz track circuit, turnout, signal, external power grid, switch machine, interlock, train control, axle counter, and air conditioner; the device is defined as respective specific devices under the device type; the attribute is defined as a collection quantity contained under each device, the collection quantity is a switch quantity or an analog quantity, the switch quantity is a quantity having a finite number of states; and the analog quantity represents a quantity having a continuous value.

5. The alarming method according to claim 1, wherein, the alarm conditional expression contains one or more of analog quantity, switch quantity and historical alarm.

6. The alarming method according to claim 1, wherein, the checking the alarm condition comprises: rechecking the alarm condition containing an attribute when an attribute value changes.

7. The alarming method according to claim 1, wherein, if the alarm condition is not satisfied, delaying for a certain period of time, and returning to recheck whether the alarm condition is satisfied.

8. The alarming method according to claim 1, wherein, the checking whether an alarm condition is satisfied comprises checking whether the alarm condition is continuously satisfied within configured delay time.

9. The alarming method according to claim 8, wherein, the checking whether the alarm condition is continuously satisfied within configured delay time comprises steps of:

if the alarm condition is continuously satisfied within the configured time, exhibiting an alarm in the monitoring system;
if the alarm condition is not satisfied within the configured time, then returning to recheck whether the alarm condition is satisfied.

10. The alarming method according to claim 1, wherein, if the restoration condition is not satisfied, delaying for a certain period of time, and returning to recheck whether the restoration condition is satisfied.

11. The alarming method according to claim 1, wherein, the checking whether alarm exhibition satisfies the restoration condition comprises checking whether the restoration condition is continuously satisfied within the configured delay time.

12. The alarming method according to claim 11, wherein, the checking whether the restoration condition is continuously satisfied within configured delay time comprises steps of:

judging, after starting alarm exhibition in the monitoring system, whether the restoration condition is continuously satisfied within the configured delay time;
if the restoration condition is satisfied within the configured delay time, then cancelling alarm exhibition in the monitoring system and returning to recheck whether the alarm condition is satisfied;
if the restoration condition is not satisfied within the configured delay time, then returning to recheck whether the restoration condition is satisfied within the configured delay time.

13. An alarming apparatus for a railway monitoring system based on conditional expressions, the alarming apparatus comprising modules below:

a normalization processing module: configured to normalize a monitoring value, and acquire a device configuration file;
an alarm conditional expression generating module: configured to form an alarm conditional expression and a restoration conditional expression according to the device configuration file, and input the alarm conditional expression and the restoration conditional expression into an alarm configuration file;
an alarm operating module: configured to load the alarm configuration file into a monitoring system, and sequentially check whether an alarm condition and a restoration condition are satisfied;
an alarm processing module: configured to exhibit an alarm in the monitoring system based on an operation result of the alarm operating module; and cancel alarm exhibition in the monitoring system when alarm exhibition satisfies the restoration condition.

14. The alarming apparatus according to claim 13, wherein, the normalization processing module is configured to process a monitoring value self-collected by the monitoring system and all monitoring values received by system interfaces corresponding to respective device types.

15. The alarming apparatus according to claim 13, wherein, the alarm conditional expression generating module is configured to form an alarm conditional expression containing one or more of analog quantity, switch quantity and historical alarm according to the configuration file.

16. The alarming apparatus according to claim 13, wherein, the alarm operating module is configured to check the alarm condition comprising an attribute when an attribute value changes.

17. The alarming apparatus according to claim 13, wherein, the alarm processing module is further configured to process whether the alarm condition is continuously satisfied within configured delay time; and whether the restoration condition is continuously satisfied within the configured delay time.

18. A computer-readable storage medium, wherein, the computer-readable storage medium has a computer program stored therein; and when executed by a processor in a monitoring system, the computer program implements the steps of the method according to any one of claims 1 to 12.

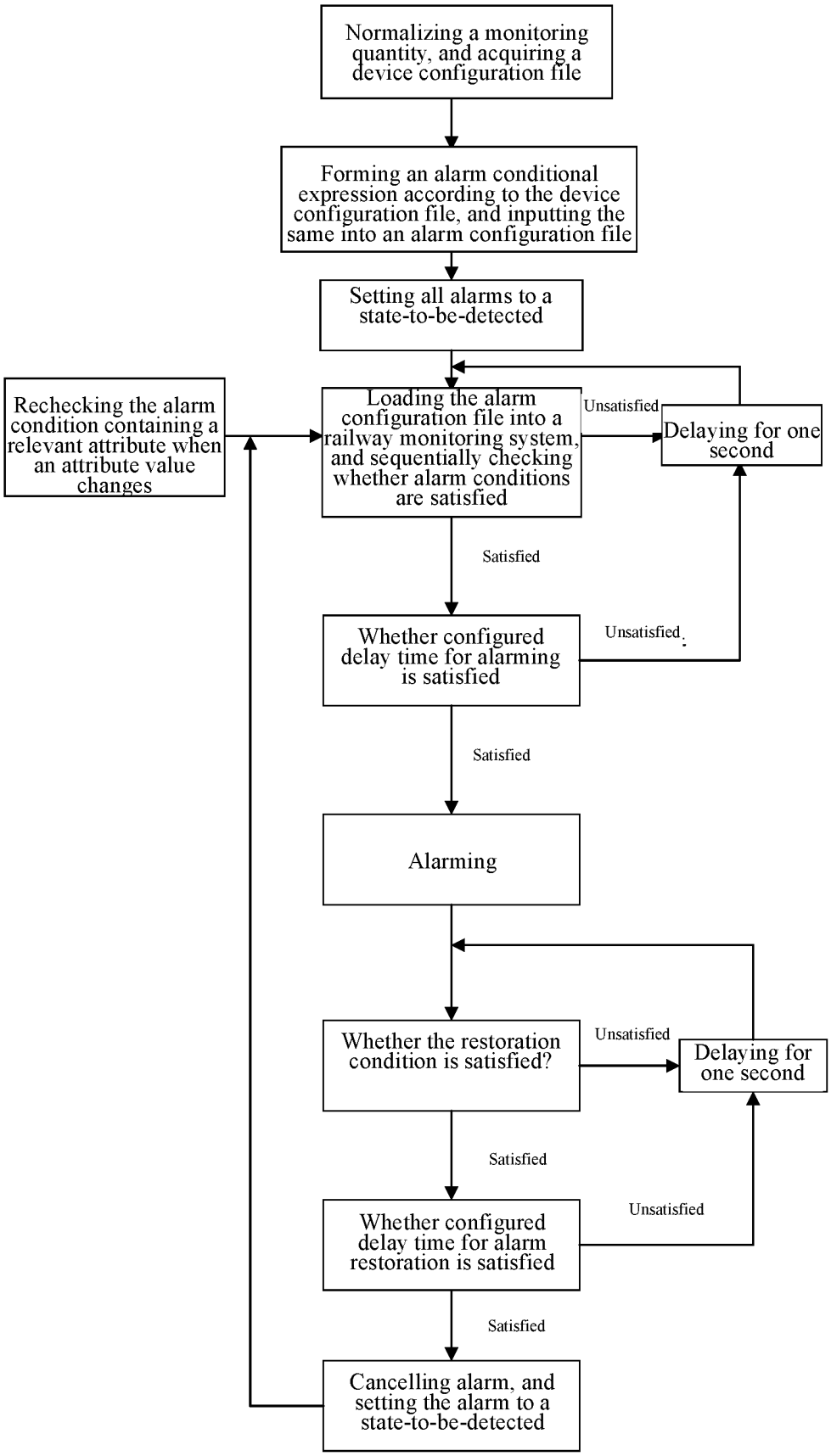
Normalizing a monitoring quantity, and acquiring a device configuration file
Forming an alarm conditional expression according to the device configuration file, and inputting the same into an alarm configuration file
Setting all alarms to a state-to-be-detected
Rechecking the alarm condition containing a relevant attribute when an attribute value changes
Loading the alarm configuration file into a railway monitoring system, and sequentially checking whether alarm conditions are satisfied
Unsatisfied
Delaying for one second
Satisfied
Whether configured delay time for alarming is satisfied
Unsatisfied
Satisfied
Alarming
Whether the restoration condition is satisfied?
Unsatisfied
Delaying for one second
Satisfied
Whether configured delay time for alarm restoration is satisfied
Unsatisfied
Satisfied
Cancelling alarm, and setting the alarm to a state-to-be-detected

FIG. 1

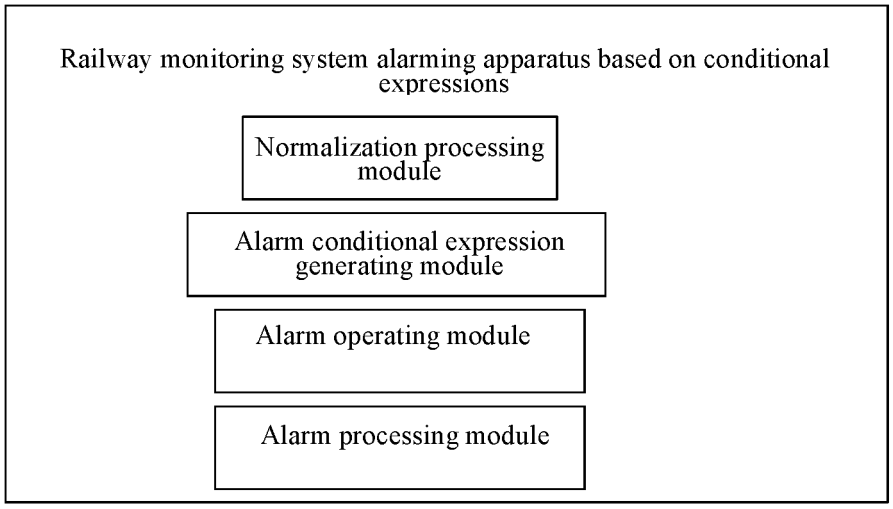
Railway monitoring system alarming apparatus based on conditional expressions
Normalization processing module
Alarm conditional expression generating module
Alarm operating module
Alarm processing module

FIG. 2

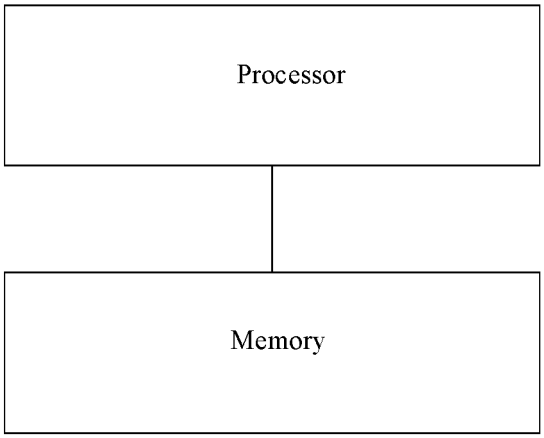
Processor
Memory

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/104724

A. CLASSIFICATION OF SUBJECT MATTER

B61L 27/00(2022.01)i; G06F 16/00(2019.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B61L 27, G06F 16

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNTXT; DWPI; VEN; CNKI: 铁路, 列车, 监测, 检测, 表达式, 关系, 条件, 恢复, 报警, 警报, 告警, railway, train, monitor +, alarm+, warn+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 112685605 A (SHENZHEN KEANDA ELECTRONIC TECHNOLOGY CO., LTD.) 20 April 2021 (2021-04-20) description paragraphs [0001]-[0063], figures 1-4	1-18
X	CN 111994137 A (SHENZHEN KEANDA ELECTRONIC TECHNOLOGY CO., LTD. et al.) 27 November 2020 (2020-11-27) description paragraphs [0002]-[0045], figures 1-2	1-18
A	CN 101905704 A (BEIJING NATIONAL RAILWAY RESEARCH & DESIGN INSTITUTE OF SIGNAL & COMMUNICATION) 08 December 2010 (2010-12-08) entire document	1-18
A	CN 202693751 U (CHINA SHENHUA ENERGY COMPANY LIMITED et al.) 23 January 2013 (2013-01-23) entire document	1-18
A	JP H08310398 A (TOSHIBA ENGINEERING CO) 26 November 1996 (1996-11-26) entire document	1-18

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
09 March 2022	**21 March 2022**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2021/104724

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 112685605 A	20 April 2021	None	
CN 111994137 A	27 November 2020	None	
CN 101905704 A	08 December 2010	CN 101905704 B	14 March 2012
CN 202693751 U	23 January 2013	None	
JP H08310398 A	26 November 1996	None	

Form PCT/ISA/210 (patent family annex) (January 2015)