TITLE: Automatic alarm scheduling method and system

A method and system for automatically scheduling alarms which indicate malfunctions in a supervised system.

The invention belongs to the field of supervision of complex systems including equipment connected to a central supervision system suitable for generating malfunction alarms.

The invention finds applications in various fields, e.g. in the industrial field or in the field of transport infrastructures.

Especially in a transport infrastructure, e.g. a subway infrastructure, it is necessary to supervise the operation and to manage any malfunction alarms. Where a supervised system is a transport infrastructure, the system comprises a large number of equipment items, e.g. escalators, elevators, access gates, lighting, automatic ticket machines, rails, trains, signaling PLCs, as well as many sensors associated with calculation systems for detecting hazard conditions, e.g. smoke sensors, video surveillance cameras, etc.

In a known manner, the various pieces of equipment of the supervised system are connected to a central supervision system and are suitable for sending alarms to such central supervision system. In a conventional mode of operation, one or more supervision operators are responsible for managing the malfunction alarms received by the central supervision system, from the various human-machine interfaces made available to the operators, e.g. screens, loudspeakers suitable for sending audible alarms.

In a complex supervised system, such as e.g. a transport infrastructure such as an urban subway network, the number of alarms indicating malfunctions of the system equipment is as high as 20 or more alarms per minute. The supervisory operators thus have a very high workload and have to sort the alarms received in order to perform the most optimized processing possible for following the rules regarding the safety and the proper operation of the supervised system. It is known how to associate a category or a criticality level with the malfunction alarms issued, which makes it possible to deduce therefrom a priority level, but the categories, statically a priori defined, are limited in number, and make it possible to distinguish between critical safety alarms, which require immediate intervention, e.g. a detection of the onset of fire, as issued by sensors, compared to malfunction alarms which do not require immediate intervention, e.g. an escalator failure.

For each alarm, the supervisor operator has to take on the alarm management, and takes corrective actions, in order to resolve the problem which led to issuing the alarm.

In the presence of a very large number of alarms, the supervisor operator is submerged, and has a mental load such that the risk of error in the scheduling of the management of alarms is increased.

Moreover, it has been observed in practice that the extent of the urgent nature of the management of alarms varies with the context wherein alarms are issued by the equipment of the supervised system. In a transport network e.g., the priority of management a malfunction

of an access gate or of an escalator will be different depending on the actual load of the transport network, e.g. whether it is a rush hour or not.

Thus, there is a need to make the scheduling of alarms for supervised systems of said type more automatic and dynamic.

To this end, the invention proposes, according to one aspect, a method of automatic scheduling of alarms indicating malfunctions in a supervised system including a plurality of pieces of equipment connected to a central supervision system, the scheduling indicating a priority rank of processing said alarms, said alarms being generated by pieces of equipment of the supervised system and sent to the central supervision system, the scheduling method being implemented by said central supervision system. The method includes, in an operational phase, the following steps:

- for each alarm received from the supervised system:

(i) obtaining alarm data with at least one alarm identifier, a date of issue of alarm;

(ii) implementing a prediction model recorded beforehand, for calculating a predicted management time based on the alarm data,

(iii) calculating an alarm processing priority depending on the predicted response time, and

displaying the received alarms on a human-machine interface of the central supervision system in an order dependent on the priority rank of alarm processing.

Advantageously, the method of automatic scheduling of alarms according to the invention implements an automatic calculation of the predicted management time of alarms, depending on the context, and an automatic calculation of an associated priority rank. The scheduling performed is dynamic depending on the context, the mental load of the operator is reduced, and hence the risk of error is reduced and the security of the system is increased.

In particular, advantageously, the prediction model is obtained by implementing a learning algorithm based on management decisions by a specialized supervisor operator.

The automatic scheduling method according to the invention can further have one or a plurality of the features below, taken independently or according to all technically feasible combinations.

The alarm data further include an indication of the issuing equipment and/or a subsystem of the supervised system to which the issuing equipment belongs, and a description of the malfunction associated with the alarm.

The method further includes a step of determining context parameters of the alarm.

The calculation of a processing priority rank implements a calculation function which combines a function of the predicted management time and functions of context parameters.

The prediction model for calculating a predicted management time is a first prediction model, and the method further includes, for each alarm, an implementation of a second prediction model recorded beforehand, for calculating a predicted alarm resolution time depending on alarm data.

The calculation of an alarm processing priority further depends on the predicted resolution time.

The method further comprises a learning phase, prior to the operational phase, including steps, implemented for a plurality of alarms:

- for each alarm, reception and storage of alarm data including an identifier, a date of issue and an indication of the issuing equipment and/or a subsystem of the supervised system to which the issuing equipment belongs
- determination and storage of alarm context parameters of said supervised system;
- for each alarm, calculation of a management time equal to the time elapsed between the date of issue and a date of management by an operator supervising said alarm;
- implementation of a supervised learning algorithm of the parameter values of a prediction model used for calculating a predicted management time from stored alarm data and calculated management times.

The method further includes a determination and a storage of parameters of a function for calculating an alarm processing priority rank, said function combining a function of the predicted management time and functions of context parameters.

The method further includes, after calculating a management time for each alarm, a calculation of a statistical distribution of the calculated management times, and then a classification of said times into a predetermined number of classes.

The implementation of a learning algorithm includes a prediction of the classification of each alarm depending on alarm data recorded beforehand.

The prediction model for calculating a predicted management time is a first prediction model, the method further including, for each alarm, a calculation of an alarm resolution time equal to the time elapsed between the date of issue and a date of alarm resolution, and an implementation of a supervised learning algorithm of the parameter values of a second prediction model for calculating a predicted resolution time from the stored alarm data and the calculated resolution times.

According to another aspect, the invention relates to a system for automatic scheduling of alarms indicating malfunctions in a supervised system, including a central supervision system, the supervised system including a plurality of pieces of equipment connected to said central supervision system, the scheduling indicating a priority rank of processing said alarms, said alarms being generated by pieces of equipment of the supervised system and sent to the central supervision system. The central supervision system includes modules configured for, in an operational phase:

for each alarm received from the supervised system:

- obtaining alarm data including at least one alarm identifier, a date of issue of the alarm;
- implementing a prediction model recorded beforehand, for calculating a predicted management time depending on alarm data,

- calculating an alarm processing priority rank depending on the predicted management time,

- displaying alarms received on a human-machine interface of the central supervision system in an order dependent on the priority rank of alarm processing.

According to one feature, the automatic alarm scheduling system further includes modules configured for, a learning phase, prior to the operational phase:

- for each alarm, receiving and storing alarm data including an identifier, a date of issue and an indication of the issuing equipment and/or a subsystem of the supervised system to which the issuing equipment belongs

- determining and storing alarm context parameters of said supervised system;

- for each alarm, calculating a management time equal to the time elapsed between the date of issue and a date of management by an operator supervising said alarm;

- implementing a supervised learning algorithm of the parameter values of a prediction model used for calculating a predicted management time from stored alarm data and calculated management times.

The prediction model for calculating a predicted management time is a first prediction model, the system further including,

- a module configured for, in the learning phase for each alarm, calculating an alarm resolution time equal to the time elapsed between the date of issue and a date of resolution of the alarm, and a module configured for implementing a supervised learning algorithm of the parameter values of a second prediction model for calculating a predicted resolution time from the stored alarm data, and the calculated resolution times, and

- a module configured for, for each alarm, in the operational phase, implementing a second prediction model recorded beforehand, for calculating a predicted resolution time of the alarm depending on alarm data.

According to another aspect, the invention relates to an information recording medium, on which software instructions are stored for executing a method of automatic scheduling of alarms as briefly described hereinabove, when such instructions are executed by a programmable electronic system.

According to another aspect, the invention relates to a computer program including software instructions which, when implemented by a programmable electronic system, implement a method of automatic scheduling of alarms as briefly described hereinabove.

Other features and advantages of the invention will be clear from the description thereof which is given below as a non-limiting example, with reference to the enclosed figures, among which:

[Fig 1] Figure 1 is a schematic example of automatic scheduling system for alarms according to an embodiment of the invention;

[Fig 2] Figure 2 is a block diagram of the main steps of a learning phase of an automatic scheduling method for alarms according to a first embodiment of the invention;

[Fig 3] Figure 3 is a schematic example of an alarm table;

[Fig 4] Figure 4 is a block diagram of the main steps of a learning phase of an automatic scheduling method for alarms according to a second embodiment of the invention;

[Fig 5] Figure 5 is a block diagram of the main steps of an operational phase of an automatic scheduling method for alarms according to a first embodiment of the invention;

[Fig 6] Figure 6 is a block diagram of the main steps of an operational phase of an automatic scheduling method for alarms according to a second embodiment of the invention.

The invention will be described hereinafter in the particular example of application to a supervised system which is a transport network. It should nevertheless be noted that the invention is not limited to said application case and applies more generally to other types of supervised systems generating malfunction alarms to be managed.

Figure 1 schematically shows a supervised system 2 including a plurality of pieces of equipment 4A, 4B, 4C connected to a central supervision system 10 via communication interfaces 6A, 6B.

The pieces of equipment 4A, 4B e.g. are part of the same subsystem 5 of the supervised system 2.

Of course, in practice, the number of pieces of equipment in the supervised system is arbitrary, and typically on the order of several tens to several thousands. In the case of the application e.g. to a transport network, the equipment of the supervised system is e.g. lighting, air conditioning, station ventilation, tunnel ventilation, escalators, elevators, gates, ticket selling kiosks, information boards, communication systems with the public, surveillance cameras, computer systems, electrical systems with different voltages, access doors, platform doors, signaling elements, elements of communication with trains, etc.

The communication interfaces e.g. are radio communication interfaces according to various radio communication protocols, e.g. TETRA (Terrestrial Trunked Radio) or GSM (Global System for Mobile Communications).

In a variant or in addition, wired communications are used as well.

The pieces of equipment 4A to 4C are suitable for sending equipment status information and malfunction alarms 8, which are sent by the communication interfaces to the central supervision system 10.

The central supervision system 10 is also shown schematically herein, e.g. a computer system including one or a plurality of interconnected computers.

The central supervision system 10 shown in Figure 1 comprises a communication interface 12 configured for communicating with the communication interfaces 6A, 6B of the supervised system 2.

According to a variant, the central supervision system 10 comprises a plurality of communication interfaces, each communication interface being suitable for communicating according to a communication protocol, so as to communicate according to all the communication protocols implemented in the supervised system 2.

In the schematic example shown in Figure 1, the central supervision system 10 is a programmable electronic computing device, comprising an electronic computing unit, e.g. a computing processor 14, and an electronic data storage unit 16, e.g. in the form of files or registers, as well as one or a plurality of human-machine interfaces 18. The human-machine interface 18 comprises at least one information display device, e.g. a screen 20, and a device for entering the commands of the operator 22, which can be combined into only one display and interaction device, e.g. a touch screen.

The computing processor 14 is apt to execute computations and computer program code instructions or software instructions when the system 10 is powered on. The elements 12, 14, 16, 18 of the central supervision system 10 are suitable for communicating via communication buses.

The electronic data storage unit 16 is suitable for storing parameters 24 for alarm context and/or operation of the supervised system 2, alarm data 26 relating to the alarms received from the supervised system 2 and prediction model parameters 28 for calculating a predicted alarm management time and/or a predicted alarm resolution time.

The calculation processor 14 is configured for executing for modules produced in the form of software instructions for implementing an automatic alarm scheduling method according to the invention.

Such modules comprise:

- a module 30 for receiving alarm data and storage data,
- a module 32 for determining and storing context parameters,
- a module 34 for calculating the alarm management time by a supervisor operator and, optionally, for calculating the alarm resolution time,
- a module 36 for implementing an algorithm for learning the values of prediction model parameters,
- a module 38 for calculating, for each new alarm received from the supervised system 2, a predicted management time and optionally a predicted resolution time;
- a module 40 for calculating a processing priority rank for each alarm.

The more detailed operation of said modules will be described hereinafter.

In one embodiment, the modules 30 and 40 are embodied in the form of executable software instructions which are recorded on a non-transitory, computer-readable information medium. The computer-readable medium is e.g. a medium apt to store the electronic

instructions and to be coupled to a bus of a computer system. As an example, the readable medium is an optical disk, a magneto disk, a ROM memory, a RAM memory, any type of non-volatile memory (e.g. EPROM, EEPROM, FLASH, NVRAM), a magnetic card or an optical card.

In a variant of embodiment, the modules 30 to 40 are each produced in the form of a programmable logic component, such as an FPGA (*Field Programmable Gate Array*), a GPU (graphics processor) or a GPGPU (*General-purpose processing on graphics processing*), or in the form of a dedicated integrated circuit, such as an ASIC (*Application Specific Integrated Circuit*).

The central supervision system 10 further includes a module 42 for corrective action control and for receiving information on the resolution of the malfunction at the origin of the alarm when an alarm is resolved.

Figure 2 is a block diagram of the main steps of an alarm scheduling method in a learning phase, which is used for calculating the parameters of a prediction model of an alarm management time, and the parameters of a function for calculating an alarm processing priority rank.

The learning phase is carried out over a learning period e.g., which makes it possible to collect information on a large number of alarms, e.g. at least one month of alarms processed.

The method includes a step 50 of receiving and storing data relating to alarms issued by pieces of equipment or subsystems of the supervised system. Such data on alarms, hereinafter called alarm data, include for each alarm, at least one alarm identifier, a date of issue, an indication relating to the sending equipment and a description of the malfunction associated with the alarm, e.g. "off", "unserviceable", "temperature exceeding 40°C", etc.

The alarm identifier is a unique identifier used for identifying the alarm in the system.

The date of issue is a temporal dating with a given level of accuracy, e.g. day/month/year/hour/minutes/seconds. Any other format for representing the date can be used.

For each alarm, an alarm status is calculated and updated depending on information from the human-machine interface following an action (alarm management) by the supervisor operator and on information about the resolution of an alarm.

The alarm status is e.g. one of: “alarm in progress", "alarm managed", "alarm resolved", where "alarm in progress" indicates a new alarm from the supervised system, "alarm managed" indicates that the alarm is being managed by the supervisor operator, and “alarm resolved” means that the problem at the origin of the alarm has been resolved.

Each alarm status has an associated date.

Thus, the "alarm in progress" status is associated with the date of issue of the alarm; the "alarm managed" status is associated with the date of management of the alarm by a supervisor operator; the "alarm resolved" status is associated with the resolution date of the problem at the origin of the alarm, e.g. said date/time is indicated by the supervised system.

In one embodiment e.g., the alarms are displayed on a display screen of the human-machine interface of the central supervision system, e.g. in the form of a table, for processing by a supervision operator.

To indicate alarm management, the supervisor operator acts through the entry device, and the date/time of the operator entry is stored in connection with the "alarm managed" status.

Of course, any appropriate format for the representation of the date is acceptable.

Figure 3 is a schematic example of a display table T containing information relating to the same alarm in a plurality of statuses. Table T comprises columns T_1 to T_5, column T_1 comprising the unique alarm identifier, column T_2 a binary value representing whether the alarm is active (value 1) or not active (value 0), column T_3 indicates whether management is required (value 1) or not required (value 0), column T_4 comprises the associated date, and column T_5 comprises information about the supervisor operator who manages the alarm.

The values of columns T_2 and T_3 taken jointly indicate the alarm status among the above-mentioned statuses:

- for "alarm in progress", T_2=1, T_3=1;
- for "alarm management", T_2=1, T_3=0;
- for "alarm resolved", T_2=0, T_3=0.

For each status, column T_4 shows the associated date.

Moreover, the alarm data include, as a supplement, a static category assigned to the alarm, among a limited number N of static categories, representative of a criticality level of the alarm. N is e.g. between 1 and 3 corresponding to low, medium, high criticality levels.

The method further includes a step 52 for determining and storing context parameters of the recorded alarms, e.g.:

- the density of alarms per time interval over predetermined intervals,
- the ratio of alarms of the same group (the groups being calculated by a grouping algorithm) in the short term, e.g. on the order of 5 to 10 minutes before the date/time of issue of the alarm in question;
- the entropy of the subsystem to which the equipment issuing the alarm in question belongs. It is a measure which corresponds to the amount of information contained or delivered by a source of information.
- the entropy of the place of the equipment issuing the alarm.

The method further includes a step 54 of calculating, for each alarm, a management time, which is the time difference between the date of issue of the alarm and the date of management of the alarm.

The management time is also stored in connection with the alarm considered during the step 54.

During a step 56, a statistical distribution of the management times for the stored alarms is calculated, then a classification into a number C of classes is performed during the classification step 58.

The number C of groups is predetermined, e.g. C=10, and the classification is performed according to the characteristics of the alarms using a GMM (Gaussian Mixture Model).

A prediction model of the management time is calculated in the prediction model calculation step 60, from the classification according to the stored alarm data of the step 56 and to the classification performed during the classification step 58.

Preferentially, a learning method such as “Voting Classifier” is used to calculate a prediction of the classification of each alarm depending on the stored alarm data. Each class of the C classes in the classification is assigned a management time, called predicted management time. Thus, following the classification prediction of each alarm, a predicted management time is obtained.

The calculated prediction model, as well as all the associated parameters, are stored during the storage step 62.

A step 65 for calculating parameters of a model for determining a priority processing rank for each alarm is then implemented.

In one embodiment, a generalized linear model is applied for calculating the priority rank of an alarm A_i, according to the following formula:

[MATH1] $Rank(A_i) = \alpha_1 \cdot f_1(d_{1,i}) + \alpha_2 \cdot f_2(C_1(A_i)) + \alpha_3 \cdot f_3(C_2(A_i)) + \alpha_4 \cdot f_4(C_3(A_i)) + \alpha_5 \cdot f_5(C_4(A_i))$

Where $\alpha_1,\ldots \alpha_5$ are weighting coefficients, the sum of which is equal to 1, the functions $f_1()$ to $f_5()$ are scale normalization functions, also called min-max normalization functions: for X lying between min_n and max_n, the function $f_n(X)$ transposes X on a predetermined scale, e.g. [0,100].

Moreover:

- $d_{1,i}$ is the predicted management time for the alarm A_i

-$C_1(A_i)$ is a first context parameter of the alarm A_i, which is the alarm density over a time interval to which the date of issue of the alarm belongs;

-$C_2(A_i)$ is a second context parameter of the alarm A_I, which is the ratio of alarms of the same group, over the short term;

-$C_3(A_i)$ is a third context parameter of the alarm A_i, which is the entropy of the subsystem to which the equipment issuing the alarm A_i belongs;

-$C_4(A_i)$ is a fourth context parameter of the alarm A_I, which is the entropy of the location of the equipment issuing the alarm A_i.

In one embodiment, the values of the weighting coefficients $\alpha_1,\ldots \alpha_5$ are predetermined.

In another embodiment, the weighting values of the coefficients $\alpha_1,\ldots \alpha_5$ are calculated by a supervised learning algorithm, depending on a criticality level assigned to the alarm. Such step targets the prediction of criticality levels only in order to obtain the values $\alpha_1,\ldots \alpha_5$.

To this end, the ranks will be temporarily adapted for a scale e.g. from 1 to 3 by adapting the functions f1() to f5(), in order to obtain, by means of a linear regression model, the values $\alpha_1,\ldots \alpha_5$, which give the best prediction of the criticality. Once the values $\alpha_1,\ldots \alpha_5$ are obtained, the initial f1() to f5() functions are used for the final model.

Depending on variants of implementation, a variable number of context parameters are used in the formula for calculating a predicted priority rank. Passenger flow information, weather information, or the alarm resolution time described below can be e.g. added.

In a second embodiment described with reference to Figure 4, in addition to the steps 50 to 62 described hereinabove, the method further includes the steps 64 to 72 of calculating, by learning, a model for predicting alarm resolution times.

Steps 64 to 72 are similar to steps 54 to 62 previously described but applied to the alarm resolution time.

Thus, for each alarm, the step 64 performs a calculation of a resolution time which is the time difference between the date of issue of the alarm and the date of resolution of the alarm. The steps 66 to 72 are similar to the previously described steps 56 to 62 but are applied to the alarm resolution time instead of the alarm management time.

In one embodiment, the steps 64 to 72 are performed after the steps 54 to 62. In a variant, the steps 64 to 72 are carried out in parallel with the steps 54 to 62.

After obtaining an alarm-predicted management time (step 62), and obtaining an alarm-predicted resolution time (step 72), a step 75 of calculating parameters of a model for determining a priority rank of each alarm is implemented. The step 75 is similar to the step 65, but in addition, the resolution time of each alarm A_i considered is taken into account in the calculation formula, which becomes:

[MATH 2] $Rank(A_i) = \alpha_1 \cdot f_1(d_{1,i}) + \alpha_2 \cdot f_2(C_1(A_i)) + \alpha_3 \cdot f_3(C_2(A_i)) + \alpha_4 \cdot f_4(C_3(A_i)) + \alpha_5 \cdot f_5(C_4(A_i)) + \alpha_6 \cdot f_6(d_{2,i})$

Where $d_{2,i}$ is the predicted resolution time for the alarm A_i, and $\alpha_1,\ldots \alpha_5$ are weighting coefficients of which sum is equal to 1.

In a manner similar to the embodiment described with reference to Figure 2, the weighting coefficients are either predetermined or calculated by implementing a learning algorithm.

The automatic alarm scheduling method includes a second operational phase wherein the prediction models and the parameters calculated in the learning phase are used for performing the effective scheduling of the new alarms issued by the supervised system, thus facilitating the work of the supervisor operator. The operational phase is carried out after the learning phase.

A first embodiment of the steps of the operational phase of the alarm scheduling method is described with reference to Figure 5.

In such first embodiment, the operational phase comprises an alarm reception step 80 and alarm data including at least one alarm identifier and a date of issue of the alarm. Upon reception, each alarm is in an "alarm in progress" state, pending management. Moreover, information on the issuing equipment and/or subsystem of the supervised system to which the issuing equipment belongs, are received as well.

The method further comprises a step 82 for determining context parameters, which consists in calculating, for each alarm received, the values of the associated context parameters depending on data stored beforehand. The context parameters are e.g. the first to fourth context parameters mentioned hereinabove.

The method then comprises a step 84 of calculating a predicted management time of the alarm considered, based on the implementation of the prediction model and of the associated stored parameters, and a step 86 of calculating a priority rank depending on the predicted management time and on the context parameters, by applying the formula [MATH 1].

The priority rank is stored and the display of alarms for the supervision operator is performed (display step 92) according to the calculated priority rank.

Preferentially, the alarms are displayed in the order given by the calculated priority rank, starting from the highest priority down to the lowest priority.

In one embodiment, only the P highest priority alarms are displayed in an alarm banner, so as to always display the last priority alarms when the operator is on other screens, with P on the order of 3.

If a plurality of alarms have the same priority rank, same are e.g. scheduled according to the date of issue thereof, so as to favor the processing of the oldest alarms among the alarms with the same priority rank.

A second embodiment of the steps of the operational phase of the alarm scheduling method is described with reference to Figure 6.

In addition to the steps 80 to 84 described above, the method includes a step 88 of calculating a predicted resolution time using the prediction model and the associated stored parameters.

The step of calculating a priority rank 90 according to the predicted management time and context parameters implements the formula [MATH 2].

The calculated priority rank is stored and used for the display to the supervisor operator (step 92), in a manner similar to what was described hereinabove.

Advantageously, the invention makes it possible to obtain an automatic and dynamic scheduling, according to the context of the alarms in the supervised system.

CLAIMS

1. An automatic alarm scheduling method indicating malfunctions in a supervised system (2) including a plurality of pieces of equipment (4A-4C) connected to a central supervision system (10), the scheduling indicating a priority rank for processing said alarms, said alarms being generated by pieces of equipment (4A-4C) of the supervised system (2) and sent to the central supervision system (10), the scheduling method being implemented by said central supervision system (10) and being characterized in that same includes steps, in an operational phase, of:

- for each alarm received from the supervised system:
  I. obtaining (80) alarm data with at least one alarm identifier, a date of issue of the alarm;
  II. implementing (84) a prediction model recorded beforehand, for calculating a predicted management time depending on alarm data,
  III. calculating (86) an alarm processing priority depending on the predicted management time,
- displaying (92) alarms received on a human-machine interface of the central supervision system in an order dependent on the alarm processing priority rank.

2. The automatic alarm scheduling method according to claim 1, wherein the alarm data further includes an indication of the issuing equipment and/or a subsystem of the supervised system to which the issuing equipment belongs, and a description of the malfunction associated with the alarm.

3. The automatic alarm scheduling method according to one of claims 1 or 2, further including a step (82) of determining context parameters of the alarm.

4. The automatic alarm scheduling method of claim 3, wherein the calculation of a processing priority rank implements a calculation function which combines a function of the predicted management time and context parameter functions.

5. The automatic alarm scheduling method according to one of claims 1 to 4, wherein the prediction model for calculating a predicted management time is a first prediction model, the method further including, for each alarm, an implementation (88) of a second prediction model recorded beforehand, for calculating a predicted alarm resolution time depending on the alarm data.

6. The automatic alarm scheduling method according to claim 5, wherein the calculation (90) of an alarm processing priority rank, further depends on the predicted resolution time.

7. The automatic alarm scheduling method according to any of claims 1 to 6, further including a learning phase, prior to the operational phase, including steps, implemented for a plurality of alarms:

- each alarm, reception and storage (50) of alarm data including an identifier, a date of issue and an indication of the issuing equipment and/or a subsystem of the supervised system to which the issuing equipment belongs
- determination and storage (52) of alarm context parameters of said supervised system;

- for each alarm, calculation (54) of a management time equal to the time elapsed between the date of issue and a date of management by an operator supervising said alarm;
- Implementation of a supervised learning algorithm (56, 58, 60) of the parameter values of a prediction model used for calculating a predicted management time from stored alarm data and calculated management times.

8. The automatic alarm scheduling method according to claim 7, further including a determination and a storage (65) of parameters of a function for calculating an alarm processing priority rank, said function combining a function of the predicted management time and functions of context parameters.

9. The automatic alarm scheduling method according to one of claims 7 or 8, further including, after calculating a management time for each alarm, a calculation of a statistical distribution (56) of the calculated management times, and then a classification (58) of said times into a predetermined number of classes.

10. The automatic alarm scheduling method according to claim 9, wherein the implementation of a learning algorithm includes a prediction (60) of the classification of each alarm depending on alarm data recorded beforehand.

11. The automatic alarm scheduling method according to one of claims 7 to 10, wherein the prediction model for calculating a predicted management time is a first prediction model, the method further including, for each alarm, a calculation (64) of an alarm resolution time equal to the time elapsed between the date of issue and a date of alarm resolution, and an implementation of a supervised learning algorithm of the parameter values of a second prediction model for calculating a predicted resolution time from the stored alarm data and the calculated resolution times.

12. A computer program including software instructions which, when implemented by a programmable electronic system, implement an automatic alarm scheduling method according to claims 1 to 11.

13. An automatic alarm scheduling system indicating malfunctions in a supervised system (2), including a central supervision system, the supervised system including a plurality of equipment (4A-4C) connected to said central supervision system (10), the scheduling indicating a priority rank for processing said alarms, said alarms being generated by pieces of equipment (4A-4C) of the supervised system (2) and sent to the central supervision system (10), the central supervision system (10) being characterized in that same includes modules configured for, in an operational phase:

- for each alarm received from the supervised system:
  I. obtaining (30) alarm data including at least one alarm identifier, a date of issue of the alarm;
  II. implementing (36, 38) a prediction model recorded beforehand for calculating a predicted management time depending on the alarm data,

III. calculating (40) an alarm processing priority rank depending on the predicted management time,

- displaying alarms received on a human-machine interface of the central supervision system in an order dependent on the priority rank of alarm processing.

14. The automatic alarm scheduling system according to claim 13, further including modules configured for, a learning phase, prior to the operational phase:

- for each alarm, receiving and storing alarm data including an identifier, a date of issue and an indication of the issuing equipment and/or a subsystem of the supervised system to which the issuing equipment belongs
- determining and storing alarm context parameters of said supervised system;
- for each alarm, calculating a management time equal to the time elapsed between the date of issue and a date of management by an operator supervising said alarm;
- Implementing a supervised learning algorithm of the parameter values of a prediction model used for calculating a predicted management time from stored alarm data and calculated management times.

15. The automatic alarm scheduling system according to claim 14, wherein the prediction model for calculating a predicted management time is a first prediction model, the system further including,

- a module configured for, in the learning phase for each alarm, calculating an alarm resolution time equal to the time elapsed between the date of issue and a date of resolution of the alarm, and a module configured for implementing a supervised learning algorithm of the parameter values of a second prediction model for calculating a predicted resolution time from the stored alarm data and the calculated resolution times, and
- a module configured for, for each alarm, in the operational phase, implementing a second prediction model recorded beforehand, for calculating a predicted resolution time of the alarm depending on alarm data.