

# **ENERGY MANAGEMENT METHOD AND SYSTEM BASED ON INTERNET OF THINGS**

## **TECHNICAL FIELD**

The present invention relates to the field of Internet of Things management, and in particular, to an energy management method and system based on the Internet of Things.

## **BACKGROUND**

With the development of China economy, a problem of high energy consumption in buildings has become increasingly notable. For existing buildings in China, energy-saving measures are taken for only a few part of the buildings. National economy is booming, great-leap-forward development of an industrialization process has been achieved, and there are increasing demands for energy in all walks of life. With the continuous popularization of the awareness of economic and environmental protection, in view of environmental problems caused by haze, a problem of energy conservation and emission reduction is particularly important.

During some situations of existing energy control, energy-saving devices are used to achieve energy conservation and emission reduction. However, for most devices, there is still a serious waste, management is extensive, and operating costs are excessively high.

## **SUMMARY**

An objective of the present invention is to provide an energy management method and system based on the Internet of Things, so as to reduce operating costs of building equipment, avoid an energy waste, and achieve energy conservation and emission reduction.

To achieve the above objective, the present invention provides the following technical solutions.

An energy management method based on the Internet of Things includes:

obtaining an operating parameter of a device, where the operating parameter of the device includes electric quantity, water consumption, fuel gas quantity, concentrated-cooling energy consumption, and concentrated hot-water supply quantity;

obtaining a building type to which the device belongs, where the building type includes an office building, a library, a stadium, a concert hall, a teaching building, a laboratory building, a hotel, a hospital, a dining hall, and an apartment;

determining whether the operating parameter of the device is greater than a specified threshold corresponding to the building type to which the device belongs, to obtain a first determining result;

triggering an alarm when the first determining result indicates that the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs, to alert a manager of the device; and

when the first determining result indicates that the operating parameter of the device is not greater than the specified threshold corresponding to the building type to which the device belongs, returning to obtain the operating parameter of the device.

Optionally, after the triggering an alarm when the first determining result indicates that the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs, to alert a manager of the device, the method further includes:

determining whether feedback information of the manager of the device is received within a specified time period, to obtain a second determining result;

when the second determining result indicates that no feedback information of the manager of the device is received within the specified time period, decreasing the operating parameter of the device to the specified threshold corresponding to the building type to which the device belongs;

when the second determining result indicates that feedback information of the manager of the device is received within the specified time period, determining, according to the feedback information, whether the operating parameter of the device satisfies a stored special condition, to obtain a third determining result, where the stored special condition includes a range of the operating parameter of the device corresponding to the building type in a specific case; and

when the third determining result indicates that the operating parameter of the device does not satisfy the stored special condition, decreasing the operating parameter of the device to the specified threshold corresponding to the building type to which the device belongs.

Optionally, before the determining whether the operating parameter of the device is greater than a specified threshold corresponding to the building type to which the device belongs, the method further includes:

determining whether the building type belongs to a special type to obtain a fourth determining result;

storing the operating parameter of the device when the fourth determining result indicates that the building type belongs to the special type; and

when the fourth determining result indicates that the building type does not belong to the special type, determining whether the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs.

Optionally, after the triggering an alarm when the first determining result indicates that the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs, to alert a manager of the device, the method further includes:

determining whether the operating parameter of the device is greater than a safety threshold corresponding to the building type, to obtain a fifth determining result, and

shutting down the device when the fifth determining result indicates that the operating parameter of the device is greater than the safety threshold corresponding to the building type.

Optionally, after the obtaining a building type to which the device belongs, the method further includes:

storing the operating parameter of the device according to an obtaining time and the building type, and

automatically generating a data report according to the stored data.

An energy management system based on the Internet of Things includes:

an operating parameter obtaining module, configured to obtain an operating parameter of a device, where the operating parameter of the device includes electric quantity, water consumption, fuel gas quantity, concentrated-cooling energy consumption, and concentrated hot-water supply quantity;

a building type obtaining module, configured to obtain a building type to which the device belongs, where the building type includes an office building, a library, a stadium, a concert hall, a teaching building, a laboratory building, a hotel, a hospital, a dining hall, and an apartment;

a first determining module, configured to determine whether the operating parameter of the device is greater than a specified threshold corresponding to the building type to which the device belongs, to obtain a first determining result;

an alarm trigger module, configured to trigger an alarm when the first determining result indicates that the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs, to alert a manager of the device; and

a returning module, configured to: when the first determining result indicates that the operating parameter of the device is not greater than the specified threshold corresponding to the building type to which the device belongs, return to obtain the operating parameter of the

device.

Optionally, the system further includes:

a second determining module, configured to: after the alarm is triggered when the first determining result indicates that the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs, to alert the manager of the device, determine whether feedback information of the manager of the device is received within a specified time period, to obtain a second determining result;

an operating parameter adjustment module, configured to: when the second determining result indicates that no feedback information of the manager of the device is received within the specified time period, decrease the operating parameter of the device to the specified threshold corresponding to the building type to which the device belongs; and

a third determining module, configured to: when the second determining result indicates that feedback information of the manager of the device is received within the specified time period, determine, according to the feedback information, whether the operating parameter of the device satisfies a stored special condition, to obtain a third determining result, where the stored special condition includes a range of the operating parameter of the device corresponding to the building type in a specific case, where

the operating parameter adjustment module is further configured to: when the third determining result indicates that the operating parameter of the device does not satisfy the stored special condition, decrease the operating parameter of the device to the specified threshold corresponding to the building type to which the device belongs.

Optionally, the system further includes:

a fourth determining module, configured to: before whether the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs is determined, determine whether the building type belongs to a special type to determine a fourth determining result, and

a first storage module, configured to store the operating parameter of the device when the fourth determining result indicates that the building type belongs to the special type, where

when the fourth determining result indicates that the building type does not belong to the special type, the first determining module is configured to determine whether the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs.

Optionally, the system further includes:

a fifth determining module, configured to: after the alarm is triggered when the first

determining result indicates that the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs, determine whether the operating parameter of the device is greater than a safety threshold corresponding to the building type, to obtain a fifth determining result, and

a device shutdown module, configured to shut down the device when the fifth determining result indicates that the operating parameter of the device is greater than the safety threshold corresponding to the building type.

Optionally, the system further includes:

a second storage module, configured to store the operating parameter of the device according to an obtaining time and the building type after the building type to which the device belongs is obtained; and

a report generation module, configured to automatically generate a data report according to the stored data.

According to specific embodiments provided in the present invention, the present invention discloses the following technical effects:

In the present invention, whether operating parameters of devices are normal is determined according to thresholds specified for different building types, to implement real-time monitoring of different devices in different buildings. When an operating parameter of a device exceeds a specified threshold, if there is no special circumstance, and when a specified time arrives, the operating parameter of the device is automatically adjusted to the specified threshold. When a staff feeds back that there is a special circumstance, the operating parameter of the device is not adjusted if the special circumstance conforms to stipulation. Therefore, humanized control of the device is implemented, operating costs of the device are reduced, and an effect of energy conservation and emission reduction is achieved.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

To describe the technical solutions in the embodiments of the present invention or in the prior art more clearly, the following briefly introduces the accompanying drawings required for describing the embodiments. Apparently, the accompanying drawings in the following description show merely some embodiments of the present invention, and a person of ordinary skill in the art may still derive other drawings from these accompanying drawings without creative efforts.

FIG. 1 is a schematic flowchart of an energy management method based on the Internet of Things according to the present invention; and

FIG. 2 is a schematic structural diagram of an energy management system based on the Internet of Things according to the present invention.

### **DETAILED DESCRIPTION**

The following clearly and completely describes the technical solutions in the embodiments of the present invention with reference to the accompanying drawings in the embodiments of the present invention. Apparently, the described embodiments are merely a part rather than all of the embodiments of the present invention. All other embodiments obtained by a person of ordinary skill in the art based on the embodiments of the present invention without creative efforts shall fall within the protection scope of the present invention.

To make objectives, features, and advantages of the present invention more comprehensible, the following describes the present invention in more detail with reference to accompanying drawings and specific implementations.

FIG. 1 is a schematic flowchart of an energy management method based on the Internet of Things according to the present invention. As shown in FIG. 1, the energy management method includes the following steps:

Step 100. Obtain an operating parameter of a device. The operating parameter of the device includes electric quantity, water consumption, fuel gas quantity, concentrated-cooling energy consumption, and concentrated hot-water supply quantity. Operating parameters of different devices are different. For example, for an air conditioning device, an obtained operating parameter is an electric quantity value, and for a water supply device, an obtained operating parameter is water consumption.

Step 200. Obtain a building type to which the device belongs. The building type includes an office building, a library, a stadium, a concert hall, a teaching building, a laboratory building, a hotel, a hospital, a dining hall, and an apartment. Each device needs to correspond to a building type to which the device belongs, and for different building types, requirements and limitations on operating parameters of devices are different.

After the operating parameter of the device and the building type to which the device belongs are determined, the operating parameter of the device is stored according to an obtaining time and the building type, and a data report is automatically generated according to the stored data.

Step 300. Determine whether the operating parameter of the device is greater than a specified threshold corresponding to the building type to which the device belongs. If yes, step

400 is performed; if no, the process returns to step 100 to re-obtain the operating parameter of the device. Specified thresholds corresponding to different building types are different. According to operating parameters and building types in a national regulation, energy conservation and emission reduction standards are preset, for example, a preset electric quantity value and a preset water consumption value.

Step 400. Trigger an alarm to alert a manager of the device. When the operating parameter of the device is greater than the specified threshold, a waste may exist. Therefore, the alarm is triggered to remind the manager of the device to perform examination and corresponding adjustment.

Then, there are two cases: One case is that a special circumstance causes the operating parameter of the device to be greater than the specified threshold, for example, when a special experiment is performed on a laboratory building, its power consumption exceeds a specified threshold, and in this case, a manager of the device may provide a feedback during a specified time period; and the other case is that there is no special circumstance, which is a case of energy waste.

Therefore, whether feedback information of the manager of the device is received within the specified time period is further determined, to obtain a second determining result.

When the second determining result indicates that no feedback information of the manager of the device is received within the specified time period, the operating parameter of the device is decreased to the specified threshold corresponding to the building type to which the device belongs. In this case, a case of energy waste occurs.

When the second determining result indicates that the feedback information of the manager of the device is received within the specified time period, it is determined, according to the feedback information, whether the operating parameter of the device satisfies a stored special condition, to obtain a third determining result. In this case, a reason why the manager feeds back that the operating parameter of the device is greater than the specified threshold is that there is a special circumstance; and whether the special circumstance satisfies a permitted special condition further needs to be determined. The stored special condition includes a range of the operating parameter of the device corresponding to the building type in a specific case, for example, a range of the operating parameter of the device during a meeting and a range of the operating parameter of the device in an emergency circumstance.

When the third determining result indicates that the operating parameter of the device does not satisfy the stored special condition, the operating parameter of the device is decreased to the specified threshold corresponding to the building type to which the device belongs. In this case,

a non-permitted special circumstance occurs, and the operating parameter of the device needs to decrease to the specified threshold, to achieve energy conservation and emission reduction.

For the feedback information of the manager of the device, in addition to a manner in which the above pre-stored special condition is used for automatic comparison, a manual check manner may also be used. When the feedback information of the manager of the device is received within the specified time period, the feedback information is uploaded to a control console for manual check; and when the check fails, the operating parameter of the device needs to decrease to the specified threshold, to achieve energy conservation and emission reduction.

For special devices in special buildings of some special industries, for example, an operating room, a resuscitation room, and the like in a hospital, before the determining whether the operating parameter of the device is greater than a specified threshold corresponding to the building type to which the device belongs, the following operation further need to be performed:

determining whether the building type belongs to a special type to obtain a fourth determining result, where the special type is a pre-stored special building of a special industry.

When the fourth determining result indicates that the building type belongs to the special type, the operating parameter of the device is stored. In this case, when the building type is the special type, normal operation of the device should be ensured. It is only required that an acquired operating parameter be stored without other control on the device, to avoid impact on the normal operation of the device.

When the fourth judgment result indicates that the building type does not belong to the special type, whether the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs further needs to be determined.

The energy management method in the present invention further includes: determining whether the operating parameter of the device is greater than a safety threshold corresponding to the building type, to obtain a fifth determining result, and shutting down the device when the fifth determining result indicates that the operating parameter of the device is greater than the safety threshold corresponding to the building type.

FIG. 2 is a schematic structural diagram of an energy management system based on the Internet of Things according to the present invention. As shown in FIG. 2, the energy management system includes:

an operating parameter obtaining module 201, configured to obtain an operating parameter

of a device, where the operating parameter of the device includes electric quantity, water consumption, fuel gas quantity, concentrated-cooling energy consumption, and concentrated hot-water supply quantity;

a building type obtaining module 202, configured to obtain a building type to which the device belongs, where the building type includes an office building, a library, a stadium, a concert hall, a teaching building, a laboratory building, a hotel, a hospital, a dining hall, and an apartment;

a first determining module 203, configured to determine whether the operating parameter of the device is greater than a specified threshold corresponding to the building type to which the device belongs, to obtain a first determining result;

an alarm trigger module 204, configured to trigger an alarm when the first determining result indicates that the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs, to alert a manager of the device; and

a returning module 205, configured to: when the first determining result indicates that the operating parameter of the device is not greater than the specified threshold corresponding to the building type to which the device belongs, return to obtain the operating parameter of the device.

The system further includes:

a second determining module, configured to: after the alarm is triggered when the first determining result indicates that the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs, to alert the manager of the device, determine whether feedback information of the manager of the device is received within a specified time period, to obtain a second determining result;

an operating parameter adjustment module, configured to: when the second determining result indicates that no feedback information of the manager of the device is received within the specified time period, decrease the operating parameter of the device to the specified threshold corresponding to the building type to which the device belongs; and

a third determining module, configured to: when the second determining result indicates that feedback information of the manager of the device is received within the specified time period, determine, according to the feedback information, whether the operating parameter of the device satisfies a stored special condition, to obtain a third determining result, where the stored special condition includes a range of the operating parameter of the device corresponding to the building type in a specific case.

The operating parameter adjustment module is further configured to: when the third determining result indicates that the operating parameter of the device does not satisfy the stored special condition, decrease the operating parameter of the device to the specified threshold corresponding to the building type to which the device belongs.

The system further includes:

a fourth determining module, configured to: before whether the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs is determined, determine whether the building type belongs to a special type to determine a fourth determining result, and

a first storage module, configured to store the operating parameter of the device when the fourth determining result indicates that the building type belongs to the special type.

When the fourth determining result indicates that the building type does not belong to the special type, the first determining module is configured to determine whether the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs.

The system further includes:

a fifth determining module, configured to: after the alarm is triggered when the first determining result indicates that the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs, determine whether the operating parameter of the device is greater than a safety threshold corresponding to the building type, to obtain a fifth determining result, and

a device shutdown module, configured to shut down the device when the fifth determining result indicates that the operating parameter of the device is greater than the safety threshold corresponding to the building type.

The system further includes:

a second storage module, configured to store the operating parameter of the device according to an obtaining time and the building type after the building type to which the device belongs is obtained; and

a report generation module, configured to automatically generate a data report according to the stored data.

Each embodiment of the present specification is described in a progressive manner, each embodiment focuses on the difference from other embodiments, and the same and similar parts between the embodiments may refer to each other. For a system disclosed in the embodiments, since it corresponds to the method disclosed in the embodiments, the description is relatively

simple, and reference can be made to the method description.

Several examples are used for illustration of the principles and implementation methods of the present invention. The description of the embodiments is used to help illustrate the method and its core principles of the present invention. In addition, those skilled in the art can make various modifications in terms of specific embodiments and scope of application in accordance with the teachings of the present invention. In conclusion, the content of this specification shall not be construed as a limitation to the invention.

**What is claimed is:**

1. An energy management method based on the Internet of Things, wherein the energy management method comprises:

obtaining an operating parameter of a device, wherein the operating parameter of the device comprises electric quantity, water consumption, fuel gas quantity, concentrated-cooling energy consumption, and concentrated hot-water supply quantity;

obtaining a building type to which the device belongs, wherein the building type comprises an office building, a library, a stadium, a concert hall, a teaching building, a laboratory building, a hotel, a hospital, a dining hall, and an apartment;

determining whether the operating parameter of the device is greater than a specified threshold corresponding to the building type to which the device belongs, to obtain a first determining result;

triggering an alarm when the first determining result indicates that the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs, to alert a manager of the device; and

when the first determining result indicates that the operating parameter of the device is not greater than the specified threshold corresponding to the building type to which the device belongs, returning to obtain the operating parameter of the device.

2. The energy management method according to claim 1, wherein after the triggering an alarm when the first determining result indicates that the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs, to alert a manager of the device, the method further comprises:

determining whether feedback information of the manager of the device is received within a specified time period, to obtain a second determining result;

when the second determining result indicates that no feedback information of the manager of the device is received within the specified time period, decreasing the operating parameter of the device to the specified threshold corresponding to the building type to which the device belongs;

when the second determining result indicates that feedback information of the manager of the device is received within the specified time period, determining, according to the feedback information, whether the operating parameter of the device satisfies a stored special condition, to obtain a third determining result, wherein the stored special condition comprises a range of the operating parameter of the device corresponding to the building type in a specific case; and

when the third determining result indicates that the operating parameter of the device does not satisfy the stored special condition, decreasing the operating parameter of the device to the specified threshold corresponding to the building type to which the device belongs.

3. The energy management method according to claim 1, wherein before the determining whether the operating parameter of the device is greater than a specified threshold corresponding to the building type to which the device belongs, the method further comprises:

determining whether the building type belongs to a special type to obtain a fourth determining result;

storing the operating parameter of the device when the fourth determining result indicates that the building type belongs to the special type; and

when the fourth determining result indicates that the building type does not belong to the special type, determining whether the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs.

4. The energy management method according to claim 1, wherein after the triggering an alarm when the first determining result indicates that the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs, to alert a manager of the device, the method further comprises:

determining whether the operating parameter of the device is greater than a safety threshold corresponding to the building type, to obtain a fifth determining result, and

shutting down the device when the fifth determining result indicates that the operating parameter of the device is greater than the safety threshold corresponding to the building type.

5. The energy management method according to claim 1, wherein after the obtaining a building type to which the device belongs, the method further comprises:

storing the operating parameter of the device according to an obtaining time and the building type, and

automatically generating a data report according to the stored data.

6. An energy management system based on the Internet of Things, wherein the energy management system comprises:

an operating parameter obtaining module, configured to obtain an operating parameter of a device, wherein the operating parameter of the device comprises electric quantity, water consumption, fuel gas quantity, concentrated-cooling energy consumption, and concentrated hot-water supply quantity;

a building type obtaining module, configured to obtain a building type to which the device belongs, wherein the building type comprises an office building, a library, a stadium, a concert hall, a teaching building, a laboratory building, a hotel, a hospital, a dining hall, and an apartment;

a first determining module, configured to determine whether the operating parameter of the device is greater than a specified threshold corresponding to the building type to which the device belongs, to obtain a first determining result;

an alarm trigger module, configured to trigger an alarm when the first determining result indicates that the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs, to alert a manager of the device; and

a returning module, configured to: when the first determining result indicates that the operating parameter of the device is not greater than the specified threshold corresponding to the building type to which the device belongs, return to obtain the operating parameter of the device.

7. The energy management system according to claim 6, wherein the system further comprises:

a second determining module, configured to: after the alarm is triggered when the first determining result indicates that the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs, to alert the manager of the device, determine whether feedback information of the manager of the device is received within a specified time period, to obtain a second determining result;

an operating parameter adjustment module, configured to: when the second determining result indicates that no feedback information of the manager of the device is received within the specified time period, decrease the operating parameter of the device to the specified threshold corresponding to the building type to which the device belongs; and

a third determining module, configured to: when the second determining result indicates that feedback information of the manager of the device is received within the specified time period, determine, according to the feedback information, whether the operating parameter of the device satisfies a stored special condition, to obtain a third determining result, wherein the stored special condition comprises a range of the operating parameter of the device corresponding to the building type in a specific case, wherein

the operating parameter adjustment module is further configured to: when the third

determining result indicates that the operating parameter of the device does not satisfy the stored special condition, decrease the operating parameter of the device to the specified threshold corresponding to the building type to which the device belongs.

8. The energy management system according to claim 6, wherein the system further comprises:

a fourth determining module, configured to: before whether the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs is determined, determine whether the building type belongs to a special type to determine a fourth determining result, and

a first storage module, configured to store the operating parameter of the device when the fourth determining result indicates that the building type belongs to the special type, wherein

when the fourth determining result indicates that the building type does not belong to the special type, the first determining module is configured to determine whether the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs.

9. The energy management system according to claim 6, wherein the system further comprises:

a fifth determining module, configured to: after the alarm is triggered when the first determining result indicates that the operating parameter of the device is greater than the specified threshold corresponding to the building type to which the device belongs, determine whether the operating parameter of the device is greater than a safety threshold corresponding to the building type, to obtain a fifth determining result, and

a device shutdown module, configured to shut down the device when the fifth determining result indicates that the operating parameter of the device is greater than the safety threshold corresponding to the building type.

10. The energy management system according to claim 6, wherein the system further comprises:

a second storage module, configured to store the operating parameter of the device according to an obtaining time and the building type after the building type to which the device belongs is obtained; and

a report generation module, configured to automatically generate a data report according to the stored data.