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(73) Titulaire(s):
HUANENG KANGBAO WIND ENERGY UTILIZATION CO., LTD. – 076650 Zhangjiakou City (China), HUADE COUNTY DADI TAIHONG WIND ENERGY UTILIZATION CO., LTD. – 013350 Ulanqab (China), KANGBAO COUNTY ZHONGNENG PHOTOVOLTAIC POWER GENERATION CO., LTD. – 076650 Zhangjiakou City (China), HUANENG ZHUOLU CLEAN ENERGY CO., LTD. – 075600 Zhangjiakou City (China), HUANENG TANGSHAN CAOFEIDIAN CLEAN ENERGY CO., LTD. – 063200 Tangshan City (China), HUANENG PINGSHAN CLEAN ENERGY CO., LTD. – 050400 Shijiazhuang City (China), WEIXIAN MAIN FRESH ENERGY CO., LTD. – 054700 Xingtai City (China), WEIXIAN ZE'EN VEGETABLE PLANTING CO., LTD. – 054700 Xingtai City (China), YIXIAN NENGWEI NEW ENERGY CO., LTD. – 074200 Baoding City (China), SHANGYI GUOLANG NEW ENERGY CO., LTD. – 076750 Zhangjiakou City (China)

(72) Inventeur(s):
WU Jianxin – China, WANG Li – China, ZHANG Rui – China, QIAN Kai – China, LU Hongxia – China

(74) Mandataire(s):
IP SHIELD – 1616 Luxembourg (Luxembourg)

(54) **GRID-CONNECTED DECENTRALIZED ENERGY STORAGE SYSTEM.**

57 The present invention relates to the technical field of electric power storage and discloses a grid-connected decentralized energy storage system, comprising: an acquisition module, a determination module, a judgment module, and a setting module. The acquisition module is used to deploy multiple distributed energy storage units, each energy storage unit containing at least one energy storage device, and to acquire corresponding power data of the power equipment based on the energy storage units, wherein the power data includes voltage power data and current power data. The determination module is used to analyze the power data and determine the power storage-related values between each piece of power equipment. The judgment module is used to judge whether to perform energy storage on all the power equipment based on the power storage-related values and power storage-related thresholds. The setting module is used to set the next sampling period based on the power storage values when it is judged that not all the power equipment should perform energy storage. This invention can achieve intelligent decentralized energy storage, balance grid load, improve energy utilization efficiency, and reduce system operation costs.

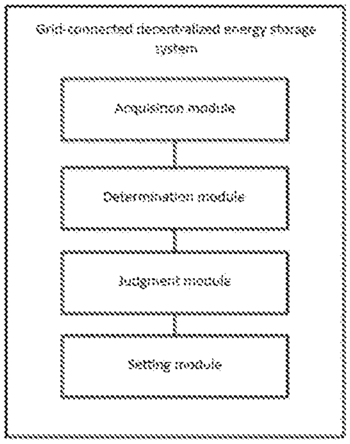

FIG.1

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GRID-CONNECTED DECENTRALIZED ENERGY STORAGE SYSTEM

Technical Field

The present invention relates to the field of electric power storage, specifically to a grid-connected decentralized energy storage system.

Background Technology

With the global shift in the energy structure and the increasing maturity of renewable energy technologies, the proportion of clean energy such as solar and wind power in power systems has been rising annually. These renewable energy sources have the advantages of being environmentally friendly and sustainable, but their intermittent and unstable nature presents new challenges to the stability, safety, and reliability of the power grid. To effectively utilize these clean energy sources and ensure the efficient and stable operation of the grid, energy storage systems have become a key technology.

In the existing technology, each energy storage unit typically uses batteries, supercapacitors, or flywheels as energy storage media. These units are designed to be modular, allowing for rapid deployment and expansion based on actual needs. However, such traditional centralized energy storage systems generally respond slowly and cannot adapt to the rapid changes in grid load in real-time. Although existing decentralized energy storage systems have made some improvements, they still suffer from inflexible scheduling and untimely response issues. Moreover, existing decentralized energy storage systems can only judge whether to store energy for a single piece of power equipment, without coordinating with other power equipment. They cannot make energy storage decisions based on all the power equipment, resulting in a rather singular approach to energy storage judgment.

Summary of the Invention

The embodiments of the present invention provide a grid-connected decentralized energy storage system to solve the technical problems in the existing technology, including the inability to achieve intelligent energy storage, balance grid load, improve energy utilization efficiency, and reduce system operating costs.

In order to achieve the above purpose, the present invention provides a grid-connected decentralized energy storage system comprising:

An acquisition module, used to deploy multiple distributed energy storage units, each energy storage unit containing at least one energy storage device, to acquire corresponding power data of the power equipment based on the energy storage units, wherein the power data includes voltage power data and current power data;

A determination module, used to analyze the power data and determine the power storage-related values between each piece of power equipment;

A judgment module, used to judge whether to perform energy storage on all the power equipment based on the power storage-related values and power storage-related thresholds;

A setting module, used to set the next sampling period based on the power storage values when it is judged that not all the power equipment should perform energy storage.

Further, the acquisition module is used for:

Utilizing at least one sensor device to monitor the voltage and current parameters of the power equipment in real-time;

Converting the monitored voltage and current parameters into digital signals through an analog-to-digital converter;

Filtering the digital signals based on Kalman filtering to remove noise and interference;

Executing data analysis algorithms on the filtered digital signals to extract key performance indicators of the power system;

Storing the analyzed key performance indicators data in a database;

Further screening and integrating the data in the database according to preset conditions and rules to generate voltage power data and current power data.

Further, the determination module is used for:

Generating sub-data packets for the power data corresponding to each piece of power equipment, and generating a power equipment sequence A based on all the sub-data packets, wherein A={a1, a2, a3, ..., an}, n is the number of sub-data packets, an={Δbn, Δen}, Δbn is the current power data corresponding to the sub-data packet an, and Δen is the voltage power data corresponding to the sub-data packet an;

Matching each sub-data packet in the power equipment sequence A with the related database to obtain the first correlation factor and calculating the sum to get the first correlation factor and value;

Extracting the voltage power data of sub-data packet a1, extracting the current power data of sub-data packet a2, determining the second correlation factor based on the extracted voltage power data and current power data, extracting the voltage power data and current power data of the remaining adjacent sub-data packets in sequence, calculating the corresponding correlation factors, and constructing a second correlation factor set based on the calculated correlation factors and the second correlation factor;

Calculating the comprehensive correlation factor and value based on the second correlation factor set;

Calculating the power storage-related value between each piece of power equipment based on the first correlation factor and value and the comprehensive correlation factor and value.

Further, the determination module is used for:

Calculating the power storage-related value between each piece of power equipment according to the following formula:

$X = y(p1) + y(p2)$;

wherein X is the power storage-related value between each piece of power equipment, y(p1) is a calculation function determined based on the first correlation factor and value, and y(p2) is a calculation function determined based on the comprehensive correlation factor and value.

Further, the determination module is used for:

Acquiring the preset first preset correlation factor and second preset correlation factor;

Dividing the correlation factors in the second correlation factor set that are less than or equal to the first preset correlation factor into the low correlation factor set;

Dividing the correlation factors in the second correlation factor set that are greater than the first preset correlation factor and less than the second preset correlation factor into the medium correlation factor set;

Dividing the correlation factors in the second correlation factor set that are greater than or equal to the second preset correlation factor into the high correlation factor set;

Calculating the comprehensive correlation factor and value based on the low correlation factor set, the medium correlation factor set, and the high correlation factor set.

Further, the determination module is used for:

Counting the number of low correlation factors in the low correlation factor set, the number of medium correlation factors in the medium correlation factor set, and the number of high correlation factors in the high correlation factor set;

Calculating the comprehensive correlation factor and value based on the number of low correlation factors, the number of medium correlation factors, and the number of high correlation factors;

Calculating the comprehensive correlation factor and value according to the following formula:

$$G = \frac{Q1 + Q3}{Q1 + Q2 + Q3} \times \ln\left(2 + \frac{\max(\mathrm{Q1},\ \mathrm{Q3})}{\mathrm{Q1} + \mathrm{Q3}}\right) \times \mathrm{h};$$

wherein G is the comprehensive correlation factor and value, Q1 is the number of low correlation factors, Q2 is the number of medium correlation factors, Q3 is the number of high correlation factors, and h is the optimization coefficient of the comprehensive correlation factor and value.

Further, the determination module is used for:

Determining the optimization coefficient h of the comprehensive correlation factor and value according to the following steps:

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Calculating the number and value of the low correlation factors and the high correlation factors;

Presetting the first preset optimization coefficient h1, the second preset optimization coefficient h2, and the third preset optimization coefficient h3;

Setting the first preset optimization coefficient h1 as the optimization coefficient of the comprehensive correlation factor and value when the first preset condition is identified, i.e., h = h1;

Setting the second preset optimization coefficient h2 as the optimization coefficient of the comprehensive correlation factor and value when the second preset condition is identified, i.e., h = h2;

Setting the third preset optimization coefficient h3 as the optimization coefficient of the comprehensive correlation factor and value when the third preset condition is identified, i.e., h = h3; wherein,

the first preset condition is that the number of medium correlation factors is less than the number and value, the second preset condition is that the number of medium correlation factors is equal to the number and value, and the third preset condition is that the number of medium correlation factors is greater than the number and value.

Further, the judgment module is used for:

Judging not to perform energy storage on all the power equipment when the power storage-related value is less than the power storage-related threshold;

Judging to perform energy storage on all the power equipment when the power storage-related value is greater than or equal to the power storage-related threshold.

Further, the setting module is used for:

Acquiring the application direction of each piece of power equipment, acquiring the first weight of the power equipment based on the application direction-weight mapping table;

Acquiring the second weight of the power equipment based on the power storage-related value-weight mapping table;

Setting the next sampling period based on the first weight and the second weight;

Setting the next sampling period according to the following formula:

$$T=\frac{\sum_{j=1}^{m}\left(r1j^{2}+r2j^{2}\right)}{m};$$

wherein T is the next sampling period, m is the number of power equipment, $r1j^2$ is the first weight of the j-th power equipment, and $r2j^2$ is the second weight of the j-th power equipment.

The beneficial effects of the present invention compared to the existing technology are as follows:

The present invention discloses a grid-connected decentralized energy storage system, comprising: an acquisition module, a determination module, a judgment module, and a setting module. The acquisition module is used to deploy multiple distributed energy storage units, each energy storage unit containing at least one energy storage device, and to acquire corresponding power data of the power equipment based on the energy storage units, wherein the power data includes voltage power data and current power data. The determination module is used to analyze the power data and determine the power storage-related values between each piece of power equipment. The judgment module is used to judge whether to perform energy storage on all the power equipment based on the power storage-related values and power storage-related thresholds. The setting module is used to set the next sampling period based on the power storage values when it is judged that not all the power equipment should perform energy storage. This invention can achieve intelligent decentralized energy storage, balance grid load, improve energy utilization efficiency, and reduce system operation costs.

Description of the Drawings

By reading the detailed description of the preferred embodiments below, various other advantages and benefits will become apparent to those skilled in the art. The drawings are merely for illustrating the preferred embodiments and are not considered as a limitation of the present invention. In the drawings, the same reference numerals denote the same parts throughout the figures.

FIG.1: a schematic structural diagram of a grid-connected decentralized energy

storage system according to an embodiment of the present invention.

Specific Embodiments

The specific embodiments of the present invention will be further described in detail below with reference to the accompanying drawings and examples. The following examples are intended to illustrate the present invention but are not intended to limit its scope.

In the description of the present application, it should be understood that the terms “center,” “upper,” “lower,” “front,” “rear,” “left,” “right,” “vertical,” “horizontal,” “top,” “bottom,” “inner,” “outer,” etc. indicating orientation or positional relationships are based on the orientations or positional relationships shown in the drawings. These terms are intended to facilitate the description of the present application and to simplify the description, rather than indicating or implying that the referred device or element must have a specific orientation, be constructed, and operate in a specific orientation, and therefore should not be construed as limiting the present application.

The terms “first” and “second” are used for descriptive purposes only and should not be construed as indicating or implying relative importance or implicitly specifying the number of technical features indicated. Thus, features defined as “first” and “second” may explicitly or implicitly include one or more of these features. In the description of the present application, “multiple” means two or more unless otherwise specified.

In the description of the present application, it should be noted that unless otherwise specified and limited, the terms “mounted,” “connected,” and “coupled” should be understood in a broad sense. For example, they can be fixed connections, detachable connections, or integral connections; they can be mechanical connections or electrical connections; they can be direct connections or indirect connections through an intermediary, and they can be internal communication between two elements. Those skilled in the art can understand the specific meanings of the above terms in the present application according to specific situations.

The following is a detailed description of the preferred embodiments of the present invention in conjunction with the accompanying drawings.

As shown in FIG.1, an embodiment of the present invention discloses a grid-connected decentralized energy storage system, comprising:

An acquisition module, used to deploy multiple distributed energy storage units, each energy storage unit containing at least one energy storage device, to acquire corresponding power data of the power equipment based on the energy storage units, wherein the power data includes voltage power data and current power data;

A determination module, used to analyze the power data and determine the power storage-related values between each piece of power equipment;

A judgment module, used to judge whether to perform energy storage on all the power equipment based on the power storage-related values and power storage-related thresholds;

A setting module, used to set the next sampling period based on the power storage values when it is judged that not all the power equipment should perform energy storage.

The beneficial effects of the above technical solutions are: the present invention can achieve intelligent decentralized energy storage, balance grid load, improve energy utilization efficiency, and reduce system operating costs.

In some embodiments of the present application, the acquisition module is used for:

Utilizing at least one sensor device to monitor the voltage and current parameters of the power equipment in real-time;

Converting the monitored voltage and current parameters into digital signals through an analog-to-digital converter;

Filtering the digital signals based on Kalman filtering to remove noise and interference;

Executing data analysis algorithms on the filtered digital signals to extract key performance indicators of the power system;

Storing the analyzed key performance indicators data in a database;

Further screening and integrating the data in the database according to preset conditions and rules to generate voltage power data and current power data.

In this embodiment, the sensor device includes a voltage sensor and a current sensor.

The beneficial effect of the above technical solution is that the invention further screens and integrates the data in the database according to preset conditions and rules to generate voltage power data and current power data, laying a foundation for decentralized energy storage for all power equipment.

In some embodiments of the present application, the determination module is used for:

Generating sub-data packets for the power data corresponding to each piece of power equipment, and generating a power equipment sequence A based on all the sub-data packets, wherein A={a1, a2, a3, ..., an}, n is the number of sub-data packets, an={Δbn, Δen}, Δbn is the current power data corresponding to the sub-data packet an, and Δen is the voltage power data corresponding to the sub-data packet an;

Matching each sub-data packet in the power equipment sequence A with the related database to obtain the first correlation factor and calculating the sum to get the first correlation factor and value;

Extracting the voltage power data of sub-data packet a1, extracting the current power data of sub-data packet a2, determining the second correlation factor based on the extracted voltage power data and current power data, extracting the voltage power data and current power data of the remaining adjacent sub-data packets in sequence, calculating the corresponding correlation factors, and constructing a second correlation factor set based on the calculated correlation factors and the second correlation factor;

Calculating the comprehensive correlation factor and value based on the second correlation factor set;

Calculating the power storage-related value between each piece of power equipment based on the first correlation factor and value and the comprehensive correlation factor and value.

In this embodiment, each piece of power equipment has a corresponding sub-data packet, and each sub-data packet includes voltage power data and current power data.

In this embodiment, each sub-data packet corresponds to a first correlation factor.

In this embodiment, each voltage power data corresponds to a correlation factor, and each current power data also corresponds to a correlation factor. The sum of these two correlation factors is used as the second correlation factor.

The beneficial effect of the above technical solution is that the invention calculates the power storage-related value between each piece of power equipment based on the first correlation factor and value and the comprehensive correlation factor and value, thereby laying a foundation for decentralized energy storage and avoiding the singularity of the energy storage method in the existing technology.

In some embodiments of the present application, the determination module is used for:

Calculating the power storage-related value between each piece of power equipment according to the following formula:

$X = y(p1) + y(p2)$;

wherein X is the power storage-related value between each piece of power equipment, y(p1) is a calculation function determined based on the first correlation factor and value, and y(p2) is a calculation function determined based on the comprehensive correlation factor and value.

In some embodiments of the present application, the determination module is used for:

Acquiring the preset first preset correlation factor and second preset correlation factor;

Dividing the correlation factors in the second correlation factor set that are less than or equal to the first preset correlation factor into the low correlation factor set;

Dividing the correlation factors in the second correlation factor set that are greater than the first preset correlation factor and less than the second preset correlation factor into the medium correlation factor set;

Dividing the correlation factors in the second correlation factor set that are greater than or equal to the second preset correlation factor into the high correlation factor set;

Calculating the comprehensive correlation factor and value based on the low correlation factor set, the medium correlation factor set, and the high correlation factor set.

In this embodiment, the first preset correlation factor is less than the second preset correlation factor.

The beneficial effect of the above technical solution is that the invention calculates the comprehensive correlation factor and value based on the low correlation factor set, the medium correlation factor set, and the high correlation factor set, thereby providing data support for the calculation of the power storage-related value, ensuring data calculation accuracy, and avoiding large errors.

In some embodiments of the present application, the determination module is used for:

Counting the number of low correlation factors in the low correlation factor set, the number of medium correlation factors in the medium correlation factor set, and the number of high correlation factors in the high correlation factor set;

Calculating the comprehensive correlation factor and value based on the number of low correlation factors, the number of medium correlation factors, and the number of high correlation factors;

Calculating the comprehensive correlation factor and value according to the following formula:

$$G=\frac{Q1+Q3}{Q1+Q2+Q3}\times\ln\left(2+\frac{\max(\mathrm{Q1},\ \mathrm{Q3})}{\mathrm{Q1}+\mathrm{Q3}}\right)\times \mathrm{h};$$

wherein G is the comprehensive correlation factor and value, Q1 is the number of low correlation factors, Q2 is the number of medium correlation factors, Q3 is the number of high correlation factors, and h is the optimization coefficient of the comprehensive correlation factor and value.

In some embodiments of the present application, the determination module is used for:

Determining the optimization coefficient h of the comprehensive correlation factor and value according to the following steps:

Calculating the number and value of the low correlation factors and the high correlation factors;

Presetting the first preset optimization coefficient h1, the second preset optimization coefficient h2, and the third preset optimization coefficient h3;

Setting the first preset optimization coefficient h1 as the optimization coefficient of the comprehensive correlation factor and value when the first preset condition is identified, i.e., h = h1;

Setting the second preset optimization coefficient h2 as the optimization coefficient of the comprehensive correlation factor and value when the second preset condition is identified, i.e., h = h2;

Setting the third preset optimization coefficient h3 as the optimization coefficient of the comprehensive correlation factor and value when the third preset condition is identified, i.e., h = h3; wherein,

the first preset condition is that the number of medium correlation factors is less than the number and value, the second preset condition is that the number of medium correlation factors is equal to the number and value, and the third preset condition is that the number of medium correlation factors is greater than the number and value.

In this embodiment, 0.8 < first preset optimization coefficient h1 < second preset optimization coefficient h2 < third preset optimization coefficient h3 < 1.2.

The beneficial effect of the above technical solution is that the invention selects the corresponding optimization coefficient based on the relationship between the number of medium correlation factors and the sum, thereby achieving dynamic adjustment of the comprehensive correlation factor and value, further ensuring calculation accuracy.

In some embodiments of the present application, the judgment module is used for:

Judging not to perform energy storage on all the power equipment when the power storage-related value is less than the power storage-related threshold;

Judging to perform energy storage on all the power equipment when the power storage-related value is greater than or equal to the power storage-related threshold.

The beneficial effect of the above technical solution is that the invention judges whether to perform energy storage on all the power equipment based on the power storage-related value and the power storage-related threshold, achieving accurate judgment and avoiding the singularity of decentralized energy storage.

In some embodiments of the present application, acquiring the application direction of each piece of power equipment, acquiring the first weight of the power equipment based on the application direction-weight mapping table;

Acquiring the second weight of the power equipment based on the power storage-related value-weight mapping table;

Setting the next sampling period based on the first weight and the second weight;

Setting the next sampling period according to the following formula:

$$T = \frac{\sum_{j=1}^{m}\left(r1j^2 + r2j^2\right)}{m};$$

wherein T is the next sampling period, m is the number of power equipment, $r1j^2$ is the first weight of the j-th power equipment, and $r2j^2$ is the second weight of the j-th power equipment.

In this embodiment, the application directions include high-voltage transmission lines, transformers, circuit breakers, distribution boxes, switches, protection devices, etc.

In this embodiment, the application direction-weight mapping table and the power storage-related value-weight mapping table are preset based on historical data.

The beneficial effect of the above technical solution is that the invention sets the next sampling period based on the first weight and the second weight, ensuring the timeliness and real-time nature of decentralized energy storage for power equipment, and avoiding large delays.

In the description of the above embodiments, specific features, structures, materials, or characteristics can be combined in any suitable way in one or more embodiments or examples.

Although the present invention has been described in detail with reference to the foregoing embodiments, various modifications can be made without departing from the scope of the present invention, and equivalents can be substituted for parts thereof. In particular, as long as there is no structural conflict, the features disclosed in the embodiments of the present invention can be combined with each other in any way. The description of these combinations is omitted in this specification merely for the sake of brevity and resource saving.

It is understood by those skilled in the art that the above embodiments are merely preferred embodiments of the present invention and are not intended to limit the present invention. Although the present invention has been described in detail with reference to the foregoing embodiments, those skilled in the art can still modify the technical solutions described in the foregoing embodiments or make equivalent replacements for some of the technical features. All modifications, equivalent replacements, and improvements within the spirit and principle of the present invention should be included in the protection scope of the present invention.

CLAIMS

1. A grid-connected decentralized energy storage system, wherein comprising:

An acquisition module, used to deploy multiple distributed energy storage units, each energy storage unit containing at least one energy storage device, to acquire corresponding power data of the power equipment based on the energy storage units, wherein the power data comprises voltage power data and current power data;

A determination module, used to analyze the power data and determine the power storage-related values between each piece of power equipment;

A judgment module, used to judge whether to perform energy storage on all the power equipment based on the power storage-related values and power storage-related thresholds;

A setting module, used to set the next sampling period based on the power storage values when it is judged that not all the power equipment should perform energy storage.

2. The grid-connected decentralized energy storage system according to claim 1, wherein the acquisition module is used for:

Utilizing at least one sensor device to monitor the voltage and current parameters of the power equipment in real-time;

Converting the monitored voltage and current parameters into digital signals through an analog-to-digital converter;

Filtering the digital signals based on Kalman filtering to remove noise and interference;

Executing data analysis algorithms on the filtered digital signals to extract key performance indicators of the power system;

Storing the analyzed key performance indicators data in a database;

Further screening and integrating the data in the database according to preset conditions and rules to generate voltage power data and current power data.

3. The grid-connected decentralized energy storage system according to claim 1, wherein the determination module is used for:

Generating sub-data packets for the power data corresponding to each piece of power equipment, and generating a power equipment sequence A based on all the sub-data packets, wherein A={a1, a2, a3, ..., an}, n is the number of sub-data packets, an={Δbn, Δen}, Δbn is the current power data corresponding to the sub-data packet an, and Δen is the voltage power data corresponding to the sub-data packet an;

Matching each sub-data packet in the power equipment sequence A with the related database to obtain the first correlation factor and calculating the sum to get the first correlation factor and value;

Extracting the voltage power data of sub-data packet a1, extracting the current power data of sub-data packet a2, determining the second correlation factor based on the extracted voltage power data and current power data, extracting the voltage power data and current power data of the remaining adjacent sub-data packets in sequence, calculating the corresponding correlation factors, and constructing a second correlation factor set based on the calculated correlation factors and the second correlation factor;

Calculating the comprehensive correlation factor and value based on the second correlation factor set;

Calculating the power storage-related value between each piece of power equipment based on the first correlation factor and value and the comprehensive correlation factor and value.

4. The grid-connected decentralized energy storage system according to claim 3, wherein the determination module is used for:

Calculating the power storage-related value between each piece of power equipment according to the following formula:

$X = y(p1) + y(p2)$;

wherein X is the power storage-related value between each piece of power equipment, y(p1) is a calculation function determined based on the first correlation factor and value, and y(p2) is a calculation function determined based on the comprehensive correlation factor and value.

5. The grid-connected decentralized energy storage system according to claim 3, wherein the determination module is used for:

Acquiring the preset first preset correlation factor and second preset correlation factor;

Dividing the correlation factors in the second correlation factor set that are less than or equal to the first preset correlation factor into the low correlation factor set;

Dividing the correlation factors in the second correlation factor set that are greater than the first preset correlation factor and less than the second preset correlation factor into the medium correlation factor set;

Dividing the correlation factors in the second correlation factor set that are greater than or equal to the second preset correlation factor into the high correlation factor set;

Calculating the comprehensive correlation factor and value based on the low correlation factor set, the medium correlation factor set, and the high correlation factor set.

6. The grid-connected decentralized energy storage system according to claim 5, wherein the determination module is used for:

Counting the number of low correlation factors in the low correlation factor set, the number of medium correlation factors in the medium correlation factor set, and the number of high correlation factors in the high correlation factor set;

Calculating the comprehensive correlation factor and value based on the number of low correlation factors, the number of medium correlation factors, and the number of high correlation factors;

Calculating the comprehensive correlation factor and value according to the following formula:

$$G = \frac{Q1 + Q3}{Q1 + Q2 + Q3} \times \ln\left(2 + \frac{\max(Q1, Q3)}{Q1 + Q3}\right) \times h;$$

wherein G is the comprehensive correlation factor and value, Q1 is the number of low correlation factors, Q2 is the number of medium correlation factors, Q3 is the number of high correlation factors, and h is the optimization coefficient of the comprehensive correlation factor and value.

7. The grid-connected decentralized energy storage system according to claim 6, wherein the determination module is used for:

Determining the optimization coefficient h of the comprehensive correlation factor and value according to the following steps:

Calculating the number and value of the low correlation factors and the high correlation factors;

Presetting the first preset optimization coefficient h1, the second preset optimization coefficient h2, and the third preset optimization coefficient h3;

Setting the first preset optimization coefficient h1 as the optimization coefficient of the comprehensive correlation factor and value when the first preset condition is identified, i.e., h = h1;

Setting the second preset optimization coefficient h2 as the optimization coefficient of the comprehensive correlation factor and value when the second preset condition is identified, i.e., h = h2;

Setting the third preset optimization coefficient h3 as the optimization coefficient of the comprehensive correlation factor and value when the third preset condition is identified, i.e., h = h3; wherein,

the first preset condition is that the number of medium correlation factors is less than the number and value, the second preset condition is that the number of medium correlation factors is equal to the number and value, and the third preset condition is that the number of medium correlation factors is greater than the number and value.

8. The grid-connected decentralized energy storage system according to claim 1,

wherein the judgment module is used for:

Judging not to perform energy storage on all the power equipment when the power storage-related value is less than the power storage-related threshold;

Judging to perform energy storage on all the power equipment when the power storage-related value is greater than or equal to the power storage-related threshold.

9. The grid-connected decentralized energy storage system according to claim 1, wherein the setting module is used for:

Acquiring the application direction of each piece of power equipment, acquiring the first weight of the power equipment based on the application direction-weight mapping table;

Acquiring the second weight of the power equipment based on the power storage-related value-weight mapping table;

Setting the next sampling period based on the first weight and the second weight;

Setting the next sampling period according to the following formula:

$$T = \frac{\sum_{j=1}^{m}\left(r1j^2 + r2j^2\right)}{m};$$

wherein T is the next sampling period, m is the number of power equipment, $r1j^2$ is the first weight of the j-th power equipment, and $r2j^2$ is the second weight of the j-th power equipment.

REVENDICATIONS

1. Un système de stockage d'énergie décentralisé connecté au réseau, comprenant :

Un module d'acquisition, utilisé pour déployer plusieurs unités de stockage d'énergie distribuées, chaque unité de stockage d'énergie contenant au moins un dispositif de stockage d'énergie, pour acquérir les données de puissance correspondantes des équipements électriques basées sur les unités de stockage d'énergie, les données de puissance comprenant les données de puissance de tension et les données de puissance de courant ;

Un module de détermination, utilisé pour analyser les données de puissance et déterminer les valeurs liées au stockage d'énergie entre chaque équipement électrique ;

Un module de jugement, utilisé pour juger s'il faut effectuer le stockage d'énergie sur tous les équipements électriques en fonction des valeurs liées au stockage d'énergie et des seuils liés au stockage d'énergie ;

Un module de réglage, utilisé pour définir la prochaine période d'échantillonnage en fonction des valeurs de stockage d'énergie lorsqu'il est jugé que tous les équipements électriques ne doivent pas effectuer de stockage d'énergie.

2. Le système de stockage d'énergie décentralisé connecté au réseau selon la revendication 1, où le module d'acquisition est utilisé pour :

Utiliser au moins un dispositif de capteur pour surveiller les paramètres de tension et de courant des équipements électriques en temps réel ;

Convertir les paramètres de tension et de courant surveillés en signaux numériques via un convertisseur analogique-numérique ;

Filtrer les signaux numériques basés sur le filtrage de Kalman pour éliminer le bruit et les interférences ;

Exécuter des algorithmes d'analyse de données sur les signaux numériques filtrés pour extraire les indicateurs de performance clés du système électrique ;

Stocker les données des indicateurs de performance clés analysées dans une base de données ;

Filtrer et intégrer davantage les données dans la base de données selon des conditions et des règles prédéfinies pour générer des données de puissance de tension et des données de puissance de courant.

3. Le système de stockage d'énergie décentralisé connecté au réseau selon la revendication 1, où le module de détermination est utilisé pour :

Générer des sous-paquets de données pour les données de puissance correspondant à chaque équipement électrique, et générer une séquence d'équipements électriques A basée sur tous les sous-paquets de données, où A={a1, a2, a3, ..., an}, n étant le nombre de sous-paquets de données, an={Δbn, Δen}, Δbn étant les données de puissance de courant correspondant au sous-paquet de données an, et Δen étant les données de puissance de tension correspondant au sous-paquet de données an ;

Faire correspondre chaque sous-paquet de données dans la séquence d'équipements électriques A avec la base de données associée pour obtenir le premier facteur de corrélation et calculer la somme pour obtenir la valeur du premier facteur de corrélation ;

Extraire les données de puissance de tension du sous-paquet de données a1, extraire les données de puissance de courant du sous-paquet de données a2, déterminer le second facteur de corrélation basé sur les données de puissance de tension et de courant extraites, extraire les données de puissance de tension et de courant des sous-paquets de données adjacents restants dans l'ordre, calculer les facteurs de corrélation correspondants, et construire un ensemble de seconds facteurs de corrélation basé sur les facteurs de corrélation calculés et le second facteur de corrélation ;

Calculer le facteur de corrélation global et la valeur basée sur l'ensemble de seconds facteurs de corrélation ;

Calculer la valeur liée au stockage d'énergie entre chaque équipement électrique basé sur le premier facteur de corrélation et la valeur, ainsi que le facteur de corrélation global et la valeur.

4. Le système de stockage d'énergie décentralisé connecté au réseau selon la revendication 3, où le module de détermination est utilisé pour :

Calculer la valeur liée au stockage d'énergie entre chaque équipement électrique selon la formule suivante :

$X = y(p1) + y(p2)$;

où X est la valeur liée au stockage d'énergie entre chaque équipement électrique, y(p1) est une fonction de calcul déterminée en fonction du premier facteur de corrélation et de la valeur, et y(p2) est une fonction de calcul déterminée en fonction du facteur de corrélation global et de la valeur.

5. Le système de stockage d'énergie décentralisé connecté au réseau selon la revendication 3, où le module de détermination est utilisé pour :

Acquérir le premier facteur de corrélation prédéfini et le second facteur de corrélation prédéfini ;

Diviser les facteurs de corrélation dans l'ensemble de seconds facteurs de corrélation qui sont inférieurs ou égaux au premier facteur de corrélation prédéfini en un ensemble de facteurs de corrélation faibles ;

Diviser les facteurs de corrélation dans l'ensemble de seconds facteurs de corrélation qui sont supérieurs au premier facteur de corrélation prédéfini et inférieurs au second facteur de corrélation prédéfini en un ensemble de facteurs de corrélation moyens ;

Diviser les facteurs de corrélation dans l'ensemble de seconds facteurs de corrélation qui sont supérieurs ou égaux au second facteur de corrélation prédéfini en un ensemble de facteurs de corrélation élevés ;

Calculer le facteur de corrélation global et la valeur basés sur l'ensemble de facteurs de corrélation faibles, l'ensemble de facteurs de corrélation moyens et l'ensemble de facteurs de corrélation élevés.

6. Le système de stockage d'énergie décentralisé connecté au réseau selon la revendication 5, où le module de détermination est utilisé pour :

Compter le nombre de facteurs de corrélation faibles dans l'ensemble de facteurs de corrélation faibles, le nombre de facteurs de corrélation moyens dans l'ensemble de facteurs de corrélation moyens, et le nombre de facteurs de corrélation élevés dans l'ensemble de facteurs de corrélation élevés ;

Calculer le facteur de corrélation global et la valeur en fonction du nombre de facteurs de corrélation faibles, du nombre de facteurs de corrélation moyens et du nombre de facteurs de corrélation élevés ;

Calculer le facteur de corrélation global et la valeur selon la formule suivante :

$$G = \frac{Q1 + Q3}{Q1 + Q2 + Q3} \times \ln\left(2 + \frac{\max(\mathrm{Q1},\ \mathrm{Q3})}{\mathrm{Q1} + \mathrm{Q3}}\right) \times \mathrm{h};$$

où G est le facteur de corrélation global et la valeur, Q1 est le nombre de facteurs de corrélation faibles, Q2 est le nombre de facteurs de corrélation moyens, Q3 est le nombre de facteurs de corrélation élevés, et h est le coefficient d'optimisation du facteur de corrélation global et de la valeur.

7. Le système de stockage d'énergie décentralisé connecté au réseau selon la revendication 6, où le module de détermination est utilisé pour :

Déterminer le coefficient d'optimisation h du facteur de corrélation global et de la valeur selon les étapes suivantes :

Calculer le nombre et la valeur des facteurs de corrélation faibles et des facteurs de corrélation élevés ;

Prédéfinir le premier coefficient d'optimisation prédéfini h1, le second coefficient d'optimisation prédéfini h2 et le troisième coefficient d'optimisation prédéfini h3 ;

Définir le premier coefficient d'optimisation prédéfini h1 comme le coefficient d'optimisation du facteur de corrélation global et de la valeur lorsque la première condition prédéfinie est identifiée, c'est-à-dire h = h1 ;

Définir le second coefficient d'optimisation prédéfini h2 comme le coefficient d'optimisation du facteur de corrélation global et de la valeur lorsque la seconde condition prédéfinie est identifiée, c'est-à-dire h = h2 ;

Définir le troisième coefficient d'optimisation prédéfini h3 comme le coefficient d'optimisation du facteur de corrélation global et de la valeur lorsque la troisième condition prédéfinie est identifiée, c'est-à-dire h = h3 ; où,

la première condition prédéfinie est que le nombre de facteurs de corrélation moyens est inférieur au nombre et à la valeur, la seconde condition prédéfinie est que le nombre de facteurs de corrélation moyens est égal au nombre et à la valeur, et la troisième condition prédéfinie est que le nombre de facteurs de corrélation moyens est supérieur au nombre et à la valeur.

8. Le système de stockage d'énergie décentralisé connecté au réseau selon la revendication 1, où le module de jugement est utilisé pour :

Jugement de ne pas effectuer le stockage d'énergie sur tous les équipements électriques lorsque la valeur liée au stockage d'énergie est inférieure au seuil lié au stockage d'énergie ;

Jugement d'effectuer le stockage d'énergie sur tous les équipements électriques lorsque la valeur liée au stockage d'énergie est supérieure ou égale au seuil lié au stockage d'énergie.

9. Le système de stockage d'énergie décentralisé connecté au réseau selon la revendication 1, où le module de réglage est utilisé pour :

Acquérir la direction d'application de chaque équipement électrique, acquérir le premier poids de l'équipement électrique en fonction du tableau de correspondance direction d'application-poids ;

Acquérir le second poids de l'équipement électrique en fonction du tableau de correspondance valeur liée au stockage d'énergie-poids ;

Définir la prochaine période d'échantillonnage en fonction du premier poids et du second poids ;

Définir la prochaine période d'échantillonnage selon la formule suivante :

$$T = \frac{\sum_{j=1}^{m} \left(r1j^2 + r2j^2 \right)}{m};$$

où T est la prochaine période d'échantillonnage, m est le nombre d'équipements électriques, $r1j^2$ est le premier poids du j-ième équipement électrique, et $r2j^2$ est le second poids du j-ième équipement électrique.

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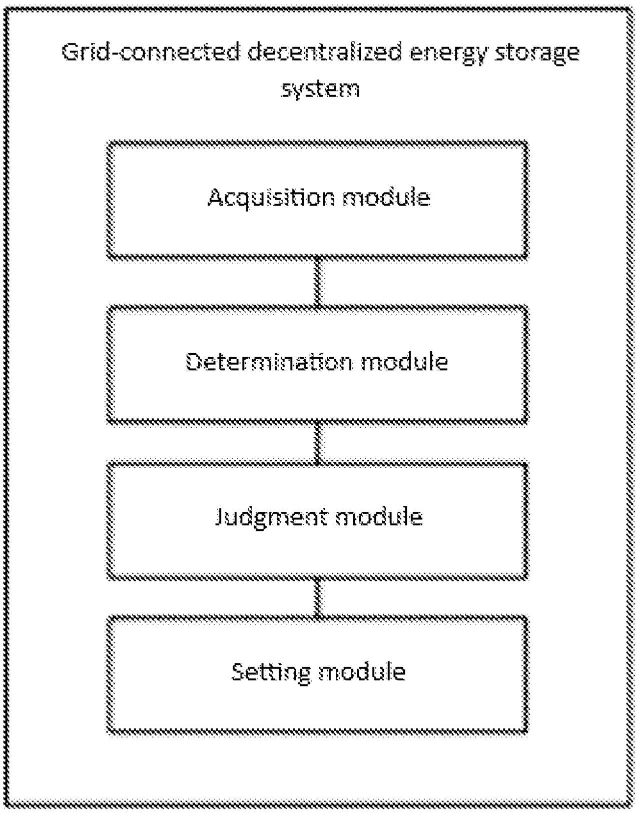

FIG.1