CONTROL SYSTEM OF EDGE DEVICE AND CONTROL METHOD THEREOF

TECHNICAL FIELD

[0001] The present disclosure relates to a control system of an edge device and a control method thereof, and in particular, to a control system of an edge device and a control method thereof that are applicable to electrical automation control.

BACKGROUND

[0002] In prior art, automation control of a local device is mainly achieved by a programmable logic controller (PLC) or a direct digital controller (DDC) plus an industrial touch screen, namely, human-machine interface (HMI).

[0003] However, since different hardware devices have different communication modes, an additional protocol conversion module needs to be added. It is necessary to synchronously upgrade or replace an original PLC (or DDC), or even to replace an entire control cabinet, increasing device and labor costs.

[0004] Meanwhile, in prior art, since storage and remote push of data points are achieved by an industrial gateway device, an additional local gateway device needs to be added, increasing a hardware cost. The added local gateway device needs to be additionally programmed, increasing extra personnel cost.

[0005] In addition, cloud data services provided by different manufacturers cannot be aggregated for use together.

[0006] Therefore, there is particularly a need for a control system of an edge device, and a control method thereof, to solve the existing problems described above.

SUMMARY

[0007] An objective of the present disclosure is to provide a control system of an edge device and a control method thereof. Directed against the shortcomings of the prior art, functions that can only be achieved by a plurality of different devices at present, such as automatic control of local electrical devices, local data storage, interface configuration, and data uploading to a cloud, are achieved, and remote monitoring and control of remote devices are achieved. A machine learning algorithm is utilized to intelligently regulate and control remote devices such that the remote devices achieve the effect of intelligent energy saving without affecting the use experience.

[0008] To solve the technical problems, the present disclosure adopts the following technical solutions:

[0009] In a first aspect, the present disclosure provides a control system of an edge device,

including an edge system and a cloud server, where the edge system includes an industrial touch screen terminal, an input/output (I/O) module, and a frequency converter; the industrial touch screen terminal is separately interconnected with the I/O module and the frequency converter; a front end of the industrial touch screen terminal is separately connected to a variable refrigerant volume (VRV) air conditioning system and a fan coil unit (FCU), and a rear end of the industrial touch screen terminal is separately connected to the cloud server and a monitoring device; the industrial touch screen terminal is separately connected to a water valve and a water leakage alarm sensor of an air handling unit (AHU) by means of the I/O module; the industrial touch screen terminal is connected to the AHU by means of the frequency converter; and a rear end of the cloud server is connected with a management control terminal.

[0010] In one embodiment of the present disclosure, the industrial touch screen terminal includes a logic control unit, an interface interaction unit, a network communication unit, a buffer unit, a hardware data acquisition unit, a database unit, and an operation monitoring unit; the logic control unit is separately interconnected with the interface interaction unit, the network communication unit, the buffer unit, the database unit, and the operation monitoring unit; the hardware data acquisition unit is interconnected with the buffer unit; a front end of the hardware data acquisition unit is separately connected to the VRV air conditioning system, the FCU, and the monitoring device; and the network communication unit is connected with the cloud server for intercommunication.

[0011] In one embodiment of the present disclosure, the cloud server includes a message queuing telemetry transport (MQTT) gateway unit, a Web service gateway unit, a logic processing unit, and a cloud database unit; the logic processing unit is separately interconnected with the MQTT gateway unit, the Web service gateway unit, and the cloud database unit; the logic processing unit is connected with the edge system by means of the MQTT gateway unit for intercommunication; and the logic processing unit is connected with the management control terminal by means of the Web service gateway unit for intercommunication.

[0012] Further, the logic processing unit includes a pre-trained neural network model; and an algorithm of the pre-trained neural network model is as follows:

[0013] a, defining a state space and an action space, where the state space defines a possible state; and the action space defines an adoptable action;

[0014] b, initializing a Q function, where for all state-action pairs (s, a), Q (s, a) is initialized as an any value, and an initial value is random or set according to priori knowledge;

[0015] c, defining a reward function, where a reward function R(s, a, s') is designed according to a concrete problem, which describes an instant reward obtained when a state s transitions to a state s' after an action a is performed; the design of the reward function needs to take an objective of the

problem into account to stimulate an agent to progress toward a desired behavior; otherwise, a negative reward is given;

[0016] d, performing Q-learning cyclical iteration;

[0017] e, selecting an action, where the action a is selected using a certain strategy according to the current state s; a common strategy is ε-greedy strategy; a random action is selected at a certain probability ε, and an action currently having a maximum Q value is selected at a probability of 1-ε;

[0018] f, performing the action and observing a reward and next state, where the selected action a is performed to interact with an environment, and the reward r and next state s' are observed;

[0019] g, updating the Q function, where a Q value is updated using an updating formula of the Q function: $Q(s, a) \leftarrow Q(s, a) + \alpha [r + \gamma \max_{a'} Q(s', a') - Q(s, a)]$, where α is a learning rate and $0 \leq \alpha \leq 1$, and γ is a discount factor ($0 \leq \gamma \leq 1$) for balancing significances of a current reward and a future reward;

[0020] h, updating the state to next state: $s \leftarrow s'$; and

[0021] i, repeating the above steps until the Q function converges, and saving a data structure of the pre-trained Q function as a binary file for subsequent loading and use.

[0022] In one embodiment of the present disclosure, the monitoring device includes an electric meter, an air quality detection apparatus, an FCU control panel, a VRV air conditioning control system control board, a frequency converter, a proportional integral electric valve, a temperature sensor, a fresh air flow meter, a water flow meter, an electric air valve, a water leakage alarm sensor, and a liquid level sensor.

[0023] In one embodiment of the present disclosure, the management control terminal includes a mobile phone, a pad, and a computer.

[0024] In a second aspect, the present disclosure provides a control method of a control system of an edge device, including the following steps:

[0025] step 1, connecting an industrial touch screen terminal of an edge system with a variable refrigerant volume (VRV) air conditioning system, a fan coil unit (FCU), and a monitoring device, and acquiring and storing data;

[0026] step 2, connecting the industrial touch screen terminal of the edge system with a water valve of an air handling unit (AHU) by means of an input/output (I/O) module, and controlling the water valve to achieve an effect of controlling a water flow; connecting the industrial touch screen terminal of the edge system with a water leakage alarm sensor of the AHU by means of the I/O module, and obtaining a water leakage alarm signal feedback when a water level in a water tray rises; and connecting the industrial touch screen terminal of the edge system with the AHU by means of a frequency converter, and controlling a blower power of the AHU;

[0027] step 3, in normal operation, dynamically regulating the water valve and the frequency converter by the industrial touch screen terminal of the edge system according to an environmental temperature and a set temperature of the AHU, thereby realizing temperature control and energy saving; and when a water leakage alarm is triggered, fully closing the water valve by the industrial touch screen terminal of the edge system, avoiding causing a relatively great loss;

[0028] step 4, packing locally acquired data by the industrial touch screen terminal of the edge system, uploading the data to a cloud server, and executing a remote control instruction obtained from the cloud server;

[0029] step 5, performing troubleshooting and data analysis using historical operating data stored on the cloud server; and

[0030] step 6, monitoring or controlling, by an administrator using a management control terminal and via the cloud server, the industrial touch screen terminal of the edge system such that the edge system operates according to a remote instruction.

[0031] In one embodiment of the present disclosure, a working process of the industrial touch screen terminal includes the following steps:

[0032] step 1, acquiring and storing, by a hardware data acquisition unit, data in a buffer unit, extracting, by a logic control unit, data from the buffer unit, and processing various types of data information;

[0033] step 2, storing, by the logic control unit, data that needs to be stored in a database unit;

[0034] step 3, transferring, by the logic control unit, structured data to an interface interaction unit for displaying;

[0035] step 4, transferring, by the logic control unit and via a network communication unit, data that needs to be transmitted to the cloud server to the cloud server; and

[0036] step 5, writing, by the logic control unit, a control instruction in the buffer unit, and fetching and dispatching, by the hardware data acquisition unit, an instruction to a corresponding hardware device.

[0037] In one embodiment of the present disclosure, a working process of the cloud server includes the following steps:

[0038] step 1, receiving, by a message queuing telemetry transport (MQTT) gateway unit, hardware related data pushed by the edge system, and receiving, by a Web service gateway unit, a related request from the management control terminal;

[0039] step 2, processing, by the logic processing unit, hardware data pushed by the edge system, and determining whether alarm information needing to be sent or other service logic needing to be operated;

[0040] step 3, processing, by the logic processing unit, a request from the management control

terminal, and responding correspondingly; and

[0041] step 4, storing or updating the data processed by the logic processing unit and data generated by the logic processing unit to a cloud database unit.

[0042] Compared with the prior art, the control system of the edge device and the control method thereof in the present disclosure have the following advantages: a plurality of devices in the prior art is replaced with the edge system, which may help an operator simultaneously control operations of a plurality of edge devices and rapidly find fault causes. Direct remote diagnosis of causes and direct remote recovery may even be performed for most of faults. An administrator can inspect remote devices by a cloud, and record operation and running logs of the devices. Data generated by a local device may be sent to the cloud server and permanently stored in theory. Log replay may facilitate subsequent problem troubleshooting and corresponding data analysis and also facilitate tracking operating states of the devices and fault analysis. The logic control unit of the cloud server may improve the device operation efficiency, reduce energy consumption, and reduce the cases of wrong settings and forgetting turning off the device, thereby achieving the effects of energy conservation and emission reduction. When a new device appears on the scene, the cloud server may remotely upgrade the edge system and realize remote software updating, saving the time and cost of manual intervention. After fault alarm information appears on the scene, a corresponding person in charge is immediately notified of the fault alarm information directly by the cloud server in a plurality of ways. The processing efficiency is improved and losses caused by faults are reduced. Operation and maintenance costs are reduced. The management efficiency is improved. Good overall scalability and convenient operation are achieved. Unintended activation is avoided. The objective of the present disclosure is thus achieved.

[0043] Features of the present disclosure can be clearly understood by referring to the drawings and detailed description of the following better examples.

BRIEF DESCRIPTION OF THE DRAWINGS

[0044] FIG. 1 is a structural schematic diagram of an edge system according to the present disclosure;

[0045] FIG. 2 is a structural schematic diagram of an industrial touch screen terminal according to the present disclosure;

[0046] FIG. 3 is a structural schematic diagram of a cloud server according to the present disclosure; and

[0047] FIG. 4 is a flowchart of a control method of a control system of an edge device according to the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0048] To make the technical means, creation features, objectives, and effects of the present disclosure more comprehensible, the present disclosure is further described below with reference to the drawings.

[0049] Embodiments

[0050] As shown in FIG. 1 to FIG. 3, a control system of an edge device provided in the present disclosure includes an edge system 10 and a cloud server 20. The edge system 10 includes an industrial touch screen terminal 11, an input/output (I/O) module 12, and a frequency converter 13. The industrial touch screen terminal 11 is separately interconnected with the I/O module 12 and the frequency converter 13. A front end of the industrial touch screen terminal 11 is separately connected to a VRV air conditioning system and a fan coil unit (FCU), and a rear end of the industrial touch screen terminal 11 is separately connected to the cloud server 20 and a monitoring device 30. The industrial touch screen terminal 11 is separately connected to a water valve 14 and a water leakage alarm sensor 15 of an air handling unit (AHU) by means of the I/O module 12. The industrial touch screen terminal 11 is connected to the AHU by means of the frequency converter 13. A rear end of the cloud server 20 is connected with a management control terminal 40.

[0051] In this embodiment, the industrial touch screen terminal 11 includes a logic control unit 111, an interface interaction unit 112, a network communication unit 113, a buffer unit 114, a hardware data acquisition unit 115, a database unit 116, and an operation monitoring unit 117. The logic control unit 111 is separately interconnected with the interface interaction unit 112, the network communication unit 113, the buffer unit 114, the database unit 116, and the operation monitoring unit 117. The hardware data acquisition unit 115 is interconnected with the buffer unit 114. A front end of the hardware data acquisition unit 115 is separately connected to the VRV air conditioning system, the FCU, and the monitoring device 30. The network communication unit 113 is connected with the cloud server 20 for intercommunication.

[0052] In this embodiment, the cloud server 20 includes a message queuing telemetry transport (MQTT) gateway unit 21, a Web service gateway unit 22, a logic processing unit 23, and a cloud database unit 24. The logic processing unit 23 is separately interconnected with the MQTT gateway unit 21, the Web service gateway unit 22, and the cloud database unit 24. The logic processing unit 23 is connected with the edge system 10 by means of the MQTT gateway unit 21 for intercommunication. The logic processing unit 23 is connected with the management control terminal 40 by means of the Web service gateway unit 22 for intercommunication.

[0053] The logic processing unit 23 includes a pre-trained neural network model; and an algorithm of the pre-trained neural network model is as follows:

[0054] a, a state space and an action space are defined: the state space defines a possible state, such as indoor 35°C, humidity 50%, and CO_2 concentration 550 ppm; and the action space defines an adoptable action, such as wide an angle of a cold water valve, increase a given frequency of the frequency converter, and open a fresh air valve;

[0055] b, a Q function is initialized: for all state-action pairs (s, a), Q (s, a) is initialized as an any value, and an initial value is random or set according to priori knowledge;

[0056] c, a reward function is defined: a reward function R(s, a, s') is designed according to a concrete problem, which describes an instant reward obtained when a state s transitions to a state s' after an action a is performed; the design of the reward function needs to take an objective of the problem into account to stimulate an agent to progress toward a desired behavior; for example, when the temperature is close to 22°C-24°C, the humidity is close to 40%-70%, and the overall energy consumption is moderate, a positive reward is given to this set of actions; otherwise, a negative reward is given;

[0057] d, Q-learning cyclical iteration is performed;

[0058] e, an action is selected: the action a is selected using a certain strategy according to the current state s; a common strategy is ε-greedy strategy; a random action is selected at a certain probability ε, and an action currently having a maximum Q value is selected at a probability of 1-ε;

[0059] f, the action is performed and a reward and next state are observed: the selected action a is performed to interact with an environment, and the reward r and next state s' are observed;

[0060] g, the Q function is updated: a Q value is updated using an updating formula of the Q function: $Q(s, a) \leftarrow Q(s, a) + \alpha [r + \gamma \max_{a'} Q(s', a') - Q(s, a)]$, where α is a learning rate and $0 \leq \alpha \leq 1$, and γ is a discount factor ($0 \leq \gamma \leq 1$) for balancing significances of a current reward and a future reward;

[0061] h, the state is updated to next state: $s \leftarrow s'$; and

[0062] i, the above steps are repeated until the Q function converges, and a data structure of the pre-trained Q function is saved as a binary file for subsequent loading and use.

[0063] The logic processing unit 23 provides a set of actions to the industrial touch screen terminal 11 according to current environmental data about a temperature, a humidity, CO_2, a current energy consumption power, and a water supply temperature so as to increase or reduce a temperature and a fan speed, control an opening of a water supply valve, etc. When the temperature is close to 22°C-24°C, the humidity is close to 40%-70%, and the overall energy consumption is moderate, a reward is given to this set of actions; otherwise, a negative reward is given.

[0064]
$$r(s, a) = E[R_t | s_t = s, a_t = a]$$

[0065] r(s,a) represents a reward for an action a taken in a certain state s, and the right side refers to an expectation of obtaining a reward when the state transitions to a state st and an action at is taken.

[0066] In this embodiment, the monitoring device 30 includes an electric meter, an air quality detection apparatus, an FCU control panel, a VRV air conditioning control system control board, a frequency converter, a proportional integral electric valve, a temperature sensor, a fresh air flow meter, a water flow meter, an electric air valve, a water leakage alarm sensor, and a liquid level sensor.

[0067] In this embodiment, the management control terminal 40 includes a mobile phone, a pad, and a computer.

[0068] As shown in FIG. 4, a control method of a control system of an edge device in the present disclosure includes the following steps:

[0069] step 1, connecting an industrial touch screen terminal of an edge system with a variable refrigerant volume (VRV) air conditioning system, a fan coil unit (FCU), and a monitoring device, and acquiring and storing data;

[0070] step 2, connecting the industrial touch screen terminal of the edge system with a water valve of an air handling unit (AHU) by means of an input/output (I/O) module, and controlling the water valve to achieve an effect of controlling a water flow; connecting the industrial touch screen terminal of the edge system with a water leakage alarm sensor of the AHU by means of the I/O module, and obtaining a water leakage alarm signal feedback when a water level in a water tray rises; and connecting the industrial touch screen terminal of the edge system with the AHU by means of a frequency converter, and controlling a blower power of the AHU;

[0071] step 3, in normal operation, dynamically regulating the water valve and the frequency converter by the industrial touch screen terminal of the edge system according to an environmental temperature and a set temperature of the AHU, thereby realizing temperature control and energy saving; and when a water leakage alarm is triggered, fully closing the water valve by the industrial touch screen terminal of the edge system, avoiding causing a relatively great loss;

[0072] step 4, packing locally acquired data by the industrial touch screen terminal of the edge system, uploading the data to a cloud server, and executing a remote control instruction obtained from the cloud server;

[0073] step 5, performing troubleshooting and data analysis using historical operating data stored on the cloud server; and

[0074] step 6, monitoring or controlling, by an administrator using a management control terminal and via the cloud server, the industrial touch screen terminal of the edge system such that the edge system operates according to a remote instruction.

[0075] In this embodiment, a working process of the industrial touch screen terminal includes the following steps:

[0076] step 1, data is acquired by a hardware data acquisition unit and stored in a buffer unit; and a logic control unit extracts data from the buffer unit, and processes various types of data information;

[0077] step 2, data that needs to be stored is stored by the logic control unit in a database unit;

[0078] step 3, structured data is transferred by the logic control unit to an interface interaction unit and displayed;

[0079] step 4, data that needs to be transmitted to the cloud server is transferred to the cloud server by the logic control unit via a network communication unit; and

[0080] step 5, a control instruction is written by the logic control unit in the buffer unit, and an instruction is fetched and dispatched by the hardware data acquisition unit to a corresponding hardware device.

[0081] In this embodiment, a working process of the cloud server includes the following steps:

[0082] step 1, hardware related data pushed by the edge system is received by a message queuing telemetry transport (MQTT) gateway unit, and a related request from the management control terminal is received by a Web service gateway unit;

[0083] step 2, hardware data pushed by the edge system is processed by the logic processing unit, and it is determined whether alarm information needing to be sent or other service logic needing to be operated;

[0084] step 3, a request from the management control terminal is processed by the logic processing unit, and responding is made correspondingly; and

[0085] step 4, the data processed by the logic processing unit and data generated by the logic processing unit are stored or updated to a cloud database unit.

[0086] Compared with the prior art, the control system of the edge device of the present disclosure has the following advantages:

[0087] 1. Taking a storage cycle of 10 min as an example, an existing technical solution may typically achieve storage of only 200-300 points with a storage time of about 300 days. An upper storage limit of the present disclosure is based on the capacity of a hard disk within the industrial touch screen terminal 11. Taking 256 G as an example, approximately tens of thousands of points can be stored for about 4 years.

[0088] 2. There is no upper limit to the capacity and time of the cloud server 20 of the present disclosure, and historical data storage is safer and more reliable.

[0089] 3. In the existing technical solution, a steady-state effect after cooling/heating is achieved by controlling the water valve using a proportional-integral-derivative (PID) algorithm. The

learning algorithm of the logic processing unit 23 of the present disclosure can control more devices, including a water valve, an air valve, frequencies of a frequency converter, and an electrical heating device by comprehensively calculating more environmental parameters including a set temperature, a return air temperature, a humidity, a current weather condition, a field CO_2 concentration, etc.

[0090] 4. In the existing technical solution, a programming speed is too slow. The present disclosure is to achieve effects by programming based on common software, and has the advantages of higher customized development and adjustment speeds and wider software implementation varieties.

[0091] The above described are the basic principles, main features, and advantages of the present disclosure. Persons skilled in the art should know that the present disclosure is not limited by the above examples. The above examples and the specification merely describe the principle of the present disclosure. The present disclosure further has various changes and improvements without departing from the principle of the present disclosure, and these changes and improvements should fall in the protection scope of the present disclosure. The protection scope of the present disclosure is limited by the appended claims and their legal equivalents.

WHAT IS CLAIMED IS:

1. A control system of an edge device, comprising an edge system and a cloud server, wherein the edge system comprises an industrial touch screen terminal, an input/output (I/O) module, and a frequency converter; the industrial touch screen terminal is separately interconnected with the I/O module and the frequency converter; a front end of the industrial touch screen terminal is separately connected to a variable refrigerant volume (VRV) air conditioning system and a fan coil unit (FCU), and a rear end of the industrial touch screen terminal is separately connected to the cloud server and a monitoring device; the industrial touch screen terminal is separately connected to a water valve and a water leakage alarm sensor of an air handling unit (AHU) by means of the I/O module; the industrial touch screen terminal is connected to the AHU by means of the frequency converter; and a rear end of the cloud server is connected with a management control terminal.

2. The control system of the edge device according to claim 1, wherein the industrial touch screen terminal comprises a logic control unit, an interface interaction unit, a network communication unit, a buffer unit, a hardware data acquisition unit, a database unit, and an operation monitoring unit; the logic control unit is separately interconnected with the interface interaction unit, the network communication unit, the buffer unit, the database unit, and the operation monitoring unit; the hardware data acquisition unit is interconnected with the buffer unit; a front end of the hardware data acquisition unit is separately connected to the VRV air conditioning system, the FCU, and the monitoring device; and the network communication unit is connected with the cloud server for intercommunication.

3. The control system of the edge device according to claim 1, wherein the cloud server comprises a message queuing telemetry transport (MQTT) gateway unit, a Web service gateway unit, a logic processing unit, and a cloud database unit; the logic processing unit is separately interconnected with the MQTT gateway unit, the Web service gateway unit, and the cloud database unit; the logic processing unit is connected with the edge system by means of the MQTT gateway unit for intercommunication; and the logic processing unit is connected with the management control terminal by means of the Web service gateway unit for intercommunication.

4. The control system of the edge device according to claim 3, wherein the logic processing unit comprises a pre-trained neural network model; and an algorithm of the pre-trained neural network model is as follows:

a, defining a state space and an action space, wherein the state space defines a possible state; and the action space defines an adoptable action;

b, initializing a Q function, wherein for all state-action pairs (s, a), Q (s, a) is initialized as an any value, and an initial value is random or set according to priori knowledge;

c, defining a reward function, wherein a reward function R(s, a, s') is designed according to a concrete problem, which describes an instant reward obtained when a state s transitions to a state s' after an action a is performed; the design of the reward function needs to take an objective of the problem into account to stimulate an agent to progress toward a desired behavior; otherwise, a negative reward is given;

d, performing Q-learning cyclical iteration;

e, selecting an action, wherein the action a is selected using a certain strategy according to the current state s; a common strategy is ε-greedy strategy; a random action is selected at a certain probability ε, and an action currently having a maximum Q value is selected at a probability of 1-ε;

f, performing the action and observing a reward and next state, wherein the selected action a is performed to interact with an environment, and the reward r and next state s' are observed;

g, updating the Q function, wherein a Q value is updated using an updating formula of the Q function: $Q(s, a) \leftarrow Q(s, a) + \alpha [r + \gamma \max_{a'} Q(s', a') - Q(s, a)]$, wherein α is a learning rate and $0 \leq \alpha \leq 1$, and γ is a discount factor for balancing significances of a current reward and a future reward, and $0 \leq \gamma \leq 1$;

h, updating the state to next state: $s \leftarrow s'$; and

i, repeating the above steps until the Q function converges, and saving a data structure of the pre-trained Q function as a binary file for subsequent loading and use.

5. The control system of the edge device according to claim 1, wherein the monitoring device comprises an electric meter, an air quality detection apparatus, an FCU control panel, a VRV air conditioning control system control board, a frequency converter, a proportional integral electric valve, a temperature sensor, a fresh air flow meter, a water flow meter, an electric air valve, a water leakage alarm sensor, and a liquid level sensor.

6. The control system of the edge device according to claim 1, wherein the management control terminal comprises a mobile phone, a pad, and a computer.

7. A control method of a control system of an edge device, comprising the following steps:

step 1, connecting an industrial touch screen terminal of an edge system with a variable

refrigerant volume (VRV) air conditioning system, a fan coil unit (FCU), and a monitoring device, and acquiring and storing data;

step 2, connecting the industrial touch screen terminal of the edge system with a water valve of an air handling unit (AHU) by means of an input/output (I/O) module, and controlling the water valve to achieve an effect of controlling a water flow; connecting the industrial touch screen terminal of the edge system with a water leakage alarm sensor of the AHU by means of the I/O module, and obtaining a water leakage alarm signal feedback when a water level in a water tray rises; and connecting the industrial touch screen terminal of the edge system with the AHU by means of a frequency converter, and controlling a blower power of the AHU;

step 3, in normal operation, dynamically regulating the water valve and the frequency converter by the industrial touch screen terminal of the edge system according to an environmental temperature and a set temperature of the AHU, thereby realizing temperature control and energy saving; and when a water leakage alarm is triggered, fully closing the water valve by the industrial touch screen terminal of the edge system, avoiding causing a relatively great loss;

step 4, packing locally acquired data by the industrial touch screen terminal of the edge system, uploading the data to a cloud server, and executing a remote control instruction obtained from the cloud server;

step 5, performing troubleshooting and data analysis using historical operating data stored on the cloud server; and

step 6, monitoring or controlling, by an administrator using a management control terminal and via the cloud server, the industrial touch screen terminal of the edge system such that the edge system operates according to a remote instruction.

8. The control method of the control system of the edge device according to claim 7, wherein a working process of the industrial touch screen terminal comprises the following steps:

step 1, acquiring and storing, by a hardware data acquisition unit, data in a buffer unit, extracting, by a logic control unit, data from the buffer unit, and processing various types of data information;

step 2, storing, by the logic control unit, data that needs to be stored in a database unit;

step 3, transferring, by the logic control unit, structured data to an interface interaction unit for displaying;

step 4, transferring, by the logic control unit and via a network communication unit, data that needs to be transmitted to the cloud server to the cloud server; and

step 5, writing, by the logic control unit, a control instruction in the buffer unit, and fetching and dispatching, by the hardware data acquisition unit, an instruction to a corresponding hardware

device.

9. The control method of the control system of the edge device according to claim 7, wherein a working process of the cloud server comprises the following steps:

step 1, receiving, by a message queuing telemetry transport (MQTT) gateway unit, hardware related data pushed by the edge system, and receiving, by a Web service gateway unit, a related request from the management control terminal;

step 2, processing, by the logic processing unit, hardware data pushed by the edge system, and determining whether alarm information needing to be sent or other service logic needing to be operated;

step 3, processing, by the logic processing unit, a request from the management control terminal, and responding correspondingly; and

step 4, storing or updating the data processed by the logic processing unit and data generated by the logic processing unit to a cloud database unit.