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(54) Title: INFORMATION ACQUIRING METHOD, APPARATUS, AND SYSTEM

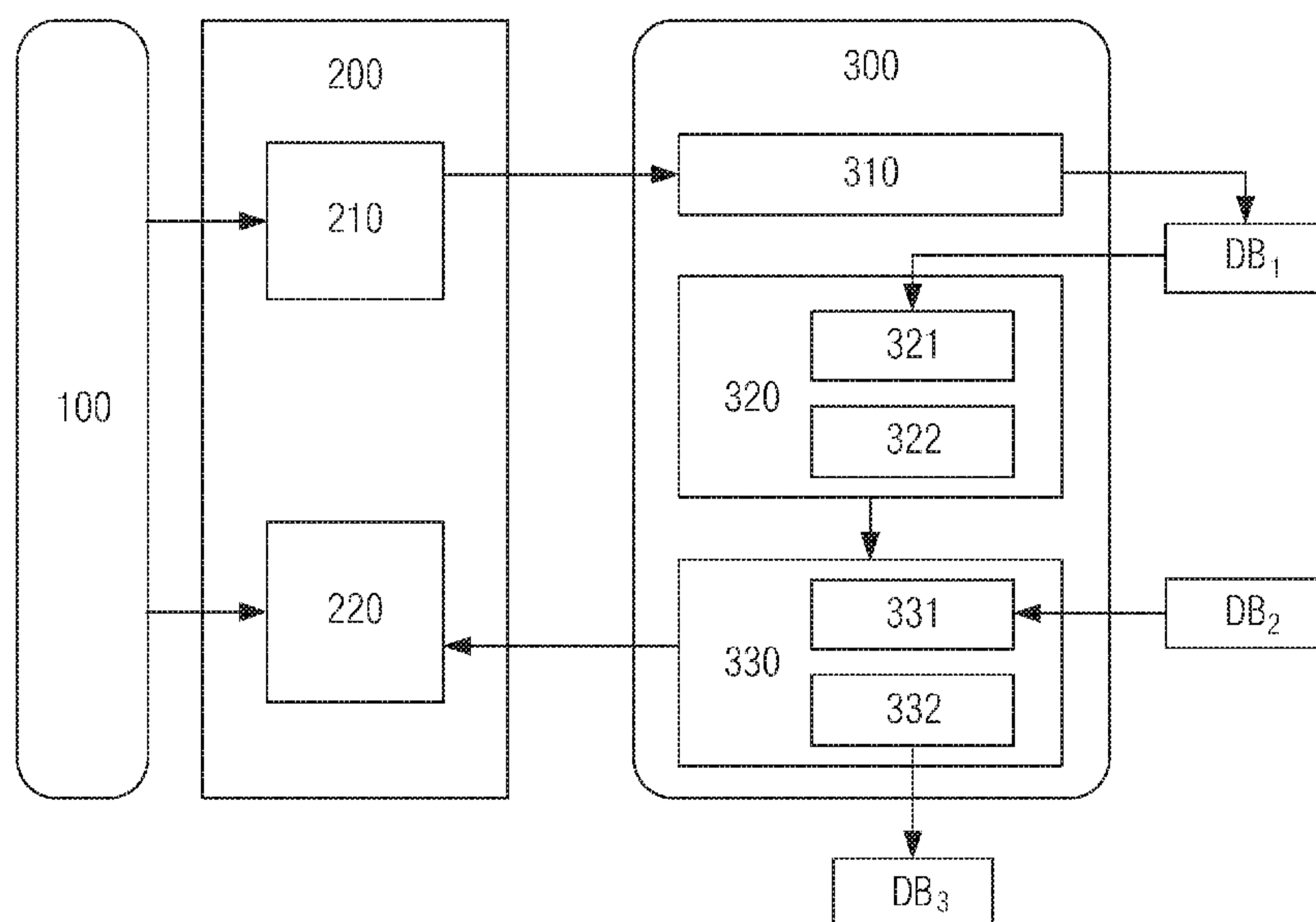


FIG 1

(57) Abstract: The present invention provides an information acquiring method, system and apparatus, including the following steps: S1: acquiring information from a field device using an edge device and transmitting the information to a cloud platform, where the information includes data and an industrial Internet of Things model; S2: converting the industrial Internet of Things model into a graph, and performing similarity analysis based on the graph; and S3: classifying the industrial Internet of Things model based on the similarity analysis, generating a first industrial Internet of Things model including a type or an example, and performing data mapping on the first industrial Internet of Things model. During data acquisition, an existing model on a device side is not required for configuration of the industrial Internet of Things model, and debugging work may be reduced in the present invention. The device side automatically extracts the industrial Internet of Things model and generates the industrial Internet of Things model on the cloud platform without



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INFORMATION ACQUIRING METHOD, APPARATUS, AND SYSTEM

BACKGROUND

Technical Field

5 The present invention relates to the field of industrial Internet of Things, and in particular, to an information acquiring method, apparatus, and system.

Related Art

In an industrial Internet of Things system, data is acquired from field systems and transmitted to an industrial cloud, which is a first step to implement a solution of industrial
10 Internet of Things. However, such a first step still requires much manual work. A field side and a cloud need to be configured, including definition of an industrial Internet of Things model for the industrial cloud and configuration of a data source and a data point for the field system.

Currently, the following problems still exist in acquisition of data of industrial Internet
15 of Things. Firstly, prior art further needs to depend on massive manual configuration for the industrial Internet of Things model and the data sources. Secondly, when the field system is complex and there are countless data points, data acquisition is extremely slow and an error is easy to occur. In addition, there is a lack of sufficient communication between an engineer of manual configuration of the field systems and an engineer of a cloud solution.
20 Finally, when the field systems are fully described in an information model, the data points still need to be manually configured, the information model including OPC UA, etc.

In the prior art, some cloud platforms provide a list of industrial Internet of Things models for a user to select, but the user should know which industrial Internet of Things device is connected to the cloud platforms. However, such cloud platforms usually support
25 only an industrial Internet of Things device of a communication language defined by the cloud platforms, and are not applied to an industrial device of other communication protocols.

SUMMARY

A first aspect of the present invention provides an information acquiring method, including the following steps: S1: acquiring information from a field device using an edge device and transmitting the information to a cloud platform, where the information includes data and an industrial Internet of Things model; S2: converting the industrial Internet of Things model into a graph, and performing similarity analysis based on the graph; and S3: classifying the industrial Internet of Things model based on the similarity analysis, generating a first industrial Internet of Things model including a type or an example, and performing data mapping on the first industrial Internet of Things model.

Further, the step S2 further includes the following steps: S21: converting the graph into a vector and loading the vector with an algorithm, to convert the graph into a digital description; S22: performing the similarity analysis on the vector and ranking the vector, and extracting the type of the industrial Internet of Things model; and S23: storing a same type of the industrial Internet of Things model.

Further, the algorithm is a random walk algorithm.

Further, an order in which the graph is analyzed using the random walk algorithm is based on the following rules: selecting adjacent nodes starting from most edge nodes of the graph, and selecting nodes whose quantity is a preset threshold; selecting only a node except the most edge nodes of the graph; and collecting the nodes whose quantity is the preset threshold starting from the most edge nodes of the graph, and, when nodes are collected again, selecting nodes on a layer of the graph and selecting nodes whose quantity is larger than the preset threshold.

A second aspect of the present invention provides an information acquiring system, including a processor; and a memory coupled to the processor, the memory having an instruction stored therein, the instruction, when executed by the processor, causing the electronic device to perform an action, the action including: S1: acquiring information from a field device using an edge device and transmitting the information to a cloud platform, the information including data and an industrial Internet of Things model; S2: converting the

industrial Internet of Things model into a graph, and performing similarity analysis based on the graph; and S3: classifying the industrial Internet of Things model based on the similarity analysis, generating a first industrial Internet of Things model including a type or an example, and performing data mapping on the first industrial Internet of Things model.

5 Further, the action S2 further includes the following actions: S21: converting the graph into a vector and loading the vector with an algorithm, to convert the graph into a digital description; S22: performing the similarity analysis on the vector and ranking the vector, and extracting the type of the industrial Internet of Things model; and S23: storing a same type of the industrial Internet of Things model.

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15 preset threshold starting from the most edge nodes of the graph, and, when nodes are collected again, selecting nodes on a layer of the graph and selecting nodes whose quantity is larger than the preset threshold.

A third aspect of the present invention provides an information acquiring apparatus, including an information acquiring apparatus configured to: acquire information from a
20 field device using an edge device and transmit the information to a cloud platform, the information including data and an industrial Internet of Things model; a converting and analyzing apparatus configured to: convert the industrial Internet of Things model into a graph, and perform similarity analysis based on the graph; and a classification generating apparatus configured to: classify the industrial Internet of Things model based on the
25 similarity analysis, generate a first industrial Internet of Things model including a type or an example, and perform data mapping on the first industrial Internet of Things model.

A fourth aspect of the present invention provides a computer program product tangibly stored on a computer readable medium and including a computer executable instruction that,

when executed, causes at least one processor to perform the method according to the first aspect of the present invention.

A fifth aspect of the present invention provides a computer readable medium storing a computer executable instruction that, when executed, causes at least one processor to
5 perform the method according to the first aspect of the present invention.

During data acquisition, an existing model on a device side is not required for configuration of the industrial Internet of Things model, and debugging work may be reduced in the present invention. The device side automatically extracts the industrial Internet of Things model and generates the industrial Internet of Things model on the cloud
10 platform without depending on knowledge of a person skilled in the art. The industrial Internet of Things model generating information about the device side and a graph database may be reused in other application scenarios. In addition, in the present invention, a device side model is converted into a node graph and the node graph is stored in a graph database for subsequent applications in different application scenarios. Graph embedding and
15 definition of a random walk calculation rule of the device side model may be suitable for features of an industrial system. In the present invention, the configuration-free cloud platform is integrated with the device side, so that difficulty in establishing an industrial Internet of Things solution is reduced. The integration and knowledge conversion from the device side to the cloud platform enhance capability and functionality of the cloud
20 platform.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic structural diagram of an information acquiring system according to a specific embodiment of the present invention;

FIG. 2 is a schematic diagram of converting an industrial Internet of Things model into
25 a graph according to a specific embodiment of the present invention; and

FIG. 3 is a schematic diagram of vectorization of a graph node according to a specific embodiment of the present invention.

DETAILED DESCRIPTION

The following describes specific implementations of the present invention in detail with reference to the accompanying drawings.

The present invention provides a model-analysis based industrial Internet of Things model and a data information acquiring mechanism, which provides zero configuration for an industrial Internet of Things model and data acquisition. In the present invention, an existing industrial Internet of Things model in a field system is used, and the industrial Internet of Things model does not need to be configured in a data acquisition process, so that a manual debugging workload can be greatly reduced. In the present invention, the industrial Internet of Things model may be automatically extracted from the field system, and the industrial Internet of Things model is established in a cloud system without depending on practical knowledge of an expert of the field system. In the present invention, the industrial Internet of Things model and a graph database are established for the field system, and the industrial Internet of Things model and the graph database can be reused.

FIG. 1 is a schematic structural diagram of an information acquiring system according to a specific embodiment of the present invention. As shown in FIG. 1, the information acquiring system includes a field device 100, an edge device 200, and a cloud platform 300. The field device 100 and the edge device 200 are exemplarily disposed at a production line end of a factory, and the edge device 200 is connected to the field device 100 and the cloud platform 300 respectively. In the present invention, data is collected from the field device 100 using the edge device 200, and an industrial Internet of Things model is simultaneously established in the cloud platform. The cloud platform is an industrial cloud platform. The edge device 200 includes a model acquiring apparatus 210 and an information configuration apparatus 220. A converting apparatus 310, an analyzing apparatus 320, and a generating apparatus 330 are disposed in the cloud platform 300.

The information acquiring method provided in a first aspect of the present invention includes step S1, step S2 and step S3. First, step S1 is performed. Information is acquired from the field device 100 using the edge device 200 and transmitted to the cloud platform 300. The information includes existing data and industrial Internet of Things models stored on a field device side 100. In particular, the present invention is applied to an industrial

device system that supports a predefined information model, such as an OPC UA network and a BAC network. Therefore, the edge device 200 may acquire a system information model from the field device side 100. In particular, the model acquiring apparatus 210 in the edge device 200 is configured to: acquire and transmit the industrial Internet of Things model to the cloud platform 300, and the data configuration apparatus 220 in the edge device 200 is configured to: acquire data and transmit the data to the cloud platform 300, and perform information configuration on a final industrial Internet of Things model subsequently established in the cloud platform 300. The edge device 200 converts a system model into a model in a unified format and transmits the model in a unified format to the cloud platform 300, such as a JSON format and an XML format. The information configuration apparatus 220 is configured to perform data acquiring configuration, including: generating a data source, a data point, and data mapping using a service, and downloading the data source, the data point and the data mapping to the edge device 200. The information configuration apparatus 220 collects data of the field device 100 based on required configuration and transmits the data to the cloud platform 300.

Afterwards, step S2 is performed. The converting apparatus 310 in the cloud platform 300 converts the industrial Internet of Things model into a graph, and the analyzing apparatus 320 in the cloud platform 300 performs similarity analysis based on the graph. In particular, the cloud platform 300 performs model analysis to automatically generate industrial Internet of Things model of a system, and classifies the model. The graph is stored in a first database DB₁.

In particular, step S2 further includes a substep S21, a substep S22 and a substep S23.

In the substep S21, the converting apparatus 310 converts the graph into a vector and loads the vector with an algorithm, to convert the graph into a digital description. In particular, FIG. 2 is a schematic diagram of converting an industrial Internet of Things model into a graph according to a specific embodiment of the present invention. As shown in FIG. 2, the industrial Internet of Things model M₁ is specifically a field system model. In order to subsequently provide a flexible graph query and a random walk algorithm, the industrial Internet of Things model M₁ is converted into a graph G₁ and stored in the first

database DB₁. The graph G₁ is described in a semantic description language, such as RDF or a performance graph. In this embodiment, the industrial Internet of Things model M₁ is an OPC-UA model, that is, software of field device network management, and the industrial Internet of Things model M₁ includes a device in a network and details thereof.

5 Correspondingly, a node and a relationship of the graph G₁ have information about all OPC-UA models.

As shown in FIG. 2, the industrial Internet of Things model M₁ refers to an OPC UA tree structure model, and the industrial Internet of Things model M₁ is converted into the graph G₁ in step S21. In particular, a target folder of the industrial Internet of Things model

10 M₁ includes a plurality of targets. The first-layer target has, for example, a first node G₁₁ "SN_DV_Mon_Siemens_3", a second node G₁₂ "SN_DV_Mon_Siemens_15", a third node G₁₃ "SN_DV_DefaultSnmDevice_2", and the like. The third node G₁₃ "SN_DV_DefaultSnmDevice_2" has a second-layer target including a fourth node G₂₁ "deviceConfiguration", a fifth node G₂₂ "deviceDetail", and the like. Further, the fifth node

15 G₂₂ "deviceDetail" further includes a sixth node G₃₁ "deviceName" and a seventh node G₃₂ "deviceDescription", and the sixth node G₃₁ "deviceName" further includes an eighth node G₄₁ "automationName" and a ninth node G₄₂ "sysName".

Therefore, the industrial Internet of Things model M₁ is converted into the graph G₂ shown in FIG. 2. A target of the graph includes nodes in a plurality of layers. Nodes in a

20 fourth layer include the first node G₁₁ "SN_DV_Mon_Siemens_3", the second node G₁₂ "SN_DV_Mon_Siemens_15", the third node G₁₃ "SN_DV_DefaultSnmDevice_2", and the like. Nodes in a third layer include the fourth node G₂₁ "deviceConfiguration", the fifth node G₂₂ "deviceDetail", and the like, nodes in a first layer include the sixth node G₃₁ "deviceName" and the seventh node G₃₂ "deviceDescription", and nodes in a first layer

25 include the eighth node G₄₁ "automationName" and the ninth node G₄₂ "sysName". A relationship among the third node G₁₃ "SN_DV_DefaultSnmDevice_2", the fourth node G₂₁ "deviceConfiguration" and the fifth node G₂₂ "deviceDetail" is as follows: the third node G₁₃ "SN_DV_DefaultSnmDevice_2" includes the fourth node G₂₁ "deviceConfiguration" and the fifth node G₂₂ "deviceDetail". A relationship among the fifth

node G_{22} "deviceDetail", the sixth node G_{31} "deviceName" and the seventh node G_{32} "deviceDescription" is as follows: the fifth node G_{22} "deviceDetail" includes the sixth node G_{31} "deviceName" and the seventh node G_{32} "deviceDescription". A relationship among the sixth node G_{31} "deviceName", the eighth node G_{41} "automationName" and the ninth node G_{42} "sysName" is as follows: the sixth node G_{31} "deviceName" includes the eighth node G_{41} "automationName" and the ninth node G_{42} "sysName".

In order to analyze similarity of all graph node contents, vector information in the graph is required, including vector information of each node and some graph fragments. A graph embedding apparatus 321 in the analyzing apparatus 320 is configured to: perform graph embedding and download a graph from the first database DB_1 . Vectorization is first performed on a node, and each node is represented using a vector, including a node name, a node type, and information about the node type. In a common graph embedding algorithm, a node is generally a word without any structure. However, in the graph of this embodiment, a node is generally a target, such as a variable and a folder, so that the most important parameter may be selected to represent a unique node. Because a repeating structure/context in a graph needs to be extracted, a type-related parameter rather than a unique identifier of a node needs to be embedded. As shown in FIG. 3, in this embodiment, one-hot encoding may be used to generate a vector that represents a node. In other words, variables such as a node name, a node type and a data type of each node in the graph are mapped to a vector, to represent different node types as different vectors. It may be understood that different node names represent different vectors. As shown in FIG. 3, in this embodiment, a node name of a node becomes a vector "1,0,0,...0" using the one-hot encoding, a node type of a node becomes a vector "1,0,0,..." using the one-hot encoding, and a data type of a node becomes a vector "1,0,0,..." using the one-hot encoding.

In the substep S22, a similarity analysis ranking apparatus 322 is configured to: perform similarity analysis on the vector and rank the vector, and extract the type of the industrial Internet of Things model.

Next, random vectorization is performed on the graph. The algorithm is a random walk algorithm, such as DeepWalk and node2vec. The random walk algorithm is used to analyze

context similarity of a node, the context of the node representing an aspect in the industrial Internet of Things model or a structure of a type of assets. In the present invention, the random walk algorithm and some rules of labelling the graph are defined. In the present embodiment, a domain system model is a hierarchical structure, and a node in an upper
5 layer is more like a folder in a node in a lower layer, so that label rules should be suitable for these scenarios, that is, a combination of nodes is selected according to the rules, and then a value of the combination is calculated.

A first rule is: Adjacent nodes are selected starting from most edge nodes of the graph, and a node whose quantity is a preset threshold is selected.

10 A second rule is: a node except the most edge nodes of the graph is only selected, the most edge nodes of the graph being, for example, the "target" in the graph G_1 .

A third rule is: the nodes whose quantity is the preset threshold are collected starting from the most edge nodes of the graph, and nodes on a layer of the graph are selected again. When the nodes are collected again, the nodes on a layer of the graph and whose quantity is
15 larger than the preset threshold are selected. For example, 3 nodes are collected for the first time, and 10 nodes are collected for the second time, that is, both a minimum combination and a maximum combination are considered, and a quantity collected each time in each layer is larger than a quantity collected last time. In particular, $N(i)$ represents a quantity of nodes of each sampling, i representing sampling times, so that $N(1) < N(2) < \dots < N(x-1) <$
20 $N(x)$.

As shown in FIG. 2, if a node of the graph G_1 is sampled for the first time, for example, starting from a node in a second layer, the sixth node G_{31} "deviceName" is selected as a first starting node, and a node in a lower layer below G_{31} "deviceName" is regarded as a context and a collection result of the starting node. During first collection, three nodes are
25 collected, that is, first sampled nodes of the graph G_1 include the sixth node G_{31} "deviceName", the eighth node G_{41} "automationName" and the ninth node G_{42} "sysName". Afterwards, node sampling is performed for the second time, and nodes and performance are sampled from a next layer of first sampling, including nodes in a lower layer. The sixth node G_{31} "deviceName" is selected as a starting node, so that a node in a lower layer of G_{31}

"deviceName" is a context of the starting node. However, 5 nodes are selected, that is, the 5 nodes are more than nodes sampled for the first time, including the sixth node G_{31} "deviceName", the eighth node G_{41} "automationName", the ninth node G_{42} "sysName", the seventh node G_{32} "deviceDescription" and the fifth node G_{22} "deviceDetail".

5 After each collection of the node of the graph, a result is input into a random walk algorithm to obtain a set of vectors, the algorithm including DeepWalk or node2vec. For graph node sampling performed each time, a starting node has a set of sample nodes and vectors of the nodes. Output of the algorithm is a vector for each starting node that represents a similarity of a context of each node. Algorithm calculation is performed after
10 each node walk and sampling, so that a similarity between different nodes in different layers in the graph may be acquired. After node context similarity is calculated, repeating structures existing in a graph may be learned. It is assumed that repeating structures in a graph include, as shown in FIG. 2, the sixth node G_{31} "deviceName", the fifth node G_{22} "deviceDetail" and a node structure in a lower layer that are repeated for a plurality of times
15 in the graph G_1 , which are regarded as aspects of the industrial Internet of Things model.

In the substep S23, a same type of the industrial Internet of Things model is stored.

Finally, the step S3 is performed. A classification apparatus 331 for the industrial Internet of Things model of the generating apparatus 330 is configured to: classify the industrial Internet of Things model based on the similarity analysis, generate, using an
20 industrial Internet of Things generating apparatus 332, a first industrial Internet of Things model including a type or an example, and perform data mapping on the first industrial Internet of Things model. The generating apparatus 330 acquires data configuration of the industrial Internet of Things model from the data configuration apparatus 220.

Optionally, classification may be performed according to a ratio of a word to an
25 industrial vocabulary. The classification apparatus 331 invokes the industrial vocabulary from a second database DB_2 . In the foregoing steps, aspects or device of the industrial internet of Things model are acquired from model analysis. Therefore, if the industrial Internet of Things model can be classified, classification of the industrial Internet of Things model helps a customer reuse the industrial Internet of Things model and helps perform

analysis for better calculation. In particular, an industrial classification database is first constructed, that is, a standard classification word is used as a basis of the database, the industrial classification database defining a type, a name, a structure and a semantic model. Synonyms or related words are collected using a word dictionary service, and then an extended classification word may be obtained. Then, a node name is segmented, that is, a name of the aspects or the device is segmented using a word segmentation tool. Finally, statistics of a name and classification of the aspects or the device are collected, that is, retrieving is performed in a classification word, and searching is performed in a most probable classification asset name, so that the aspects or the device may be classified in this type.

In this step, each type is labelled for subsequent searching, for example, if a name in the industrial vocabulary is a robot or a machine tool, a claw of a robot is labelled as a robot type.

In particular, in this step, an industrial Internet of Things model is established in a cloud platform 300 based on the aspects and the device extracted in the foregoing steps. An aspects type, a device type, and a device are created in the cloud platform 300. According to a specific embodiment of the present invention, data acquiring configuration is performed based on an original system data model, and a device group is generated. An industrial Internet of Things model is illustrated below according to a specific embodiment of the present invention:

Variable type	Device type		Device example
Name: deviceName	Name: deviceDetail	Name: device	SN_DV_Mon_DefaultSnmpDevice_2: Asset Type: device
Parameter: automationName	Variable: deviceName	Type of a secondary device: deviceDetail	SN_DV_Mon_Siemens_Standard_3: Asset Type: device
Parameter: sysName	Parameter: deviceDescription	Type of a secondary device: deviceConfiguration	SN_DV_Mon_Siemens_Standard_15: Asset Type: device
.....

The data configuration apparatus 220 of the edge device 200 downloads data acquiring

configuration to collect information from the device side 100. The generated aspects or devices may be used in this case and are also reused in next generation of the industrial Internet of Things model. A same type should not be generated twice in a same environment of the cloud platform 300.

5 An industrial Internet of Things generating apparatus 332 stores the generated industrial Internet of Things model in a third database DB₃.

A second aspect of the present invention provides an information acquiring system, including a processor; and a memory coupled to the processor, the memory having an instruction stored therein, the instruction, when executed by the processor, causing the
10 electronic device to perform an action, the action including: S1: acquiring information from a field device using an edge device and transmitting the information to a cloud platform, the information including data and an industrial Internet of Things model; S2: converting the industrial Internet of Things model into a graph, and performing similarity analysis based on the graph; and S3: classifying the industrial Internet of Things model based on the
15 similarity analysis, generating a first industrial Internet of Things model including a type or an example, and performing data mapping on the first industrial Internet of Things model.

Further, the action S2 further includes the following actions: S21: converting the graph into a vector and loading the vector with an algorithm, to convert the graph into a digital description; S22: performing the similarity analysis on the vector and ranking the vector,
20 and extracting the type of the industrial Internet of Things model; and S23: storing a same type of the industrial Internet of Things model.

Further, the algorithm is a random walk algorithm.

Further, an order in which the graph is analyzed using the random walk algorithm is based on the following rules: selecting adjacent nodes starting from most edge nodes of the
25 graph, and selecting nodes whose quantity is a preset threshold; selecting only a node except the most edge nodes of the graph; and collecting the nodes whose quantity is the preset threshold starting from the most edge nodes of the graph, and, when nodes are collected again, selecting nodes on a layer of the graph and selecting nodes whose quantity

is larger than the preset threshold.

A third aspect of the present invention provides an information acquiring apparatus, including an information acquiring apparatus configured to: acquire information from a field device using an edge device and transmit the information to a cloud platform, the information including data and an industrial Internet of Things model; a converting and analyzing apparatus configured to: convert the industrial Internet of Things model into a graph, and perform similarity analysis based on the graph; and a classification generating apparatus configured to: classify the industrial Internet of Things model based on the similarity analysis, generate a first industrial Internet of Things model including a type or an example, and perform data mapping on the first industrial Internet of Things model.

A fourth aspect of the present invention provides a computer program product tangibly stored on a computer readable medium and including a computer executable instruction that, when executed, causes at least one processor to perform the method according to the first aspect of the present invention.

A fifth aspect of the present invention provides a computer readable medium storing a computer executable instruction that, when executed, causes at least one processor to perform the method according to the first aspect of the present invention.

During data acquisition, an existing model on a device side is not required for configuration of the industrial Internet of Things model, and debugging work may be reduced in the present invention. The device side automatically extracts the industrial Internet of Things model and generates the industrial Internet of Things model on the cloud platform without depending on knowledge of a person skilled in the art. The industrial Internet of Things model generating information about the device side and a graph database may be reused in other application scenarios. In addition, in the present invention, a device side model is converted into a node graph and the node graph is stored in a graph database for subsequent applications in different application scenarios. Graph embedding and definition of a random walk calculation rule of the device side model may be suitable for features of an industrial system. In the present invention, the configuration-free cloud platform is integrated with the device side, so that difficulty in establishing an industrial

Internet of Things solution is reduced. The integration and knowledge conversion from the device side to the cloud platform enhance capability and functionality of the cloud platform.

Although the content of the present invention has been described in detail through the
5 above preferred embodiments, it should be understood that the above description should not
be considered as a limitation on the present invention. For those skilled in the art, various
modifications and replacements to the present invention will be apparent after reading the
above content. Therefore, the protection scope of the present invention should be subject to
the appended claims. In addition, any reference numerals in the claims shall not be
10 construed as limiting the claims; the word "include/comprise" does not exclude apparatuses
or steps not listed in other claims or the specification; the words such as "first" and
"second" are only used to indicate names, and do not indicate any particular order.

CLAIMS

What is claimed is:

1. An information acquiring method, comprising the following steps:

5 S1: acquiring information from a field device using an edge device and transmitting the information to a cloud platform, wherein the information comprises data and an industrial Internet of Things model;

S2: converting the industrial Internet of Things model into a graph, and performing similarity analysis based on the graph; and

10 S3: classifying the industrial Internet of Things model based on the similarity analysis, generating a first industrial Internet of Things model comprising a type or an example, and performing data mapping on the first industrial Internet of Things model.

2. The information acquiring method according to claim 1, wherein the step S2 further comprises the following steps:

15 S21: converting the graph into a vector and loading the vector with an algorithm, to convert the graph into a digital description;

S22: performing the similarity analysis on the vector and ranking the vector, and extracting the type of the industrial Internet of Things model; and

S23: storing a same type of the industrial Internet of Things model.

20 3. The information acquiring method according to claim 1, wherein the algorithm is a random walk algorithm.

4. The information acquiring method according to claim 3, wherein an order in which the graph is analyzed using the random walk algorithm is based on the following rules:

selecting adjacent nodes starting from most edge nodes of the graph, and selecting nodes whose quantity is a preset threshold;

25 selecting only a node except the most edge nodes of the graph; and

collecting the nodes whose quantity is the preset threshold starting from the most edge

nodes of the graph, and, when the nodes are collected again, selecting nodes on a layer of the graph and selecting nodes whose quantity is larger than the preset threshold.

5. An information acquiring system, comprising:

a processor; and a memory coupled to the processor, the memory having an instruction stored therein, the instruction, when executed by the processor, causing the electronic device to perform an action, the action comprising:

S1: acquiring information from a field device using an edge device and transmitting the information to a cloud platform, wherein the information comprises data and an industrial Internet of Things model;

S2: converting the industrial Internet of Things model into a graph, and performing similarity analysis based on the graph; and

S3: classifying the industrial Internet of Things model based on the similarity analysis, generating a first industrial Internet of Things model comprising a type or an example, and performing data mapping on the first industrial Internet of Things model.

6. The information acquiring system according to claim 5, wherein the step S2 further comprises the following actions:

S21: converting the graph into a vector and loading the vector with an algorithm, to convert the graph into a digital description;

S22: performing the similarity analysis on the vector and ranking the vector, and extracting the type of the industrial Internet of Things model; and

S23: storing a same type of the industrial Internet of Things model.

7. The information acquiring system according to claim 5, wherein the algorithm is a random walk algorithm.

8. The information acquiring system according to claim 7, wherein an order in which the graph is analyzed using the random walk algorithm is based on the following rules:

selecting adjacent nodes starting from most edge nodes of the graph, and selecting

nodes whose quantity is a preset threshold;

selecting only a node except the most edge nodes of the graph; and

collecting the nodes whose quantity is the preset threshold starting from the most edge nodes of the graph, and, when the nodes are collected again, selecting nodes on a layer of
5 the graph and selecting nodes whose quantity is larger than the preset threshold.

9. An information acquiring apparatus, comprising:

an information acquiring apparatus configured to: acquire information from a field device using an edge device and transmit the information to a cloud platform, wherein the information comprises data and an industrial Internet of Things model;

10 a converting and analyzing apparatus configured to: convert the industrial Internet of Things model into a graph, and perform similarity analysis based on the graph; and

a classification generating apparatus configured to: classify the industrial Internet of Things model based on the similarity analysis, generate a first industrial Internet of Things model comprising a type or an example, and perform data mapping on the first industrial
15 Internet of Things model.

10. A computer program product tangibly stored on a computer readable medium and comprising a computer executable instruction that, when executed, causes at least one processor to perform the method according to any of claims 1 to 4.

11. A computer readable medium storing a computer executable instruction that, when
20 executed, causes at least one processor to perform the method according to any of claims 1 to 4.

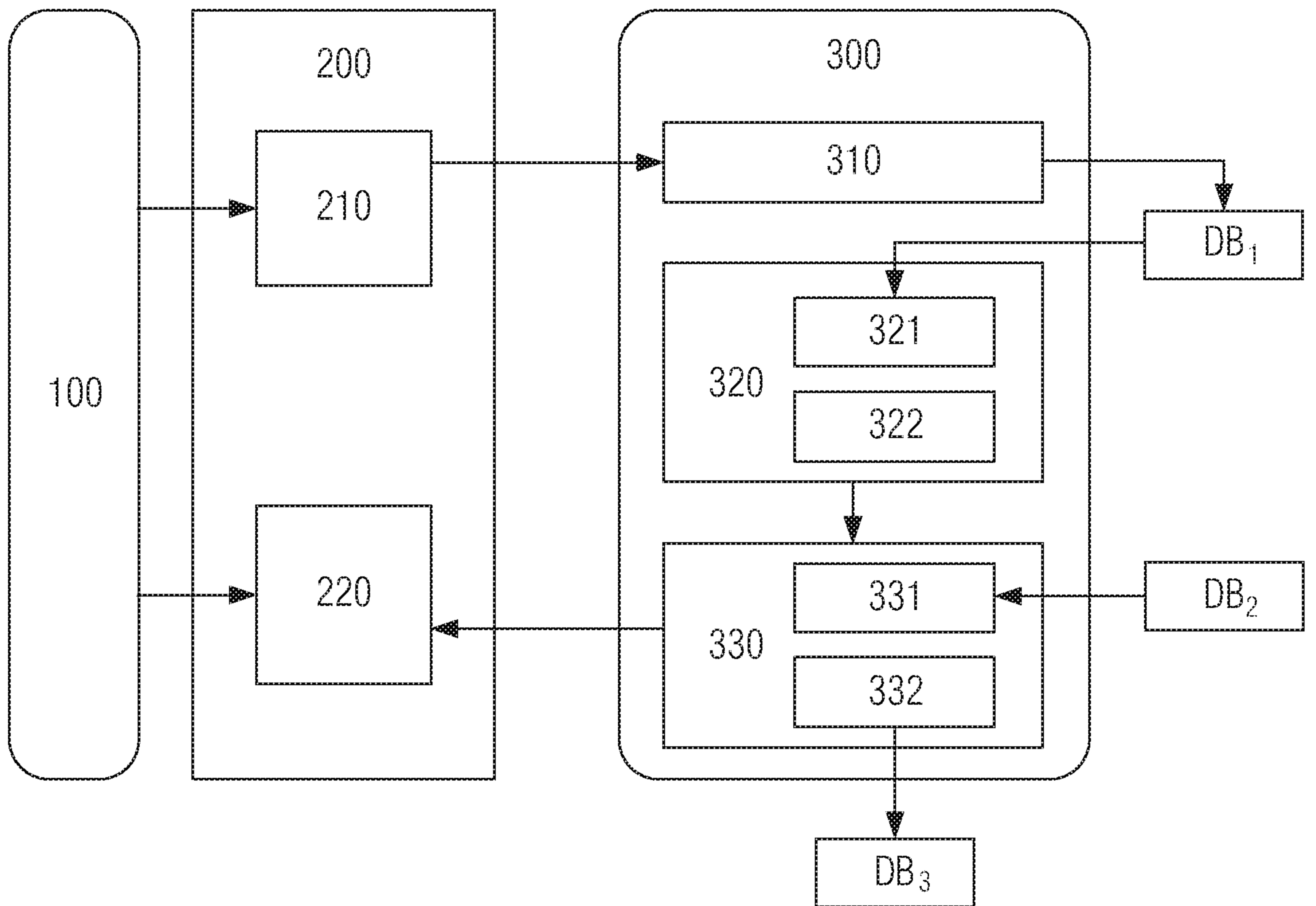


FIG 1

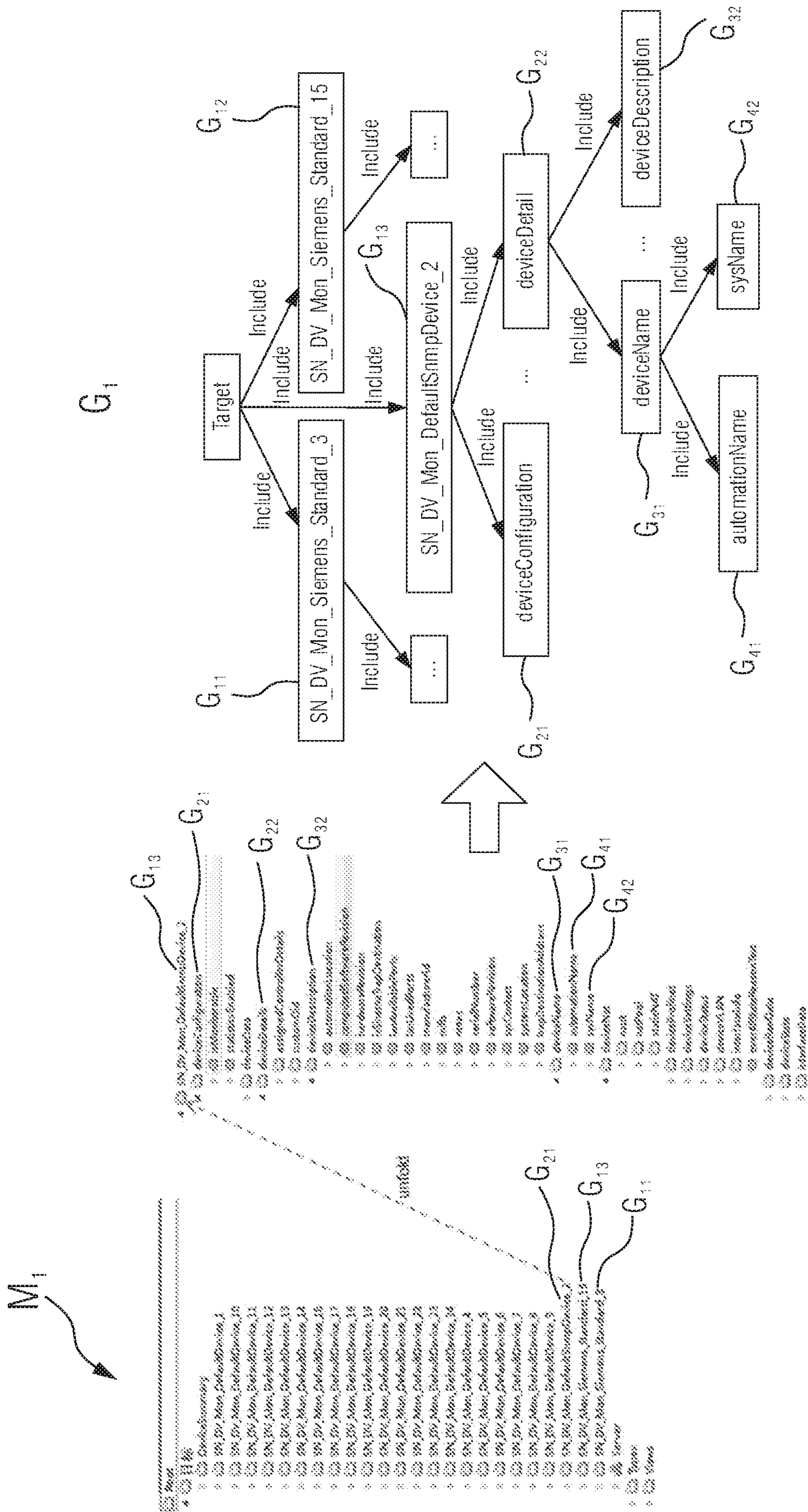


FIG 2

(Node name, Node type, Data type)

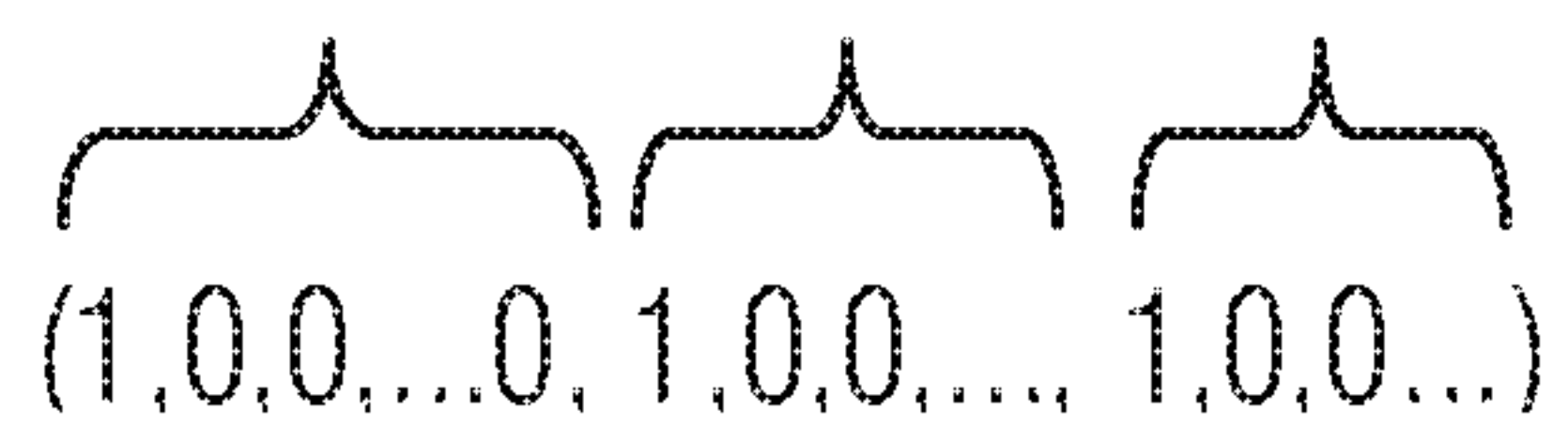

(1,0,0,...0, 1,0,0,..., 1,0,0...)

FIG 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/124102

A. CLASSIFICATION OF SUBJECT MATTER H04L 29/08(2006.01)i According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) H04L,G05B Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CNPAT,CNKI,WPI,EPODOC,IEEE: IoT, internet of things, industrial, model?, edge, cloud, graph, analysis, classify, type, mapping		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 110336845 A (CHINA UNITED NETWORK COMMUNICATIONS CORP.) 15 October 2019 (2019-10-15) claim 1	1-11
A	WO 2019127502 A1 (SIEMENS AKTIENGESELLSCHAFT) 04 July 2019 (2019-07-04) the whole document	1-11
A	CN 110414021 A (SIEMENS AKTIENGESELLSCHAFT) 05 November 2019 (2019-11-05) the whole document	1-11
A	US 2019356556 A1 (VICAT-BLANC, P.) 21 November 2019 (2019-11-21) the whole document	1-11
A	US 2018114140 A1 (IBM CORP.) 26 April 2018 (2018-04-26) the whole document	1-11
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: “A” document defining the general state of the art which is not considered to be of particular relevance “E” earlier application or patent but published on or after the international filing date “L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) “O” document referring to an oral disclosure, use, exhibition or other means “P” document published prior to the international filing date but later than the priority date claimed		“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention “X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone “Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art “&” document member of the same patent family
Date of the actual completion of the international search 28 August 2020		Date of mailing of the international search report 09 September 2020
Name and mailing address of the ISA/CN National Intellectual Property Administration, PRC 6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088 China Facsimile No. (86-10)62019451		Authorized officer WANG,Xiaoqian Telephone No. (86-10)-53961683

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No. PCT/CN2019/124102

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN	110336845	A	15 October 2019	None	
WO	2019127502	A1	04 July 2019	None	
CN	110414021	A	05 November 2019	None	
US	2019356556	A1	21 November 2019	WO	2019222353 A1 21 November 2019
US	2018114140	A1	26 April 2018	None	