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ATTORNEY 'S DOCKET NUMBER
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U.S. APPLICATION NO.

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/KR2006/005715	**December 26, 2006**	**September 1, 2006**

TITLE OF INVENTION
USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

APPLICANT(S) FOR DO/EO/US
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Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (22) indicated below.
4. ☒ The US has been elected (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☒ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☒ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☒ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).
11. ☒ For publication of assignee information under 37 CFR 1.215(b), list the assignee as:
    ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE of **Daejeon, Republic of Korea**.
    The assignment papers will be filed later.

ITEMS 12 TO 21 BELOW CONCERN DOCUMENT(S) OR INFORMATION INCLUDED:

12. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
13. ☐ An assignment document and separate cover sheet.
14. ☒ A preliminary amendment.
15. ☐ An Application Data Sheet under 37 CFR 1.76.
16. ☐ A substitute specification ("Clean copy" and "Marked-up copy").
17. ☐ A power of attorney and/or change of address letter.
18. ☐ A computer-readable form (*.txt file) of the sequence listing in accordance with PCT Rule 13ter.2 and 37 CFR 1.821-1.825.
19. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
20. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
21. ☒ Other items or information: **Copy of PCT Publication No. WO 2008/026804 A1, PCT/ISA/237 form; and PCT Request of International Application No. PCT/KR2006/005715.**

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22. ☒ The following fees are submitted:	APPLICANT USE	**OFFICE** USE
a) ☒ **Basic National Fee** $330.00	$ 330.00	
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Total claims	12 – 20 =	0	X $52.00
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MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $390.00

TOTAL OF ABOVE CALCULATIONS =	**$ 980.00**
☒ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.	- $ 490.00
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NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

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2/27/09
DATE

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USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

Description

Technical Field

The present invention relates to a Ubiquitous Sensor network (USN) middleware apparatus and method for generating information based on data transmitted from heterogeneous sensor networks and a system for providing the information service using the same; and, more particularly, to a USN middleware apparatus for collecting sensed data from sensor nodes of heterogeneous sensor networks, analyzing and processing sensed data, e.g., temperature, humidity, pressure, motion, and acceleration, generating events and context aware information, and providing the information to users through an application program, a method thereof, and an information service providing system employing the same.

Background Art

When data sensed through sensor networks are used, an application program must directly process and integrate the sensed data in order to provide information to a user using

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a specific sensor network. This way requires a lot of manpower and is cost-consuming. In addition, as the number and kinds of sensor networks required for generating an information service increase, the application program must be modified and enlarged to meet a processing capability requirement with respect to a communication scheme, control protocol, functional features, and sensed data processing scheme of each sensor network. Furthermore, when the sensed data collected from the same sensor network is simultaneously used in one or more application programs, the control and communication cost of gateways and sensor networks increases, resulting in performance degradation of the sensor networks and reduction of power resources.

In Ubiquitous Sensor Network (USN) environment, a plurality of sensor networks having different purposes and functions are expected to be installed or distributed in a wide area. Sensor nodes of each sensor network collect environment information in real-time while they are attached to objects, placed in a position, or in motion.

In order for the application program to provide useful information service to the user, there is a need for a means that can abstract one or more heterogeneous sensor networks, generate events and context aware information by analyzing sensed data from a corresponding sensor network, and provide the generated information to the application rapidly and conveniently. However, such a means does not exist at present.

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Disclosure

Technical Problem

It is, therefore, an objective of the present invention to provide a Ubiquitous Sensor Network (USN) middleware apparatus for collecting sensed data from sensor nodes of heterogeneous sensor networks, analyzing and processing sensed data, e.g., temperature, humidity, pressure, motion, and acceleration, generating events and context aware information, and providing the information to users through an application program, a method thereof, and an information service providing system employing the same.

Technical Solution

In accordance with one aspect of the present invention, there is provided a system for offering an information service based on heterogeneous sensor networks, including: a sensor node constructing a sensor network to sense its ambient environment; a sensor network data transmitter for collecting sensed data sensed by the sensor nodes in real-time and transmitting the collected sensed data in a message form; and a Ubiquitous Sensor Network (USN) middleware for extracting object and environment information by cleaning, classifying and integrating the message received from the sensor network data transmitter,

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generating conditional events, context aware information, circumstantial analysis information, and the other relevant knowledge contents from the extracted object and environment information, and providing the information service to an application program, the application program providing a user with information related to environment where the sensor network observes or is installed.

In accordance with another aspect of the present invention, there is provided a USN middleware apparatus for offering an information service based on heterogeneous sensor networks, including: a sensor network abstraction unit for extracting sensed data from a message received from a sensor network; a sensor network intelligence unit for extracting low-level information including the object properties and environment state information by performing an analysis operation to clean, classify and integrate the sensed data extracted by the sensor network abstraction unit, and generating high-level information including conditional events, context aware information, and circumstantial analysis information from the extracted low-level information; and a service platform management unit for providing the information to the application program in a form suitable for the application program.

In accordance with another aspect of the present invention, there is provided a method for generating an information service based on heterogeneous sensor networks in a USN middleware apparatus, including the steps of: a)

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extracting sensed data and monitoring a state management of a sensor network, based on the extracted sensed data; b) performing an analysis operation to clean, classify and integrate the extracted sensed data; c) extracting object and environment information from the analyzed sensed data, and generating context aware information and circumstantial analysis information based on the extracted object and environment information; d) generating conditional events according to a rule set by an application program; e) scheduling an operation sequence for providing an information service to the application program; and f) providing the application program with the information service obtained according to the scheduled operation sequence, the information service including conditional events, context aware information, and circumstantial analysis information.

In accordance with another aspect of the present invention, the USN middleware apparatus processes and manages a large amount of sensed data collected from the heterogeneous sensor networks between the senor network and the application program, generates the real-time events and context aware information related to the environment condition by analyzing the collected sensed data, and provides the information service suitable for the application program. Therefore, a plurality of sensor networks can be utilized more easily in the USN environment.

In addition, the interface with a plurality of sensor

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networks can be supported in the present invention. Therefore, information service about a specific position can be provided by analyzing the sensed data from a corresponding sensor network, while high-level information such as context aware information and conditional events about a wide area also can be provided by analyzing the sensed data collection obtained from the relevant multiple sensor networks.

Advantageous Effects

According to the present invention, the sensor nodes automatically collect the changing environment conditions in real-time and the operation states of the sensor networks are continuously monitored, thereby increasing the effectiveness and reliability of the information service remarkably. The data sensed by one or more heterogeneous sensor networks having sensor nodes and gateways are processed into the information service of a USN middleware apparatus, and the processed information service is effectively provided to a plurality of application programs. Therefore, utilization of the information service based on the sensor networks can be improved and the application program can be easily developed and expanded.

Description of Drawings

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The above and other objectives and features of the present invention will become apparent from the following description of the preferred embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1 illustrates a system for providing an information service based on sensed data collected from heterogeneous sensor networks in accordance with an embodiment of the present invention;

Fig. 2 is a block diagram of a system for providing an information service based on sensed data transmitted from heterogeneous sensor networks in accordance with an embodiment of the present invention;

Fig. 3 is a block diagram of a Ubiquitous Sensor Network (USN) middleware apparatus in accordance with an embodiment of the present invention;

Fig. 4 is a flowchart describing a method for providing an information service based on sensed data transmitted from heterogeneous sensor networks in accordance with an embodiment of the present invention; and

Fig. 5 is a flowchart illustrating a method for operating a USN middleware apparatus in accordance with an embodiment of the present invention.

Best Mode for the Invention

Other objectives and aspects of the present invention will become apparent from the following description of the

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embodiments with reference to the accompanying drawings, which is set forth hereinafter.

Fig. 1 illustrates a system for providing an information service based on sensed data transmitted from heterogeneous sensor networks in accordance with an embodiment of the present invention.

Referring to Fig. 1, the system for providing the information service based on the heterogeneous sensor networks in accordance with the embodiment of the present invention includes sensor nodes 10, sensor networks 20, gateways 30, a USN middleware apparatus 40, and application programs 50. The sensor nodes 10 sense environment information, and the sensor network 20 connects the sensor nodes 10 in order to wirelessly transfer data sensed at the sensor nodes 10 in real-time between the sensor nodes 10. The gateway 30 collects the data sensed by the sensor network 20 and transfers the collected data to the USN middleware apparatus 40. The USN middleware apparatus 40 stores, cleans, classifies and integrates the sensed data of the heterogeneous sensor networks 20, which are received through the gateways 30, and extracts low-level information, i.e., object properties and environment state information. Then, the USN middleware apparatus 40 provides an information service by generating high-level information, i.e., conditional events, context aware information, and circumstantial analysis information from the extracted low-level information. Using the information from the USN

middleware apparatus 40 including both the low-level and high-level information, the application program provides the user with information related to the environment where the sensor network 20 observes.

The sensor nodes 10 can sense at least one of ambient temperature, ambient humidity, vibration, light, pressure, and motion. The sensor nodes 10 configure the sensor network 20 through a short-range wireless communication and the sensed data of the sensor nodes 10 are collected at the gateway 30. The gateway 30 transfers the sensed data to the USN middleware apparatus 40 through Transmission Control Protocol/Internet Protocol (TCP/IP) data transmission. Using the sensed data, the USN middleware apparatus 40 can monitor the environment observed by the sensor network 20, and control the sensor network 20. In addition, the USN middleware apparatus processes the sensed data to generate events and context aware information desired by the application program 50, and provides the information to the application program.

Fig. 2 is a block diagram of the system for providing the information service based on sensed data transmitted from heterogeneous sensor networks in accordance with an embodiment of the present invention.

Referring to Fig. 2, the sensor node 10 includes a sensing unit for detecting a variety of information about environment such as temperature, humidity, heat, and infrared rays and generating sensed data.

The sensor nodes 10 are appropriately arranged, considering function and performance of the sensing units 11 and wireless communication range. At this point, it should be noted that the sensor nodes 10 must be able to transfer data to the gateway 30 through the wireless communication. In the sensor network 20, the number and the structure of the sensor nodes 10 can be divergent according to either the given environmental properties or the specific purpose of an application.

The gateway 30 includes a sensor network data transmitting unit 31 for receiving the sensed data, which are sensed in real-time by the sensing unit 11 of each sensor node 10, through the wireless communication between the sensor nodes 10 of the sensor network 20, collecting the received sensed data, and transferring the collected sensed data to the USN middleware apparatus 40 in a message form.

The USN middleware apparatus 40 includes a sensor network abstraction unit 41, a sensor network intelligence unit 42, and a service platform management unit 43. The sensor network abstraction unit 41 extracts the sensed data from the message received from the gateway 30. The sensor network intelligence unit 42 extracts the object properties and the environment state information by performing an analysis operation to clean, classify and integrate the sensed data extracted by the sensor network abstraction unit 41, and generates conditional events, context aware

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information, and the other knowledge contents such as circumstantial analysis information. The service platform management unit 43 provides the results processed by the sensor network intelligence unit 42 to the application program 50 in a form suitable for the application program 50. The processed results include both the extracted information including the object properties and the environment state information, and the generated information including conditional events, context aware information, and circumstantial analysis information. The service platform management unit 43 can also provide an information selection and interface function based on a plurality of heterogeneous sensor networks, which is required by the application program 50.

The application program 50 includes an information service receiving unit 51 for receiving the information from the USN middleware apparatus 40.

Hereinafter, operations of the sensor node 10, the sensor network 20, the gateway 30, the USN middleware apparatus 40, and the application program 50 will be described. The sensor node 10 transfers the data sensed in real-time by the sensing unit 11 to the gateway 30 through the wireless communication of the sensor network 20. The gateway 30 collects the sensed data received from the sensor network 20 and transfers the collected sensed data to the USN middleware apparatus 40 through the sensor network data transmitting unit 31. The sensor network

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abstraction unit 41 of the USN middleware apparatus 40 extracts the sensed data from the message received from the gateway 30. The sensor network intelligence unit 42 generates conditional events, context aware information, and other knowledge contents by performing an analysis operation to clean, classify and integrate the sensed data extracted by the sensor network abstraction unit 41. The service platform management unit 43 provides the results processed by the sensor network intelligence unit 42 to the information service receiving unit 51 of the application program 50 in a form suitable for the application program 50. The processed results include the object and environment information, conditional events and context aware information, and circumstantial analysis information.

In order to provide specific information required by the application program 50, the sensor network intelligence unit 42 classifies the sensed data collected by the sensor nodes 10 of the sensor network 20 and generates conditional events, i.e., notification of a specific error and alarm of crucial state, and context aware information, i.e., detection of invasion and the best position for arousing customers' interest. In order to generate more relevant information, the sensor network intelligence unit 42 may use a predetermined rule set by the application program 50. The service platform management unit 43 transfers the information to the application program 50 in a message form suitable for the application program 50.

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Table 1 below shows examples of the sensed data collected by the sensor network 20, the sensed data analyzed by the USN middleware apparatus 40, and conditional events and context aware information generated by the USN middleware apparatus 40.

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Table 1

Classification	Analysis of sensed data and generation of information	Description
Sensed data #1 collected by sensor network for an hour	15, 15, 14, 14, 12, 11	Temperature (℃) collected every 10 minutes
Sensed data #2 collected by sensor network for an hour	80, 90	Humidity (%) collected every 30 minutes
Sensed data analyzed by USN middleware apparatus	13.5	Average temperature for latest 1 hour
Conditional Events generated by USN middleware apparatus	Provide alarm ("low temperature: 13.5") for average temperature value	Application has already set a predetermined rule: alarm is generated to application program when average temperature for latest 1 hour is below 14℃
Context aware information generated by USN middleware apparatus	Provide an imminent report about the given position ("There is high probability of problem in the heating machine; Check gas leakage or breakdown of the electricity")	USN middleware found the related rule and contents from its internal storage, as following. 1) There is high probability that problem will occur in heating facility when average temperature is below 14℃, current humidity is 80%, and it is night. 2) The latest problem occurring in the heating machine was related to the gas leakage and power supply failure.

Fig. 3 is a block diagram of the USN middleware apparatus in accordance with an embodiment of the present invention.

Referring to Fig. 3, the sensor network abstraction unit 41 includes a sensor network interface 411, a sensor network interface protocol storage 412, and a sensor network monitor 413. The sensor network interface 411 extracts the sensed data by referring to a message transfer protocol, and the sensor network interface protocol storage 412 manages the message transfer protocol. The sensor network monitor 413 performs a monitoring operation for a state management of the sensor network, based on the data received from the sensor network interface 411.

The sensor network intelligence unit 42 includes a sensed data analyzer 421, an event processor 422, and a context information manager 423. The sensed data manager 421 performs an analysis operation to clean, classify and integrate the sensed data processed by the sensor network abstraction unit 41. The event processor 422 generates the events, i.e., notification and alarm about a certain condition, according to the rule set by the application program 50 and manages the generated events. The context information manager 423 senses and generates the context aware information based on the analyzed sensed data information as well as the context rule in store which are related with the object and environment.

In order to generate the events, i.e., notification

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and alarm about a certain condition, and the context aware information, the sensor network intelligence unit 42 may analyze only the sensed data from a single specific sensor network, or analyze a combination of sensed data from a plurality of heterogeneous sensor networks, or analyze the sensed data from the sensor network in association with predefined legacy data.

The service platform management unit 43 includes a directory service manager 431, a service process manager 432, and an application program interface 433. The directory service manager 431 identifies and searches resources of the sensor network 20. The service process manager 432 schedules and manages an operation order of the sensed data analyzer 421, the event processor 422, the context information manager 423, and the directory service manager 431. The application program interface 433 provides the application program 50 with the results processed by the sensor network monitor 413, the sensed data analyzer 421, the event processor 422, the context information manager 423, and the directory service manager 431 in the information service form suitable for the application program 50.

The service platform management unit 43 may provide the information to the application program only once, or periodically provide the information during a request period of the application program, or provide the information at a specific time point when a requirement

from the application program is satisfied.

Fig. 4 is a flowchart illustrating a method for providing an information service based on sensed data transmitted from heterogeneous sensor networks in accordance with an embodiment of the present invention.

Referring to Fig. 4, each of the sensor nodes 10 of the sensor network 20 senses the sensed data related to the environment in step S401. In step S402, the sensor network 20 transmits the sensed data sensed by the sensor node 10 through the gateway 30 to the USN middleware apparatus 41 in a message form.

The USN middleware apparatus 40 extracts the operation state of the sensor network 20 and the sensed data from the message received from the sensor network 20 in step S403, performs an analysis operation to clean, classify and integrate the extracted sensed data in step S404, extracts the object and environment information S405, and generates the events, i.e., notification and alarm about a certain condition, and the context aware information, according to the rule set by the application program 50 in step S406.

The USN middleware apparatus 40 provides the information, i.e., the events and the context aware information, to the application program 50 in a form suitable for the application program.

Through these procedures, the USN middleware apparatus 40 analyzes and processes the information desired by the application program 50 from the sensed data collected by

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the sensor network 20 and then provides the processed information to the application program 50.

Fig. 5 is a flowchart illustrating a method for operating the USN middleware apparatus in accordance with an embodiment of the present invention.

Referring to Fig. 5, in step S501, the sensor network monitor 413 of the sensor network abstraction unit 41 performs a monitoring operation for a state management of the sensor network based on the sensed data extracted through the sensor network interface 411.

In step S502, the sensed data analyzer 421 of the sensor network intelligence unit 42 performs an analysis operation to clean, classify and integrate the sensed data processed by the sensor network abstraction unit 41. In step S503, the context information manager 423 of the sensor network intelligence unit 42 extracts object and environment information from the sensed data analyzed by the sensed data analyzer 421, and generates the context aware information, i.e., situation recognition information, based on the extracted object and environment information as well as the as the context rule in store which are related with the object and environment. In step S504, the event processor 422 of the sensor network intelligence unit 42 generates the events, i.e., notification and alarm about a certain condition, according to the rule set by the application program 50.

In step S505, the service process manager 432 of the

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service platform management unit 43 schedules the operation order for providing the information to the application program 50 and provides the results processed based on the scheduled sequence by the sensor network monitor 413, the sensed data analyzer 421, the event processor 422, and the context information manager 423 through the application program interface 433 to the application program 50.

The methods in accordance with the embodiments of the present invention can be realized as programs and stored in a computer-readable recording medium that can execute the programs. Examples of the computer-readable recording medium include CD-ROM, RAM, ROM, floppy disks, hard disks, magneto-optical disks and the like.

The present application contains subject matter related to Korean patent application No. 2006-0084353, filed with the Korean Intellectual Property Office on September 1, 2006, the entire contents of which is incorporated herein by reference.

While the present invention has been described with respect to certain preferred embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

What is claimed is:

1. A system for providing an information service based on heterogeneous sensor networks, comprising:

a sensor node constructing a sensor network to sense environment information;

a sensor network data transmitter for collecting sensed data sensed by the sensor in real-time and transmitting the collected sensed data in a message form; and

a Ubiquitous Sensor Network (USN) middleware for extracting object and environment information by cleaning, classifying and integrating the message received from the sensor network data transmitter, generating conditional events, context aware information, and knowledge contents from the extracted object and environment information, and providing the information service to an application program, the application program providing a user with information related to environment where the sensor network is installed.

2. The system as recited in claim 1, wherein the ubiquitous sensor network middleware comprises:

a sensor network abstraction unit for extracting the sensed data from the message received from the sensor network data transmitter;

a sensor network intelligence unit for extracting the

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object and environment information by analyzing the sensed data extracted by the sensor network abstraction unit, and generating the conditional events including notification and alarm about a certain condition, and the context aware information from the extracted object and environment information; and

a service platform management unit for providing the events and the context aware information to the application program in a form suitable for the application program.

3. The system as recited in claim 2, wherein the sensor network abstraction unit comprises:

a sensor network interface for extracting the sensed data by referring to a message transfer protocol;

a sensor network interface protocol storage for managing a rule for the message transfer protocol; and

a sensor network monitor for monitoring a state of the sensor network, based on the data received from the sensor network interface.

4. The system as recited in claim 3, wherein the sensor network intelligence unit comprises:

a sensed data analyzer for performing an analysis operation to clean, classify and integrate the sensed data processed by the sensor network abstraction unit;

an event processor for generating the conditional events including notification and alarm according to a rule

set by the application program and managing the generated events; and

a context information manager for sensing and generating the context aware information, based on the sensed data analyzed by the sensed data analyzer.

5. The system as recited in claim 4, wherein the service platform management unit comprises:

a directory service manager for identifying and searching resources of the sensor network;

a service process manager for scheduling and managing an operation sequence of the sensed data analyzer, the event processor, the context information manager, and the directory service manager in order to obtain a desired information service according to the application program; and

an application program interface for providing the application program with the results processed by the sensor network monitor, the sensed data analyzer, the event processor, the context information manager, and the directory service manager in an information service form suitable for the application program.

6. A Ubiquitous Sensor Network (USN) middleware apparatus for generating an information service based on heterogeneous sensor networks, comprising:

a sensor network abstraction unit for extracting

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sensed data from a message received from a sensor network;

a sensor network intelligence unit for extracting the object and environment information by performing an analysis operation to clean, classify and integrate the sensed data extracted by the sensor network abstraction unit, and generating an event, including notification and alarm, and context aware information from the extracted object and environment information; and

a service platform management unit for providing the event and the context aware information to the application program in a form suitable for the application program.

7. The ubiquitous sensor network middleware apparatus as recited in claim 6, wherein the sensor network abstraction unit comprises:

a sensor network interface for extracting the sensed data by referring to a message transfer protocol;

a sensor network interface protocol storage for managing a rule for the message transfer protocol; and

a sensor network monitor for monitoring a state of the sensor network, based on the data received from the sensor network interface.

8. The ubiquitous sensor network middleware apparatus as recited in claim 7, wherein the sensor network intelligence unit comprises:

a sensed data analyzer for performing an analysis

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operation to clean, classify and integrate the sensed data processed by the sensor network abstraction unit;

an event processor for generating the event including the knowledge contents according to a rule set by the application program and managing the generated event; and

a context information manager for sensing and generating the environment condition information, based on the sensed data analyzed by the sensed data analyzer.

9. The ubiquitous sensor network middleware apparatus as recited in claim 8, wherein the service platform management unit comprises:

a directory service manager for identifying and searching resources of the sensor network;

a service process manager for scheduling and managing an operation order of the sensed data analyzer, the event processor, the context information manager, and the directory service manager in order to obtain a desired information service according to the application program; and

an application program interface for providing the application program with the results processed by the sensor network monitor, the sensed data analyzer, the event processor, the context information manager, and the directory service manager in an information service form suitable for the application program.

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10. A method for generating an information service based on heterogeneous sensor networks in a ubiquitous sensor network middleware apparatus, comprising the steps of:

a) extracting sensed data and monitoring a state management of a sensor network, based on the extracted sensed data;

b) performing an analysis operation to clean, classify and integrate the extracted sensed data;

c) extracting the object and environment information from the analyzed sensed data, and generating context aware information based on the extracted object and environment information;

d) generating an event including notification event, alarm, and knowledge contents according to a rule set by an application program;

e) scheduling an operation sequence for providing an information service to the application program; and

f) providing the application program with the information service obtained according to the scheduled operation sequence, the information service including events and context aware information.

11. The method as recited in claim 10, wherein the step b) analyzes sensed data from a specific single sensor network, or analyzes sensed data from a plurality of sensor networks, or analyzes sensed data from the sensor network

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in association with predefined legacy data.

12. The method as recited in claim 10, wherein the step f) provides the information service to the application program only one time, or periodically provides the information service during a request period of the application program, or provides the information service at a specific time point when a requirement from the application program is satisfied.

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Abstract

Provided are a Ubiquitous Sensor Network (USN) middleware apparatus and method for generating an information service based on heterogeneous sensor networks and a system for providing the information service using the same. In the system, a sensor node constructing a sensor network senses environment information, and a sensor network data transmitter collects sensed data sensed by the sensor node in real-time and transmits the collected sensed data in a message form. A USN middleware extracts object and environment information by cleaning, classifying and integrating the message received from the sensor network data transmitter, generates conditional events and context aware information from the extracted object and environment information, and provides the information service to an application program, the application program providing a user with information related to environment where the sensor network observes.

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FIG. 1

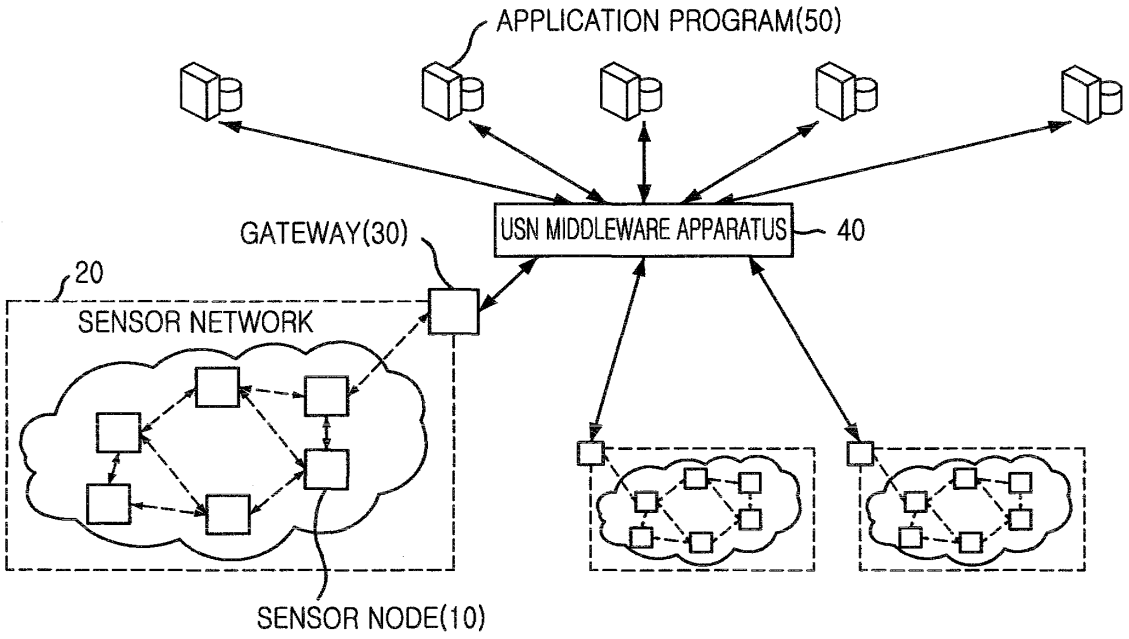

APPLICATION PROGRAM(50)
USN MIDDLEWARE APPARATUS
40
GATEWAY(30)
20
SENSOR NETWORK
SENSOR NODE(10)

FIG. 2

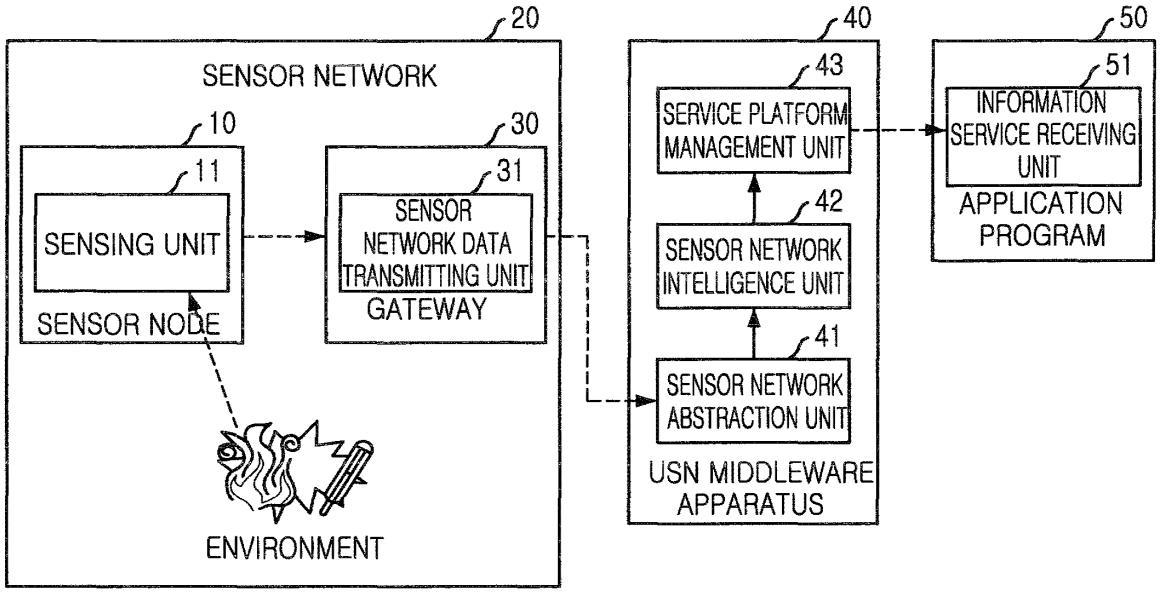

20
SENSOR NETWORK
10
11
SENSING UNIT
SENSOR NODE
30
31
SENSOR NETWORK DATA TRANSMITTING UNIT
GATEWAY
ENVIRONMENT
40
43
SERVICE PLATFORM MANAGEMENT UNIT
42
SENSOR NETWORK INTELLIGENCE UNIT
41
SENSOR NETWORK ABSTRACTION UNIT
USN MIDDLEWARE APPARATUS
50
51
INFORMATION SERVICE RECEIVING UNIT
APPLICATION PROGRAM

FIG. 3

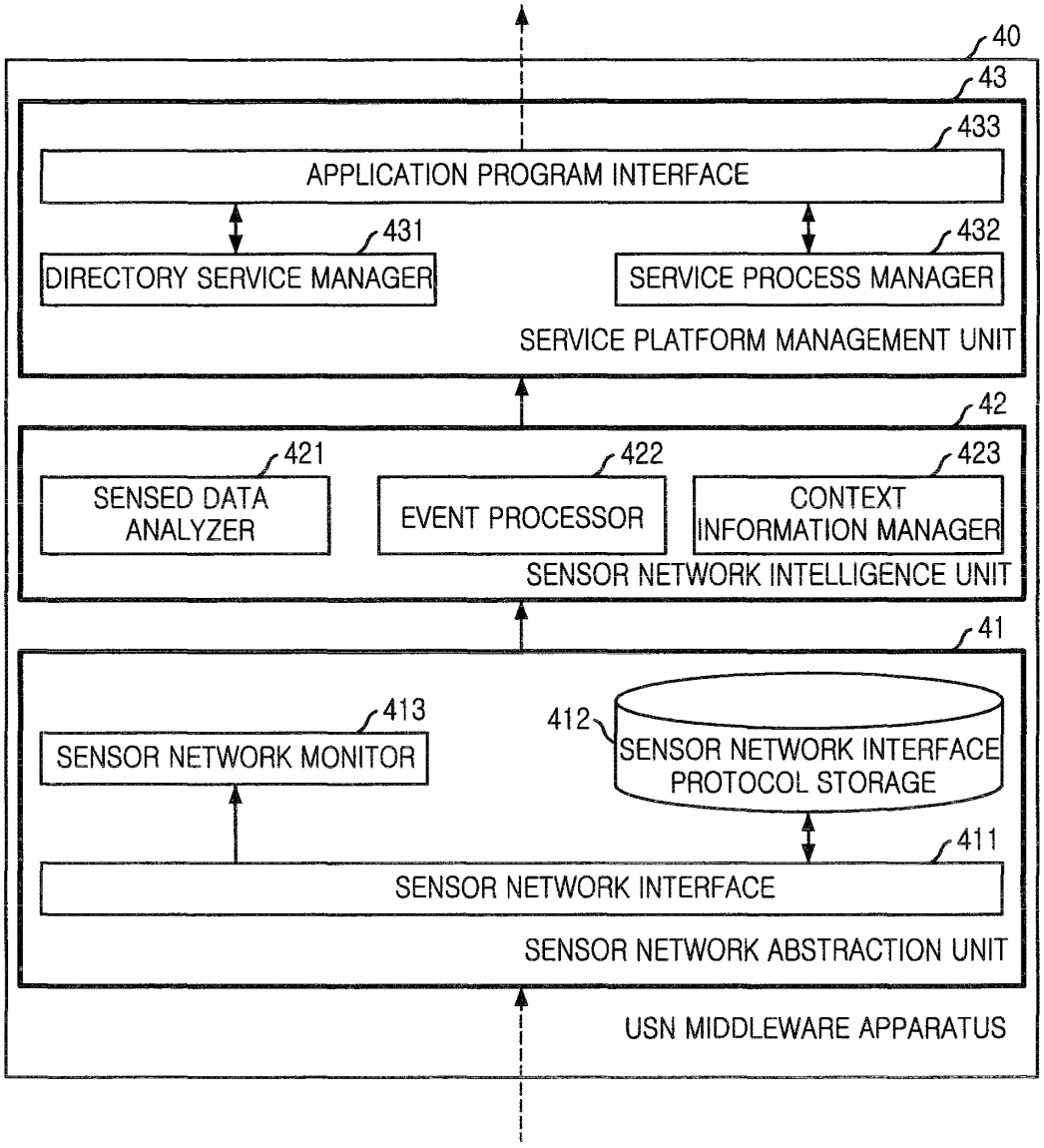

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APPLICATION PROGRAM INTERFACE
431
DIRECTORY SERVICE MANAGER
432
SERVICE PROCESS MANAGER
SERVICE PLATFORM MANAGEMENT UNIT
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SENSED DATA ANALYZER
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EVENT PROCESSOR
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CONTEXT INFORMATION MANAGER
SENSOR NETWORK INTELLIGENCE UNIT
41
413
SENSOR NETWORK MONITOR
412
SENSOR NETWORK INTERFACE PROTOCOL STORAGE
411
SENSOR NETWORK INTERFACE
SENSOR NETWORK ABSTRACTION UNIT
USN MIDDLEWARE APPARATUS

FIG. 4

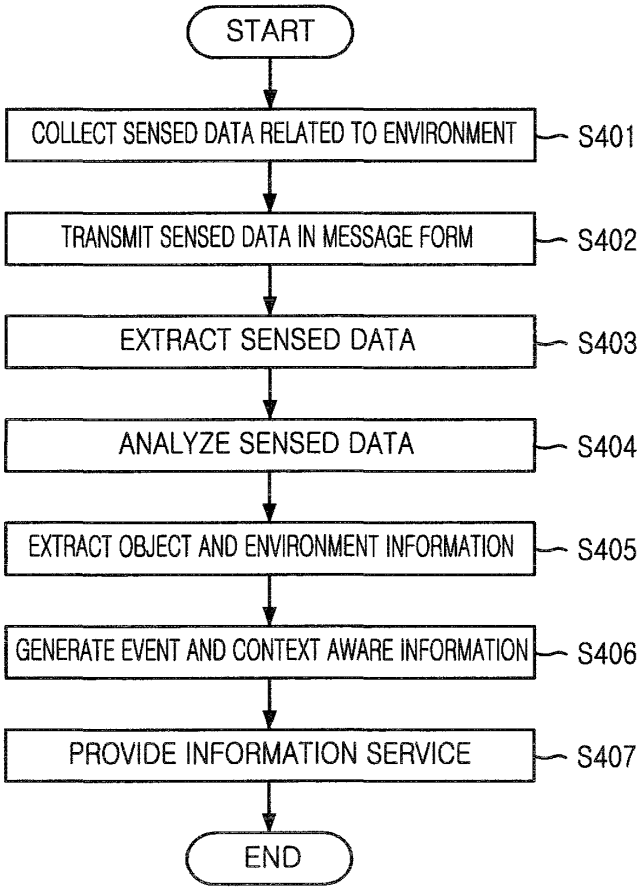
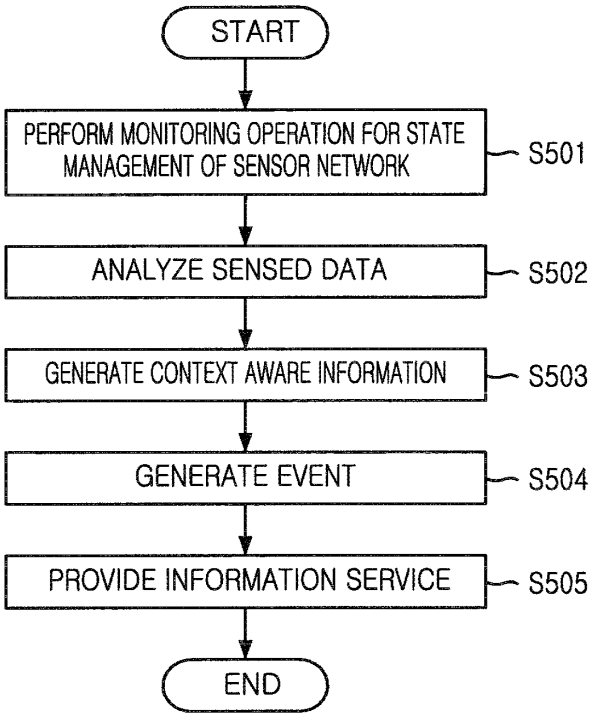

START
COLLECT SENSED DATA RELATED TO ENVIRONMENT
S401
TRANSMIT SENSED DATA IN MESSAGE FORM
S402
EXTRACT SENSED DATA
S403
ANALYZE SENSED DATA
S404
EXTRACT OBJECT AND ENVIRONMENT INFORMATION
S405
GENERATE EVENT AND CONTEXT AWARE INFORMATION
S406
PROVIDE INFORMATION SERVICE
S407
END

FIG. 5


START
PERFORM MONITORING OPERATION FOR STATE MANAGEMENT OF SENSOR NETWORK
S501
ANALYZE SENSED DATA
S502
GENERATE CONTEXT AWARE INFORMATION
S503
GENERATE EVENT
S504
PROVIDE INFORMATION SERVICE
S505
END

IP20060109A

Form (Rev. 2/01) UNITED STATES Docket No.:

COMBINED DECLARATION/POWER OF ATTORNEY FOR UTILITY/DESIGN PATENT APPLICATION

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name.
I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:
USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME
the specification of which is attached hereto, unless the following box is checked:
☐ was filed on _____ as United States Application Number or PCT International Application Number _____ and was amended on (if applicable).
I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.
I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56.
I hereby claim foreign priority benefit(s) under 35 U.S.C. § 119(a)-(d) or ' 365(a)-(c) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application(s) for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority NOT Claimed
10-2006-0084353 (Number)	Republic of Korea (Country)	1 September 2006 Day/Month/Year Filed	☐
(Number)	(Country)	Day/Month/Year Filed	☐

I hereby claim the benefit under 35 U.S.C. ' 120 or § 119(e) of any United States application(s), or ' 365(c) of any PCT international application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application(s) in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. ' 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

PCT/KR2006/005715 (Application Serial No.)	26 December 2006 (Filing Date)	pending (Status -- patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status -- patented, pending, abandoned)

I hereby appoint the attorneys and agents of Staas & Halsey LLP under USPTO Customer No. 21,171 to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

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PATENT TRADEMARK OFFICE

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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☒ Additional inventors are being named on separately numbered sheets attached hereto.

수신시각 2월 6일 4:18PM

Form (Rev. 2/01) UNITED STATES Docket No.: IP20060109A

COMBINED DECLARATION/POWER OF ATTORNEY FOR UTILITY/DESIGN PATENT APPLICATION

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Full name of fourth inventor

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Residence Citizenship

Mailing Address

Full name of fifth inventor

Inventor's Signature Date

Residence Citizenship

Mailing Address

수신시각 2월 6일 4:18PM

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1 September 2006 (01.09.2006) KR

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(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **OH, Se-Won** [KR/KR]; #301 Daewon, 144-2, Sinseong-dong, Yuseong-gu, Daejon 305-804 (KR). **LEE, Yong-Joon** [KR/KR]; #110-1504 Hanul Apt., Sinseong-dong, Yuseong-gu, Daejon 305-707 (KR). **PARK, Jong-Hyun** [KR/KR]; #1104-802 Yeolmae Maeul, 552-3, Noeun-dong, Yuseong-gu, Daejon 305-325 (KR).

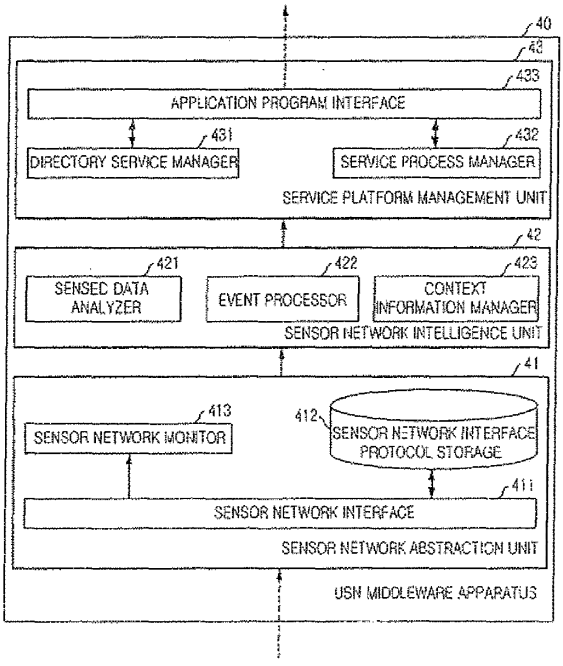
(74) Agent: **SHINSUNG INTERNATIONAL PATENT & LAW FIRM**; ID Tower #601, Jungdaero 105, (99-7 Garak-dong), Songpa-gu, Seoul 138-805 (KR).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH,

[Continued on next page]

(54) Title: USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME



(57) Abstract: Provided are a Ubiquitous Sensor Network (USN) middleware apparatus and method for generating an information service based on heterogeneous sensor networks and a system for providing the information service using the same. In the system, a sensor node constructing a sensor network senses environment information, and a sensor network data transmitter collects sensed data sensed by the sensor node in real-time and transmits the collected sensed data in a message form. A USN middleware extracts object and environment information by cleaning, classifying and integrating the message received from the sensor network data transmitter, generates conditional events and context aware information from the extracted object and environment information, and provides the information service to an application program, the application program providing a user with information related to environment where the sensor network observes.

WO 2008/026804 A1

GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

Claims

[1] A system for providing an information service based on heterogeneous sensor networks, comprising:
a sensor node constructing a sensor network to sense environment information;
a sensor network data transmitter for collecting sensed data sensed by the sensor in real-time and transmitting the collected sensed data in a message form; and
a Ubiquitous Sensor Network (USN) middleware for extracting object and environment information by cleaning, classifying and integrating the message received from the sensor network data transmitter, generating conditional events, context aware information, and knowledge contents from the extracted object and environment information, and providing the information service to an application program, the application program providing a user with information related to environment where the sensor network is installed.

[2] The system as recited in claim 1, wherein the ubiquitous sensor network middleware comprises:
a sensor network abstraction unit for extracting the sensed data from the message received from the sensor network data transmitter;
a sensor network intelligence unit for extracting the object and environment information by analyzing the sensed data extracted by the sensor network abstraction unit, and generating the conditional events including notification and alarm about a certain condition, and the context aware information from the extracted object and environment information; and
a service platform management unit for providing the events and the context aware information to the application program in a form suitable for the application program.

[3] The system as recited in claim 2, wherein the sensor network abstraction unit comprises:
a sensor network interface for extracting the sensed data by referring to a message transfer protocol;
a sensor network interface protocol storage for managing a rule for the message transfer protocol; and
a sensor network monitor for monitoring a state of the sensor network, based on the data received from the sensor network interface.

[4] The system as recited in claim 3, wherein the sensor network intelligence unit comprises:
a sensed data analyzer for performing an analysis operation to clean, classify and integrate the sensed data processed by the sensor network abstraction unit;

an event processor for generating the conditional events including notification and alarm according to a rule set by the application program and managing the generated events; and

a context information manager for sensing and generating the context aware information, based on the sensed data analyzed by the sensed data analyzer.

[5] The system as recited in claim 4, wherein the service platform management unit comprises:

a directory service manager for identifying and searching resources of the sensor network;

a service process manager for scheduling and managing an operation sequence of the sensed data analyzer, the event processor, the context information manager, and the directory service manager in order to obtain a desired information service according to the application program; and

an application program interface for providing the application program with the results processed by the sensor network monitor, the sensed data analyzer, the event processor, the context information manager, and the directory service manager in an information service form suitable for the application program.

[6] A Ubiquitous Sensor Network (USN) middleware apparatus for generating an information service based on heterogeneous sensor networks, comprising:

a sensor network abstraction unit for extracting sensed data from a message received from a sensor network;

a sensor network intelligence unit for extracting the object and environment information by performing an analysis operation to clean, classify and integrate the sensed data extracted by the sensor network abstraction unit, and generating an event, including notification and alarm, and context aware information from the extracted object and environment information; and

a service platform management unit for providing the event and the context aware information to the application program in a form suitable for the application program.

[7] The ubiquitous sensor network middleware apparatus as recited in claim 6, wherein the sensor network abstraction unit comprises:

a sensor network interface for extracting the sensed data by referring to a message transfer protocol;

a sensor network interface protocol storage for managing a rule for the message transfer protocol; and

a sensor network monitor for monitoring a state of the sensor network, based on the data received from the sensor network interface.

[8] The ubiquitous sensor network middleware apparatus as recited in claim 7,

wherein the sensor network intelligence unit comprises:
a sensed data analyzer for performing an analysis operation to clean, classify and integrate the sensed data processed by the sensor network abstraction unit;
an event processor for generating the event including the knowledge contents according to a rule set by the application program and managing the generated event; and
a context information manager for sensing and generating the environment condition information, based on the sensed data analyzed by the sensed data analyzer.

[9] The ubiquitous sensor network middleware apparatus as recited in claim 8, wherein the service platform management unit comprises:
a directory service manager for identifying and searching resources of the sensor network;
a service process manager for scheduling and managing an operation order of the sensed data analyzer, the event processor, the context information manager, and the directory service manager in order to obtain a desired information service according to the application program; and
an application program interface for providing the application program with the results processed by the sensor network monitor, the sensed data analyzer, the event processor, the context information manager, and the directory service manager in an information service form suitable for the application program.

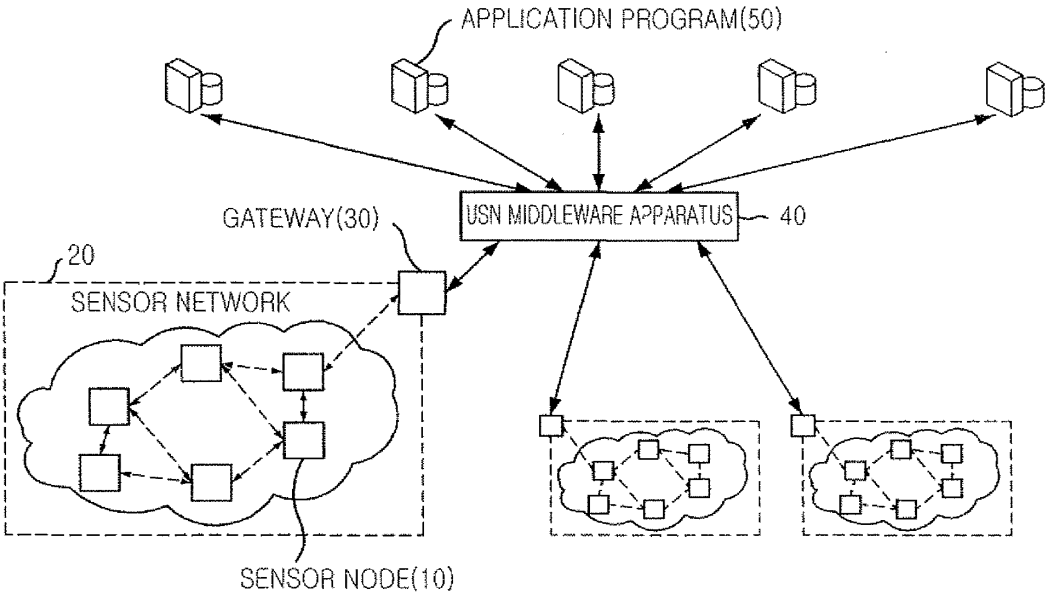
[10] A method for generating an information service based on heterogeneous sensor networks in a ubiquitous sensor network middleware apparatus, comprising the steps of:
a) extracting sensed data and monitoring a state management of a sensor network, based on the extracted sensed data;
b) performing an analysis operation to clean, classify and integrate the extracted sensed data;
c) extracting the object and environment information from the analyzed sensed data, and generating context aware information based on the extracted object and environment information;
d) generating an event including notification event, alarm, and knowledge contents according to a rule set by an application program;
e) scheduling an operation sequence for providing an information service to the application program; and
f) providing the application program with the information service obtained according to the scheduled operation sequence, the information service including events and context aware information.

[11] The method as recited in claim 10, wherein the step b) analyzes sensed data from a specific single sensor network, or analyzes sensed data from a plurality of sensor networks, or analyzes sensed data from the sensor network in association with predefined legacy data.

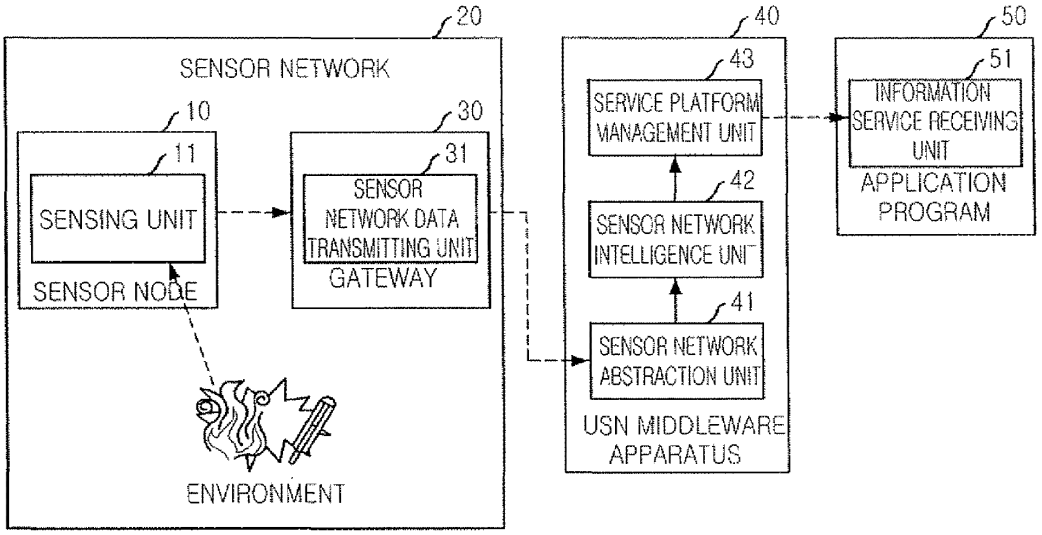
[12] The method as recited in claim 10, wherein the step f) provides the information service to the application program only one time, or periodically provides the information service during a request period of the application program, or provides the information service at a specific time point when a requirement from the application program is satisfied.

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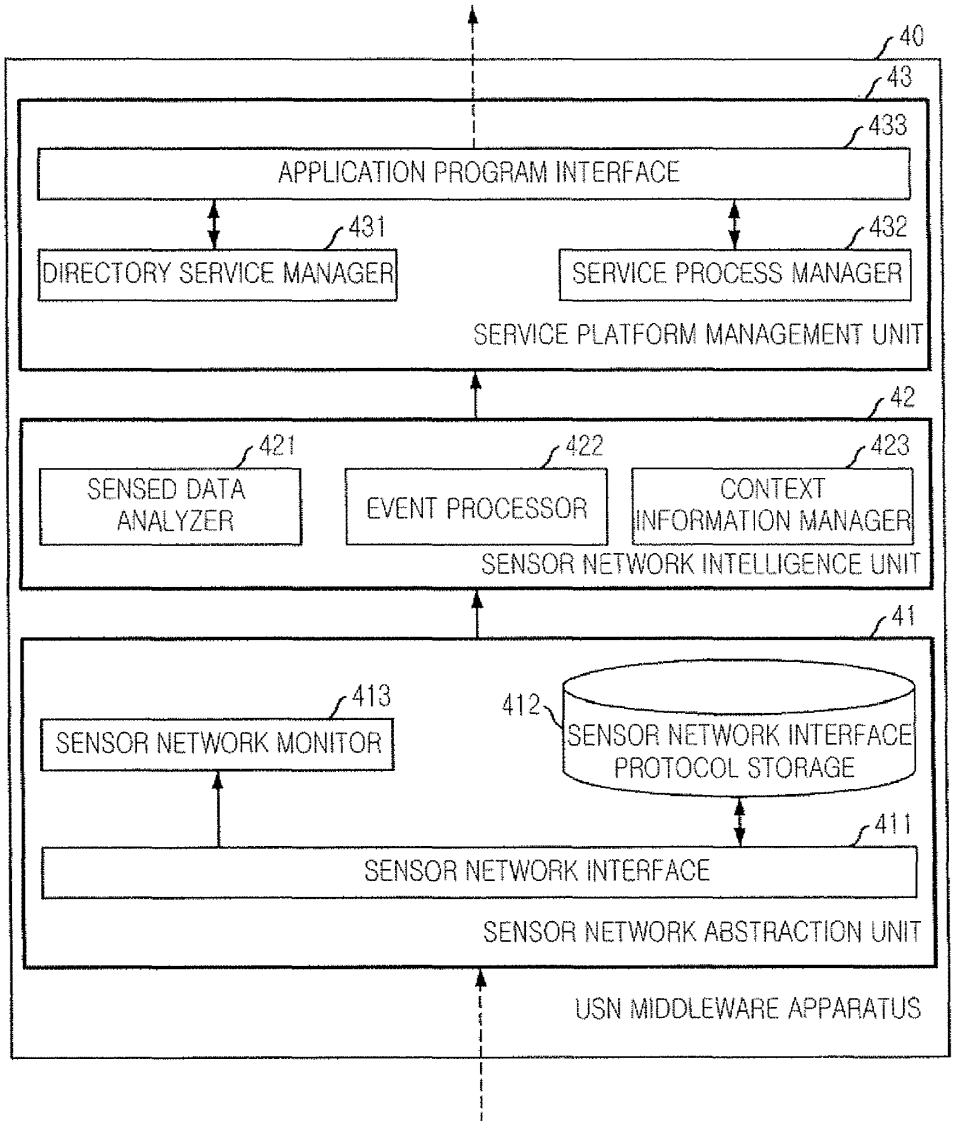
[Fig. 1]



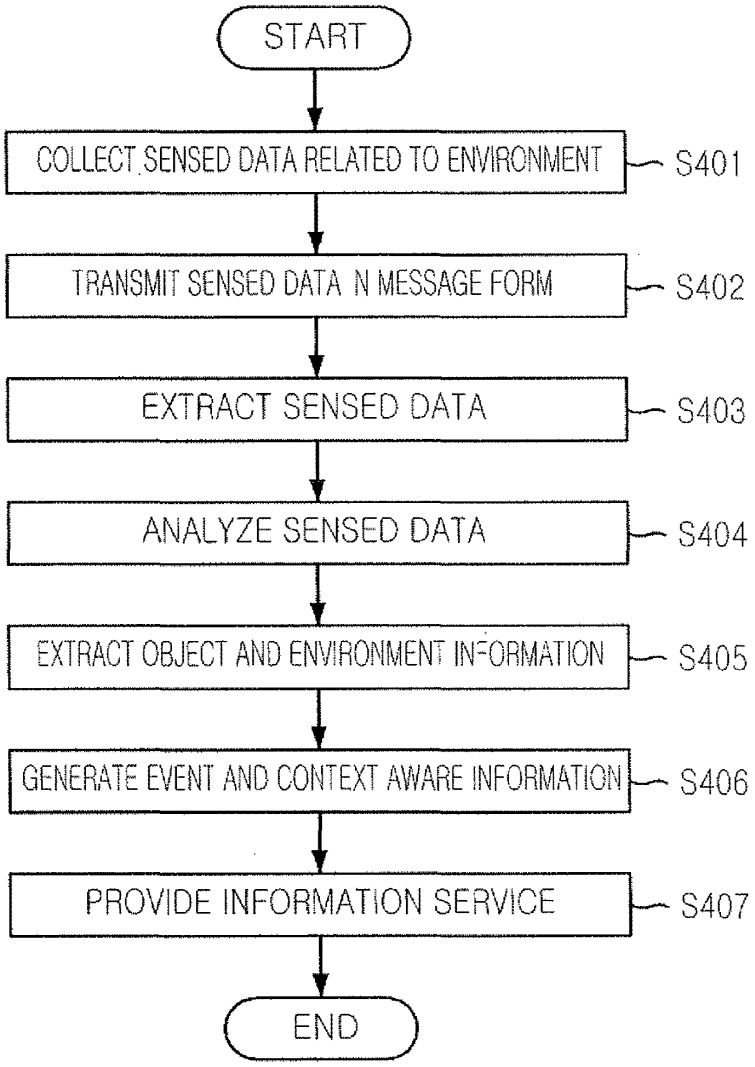
[Fig. 2]



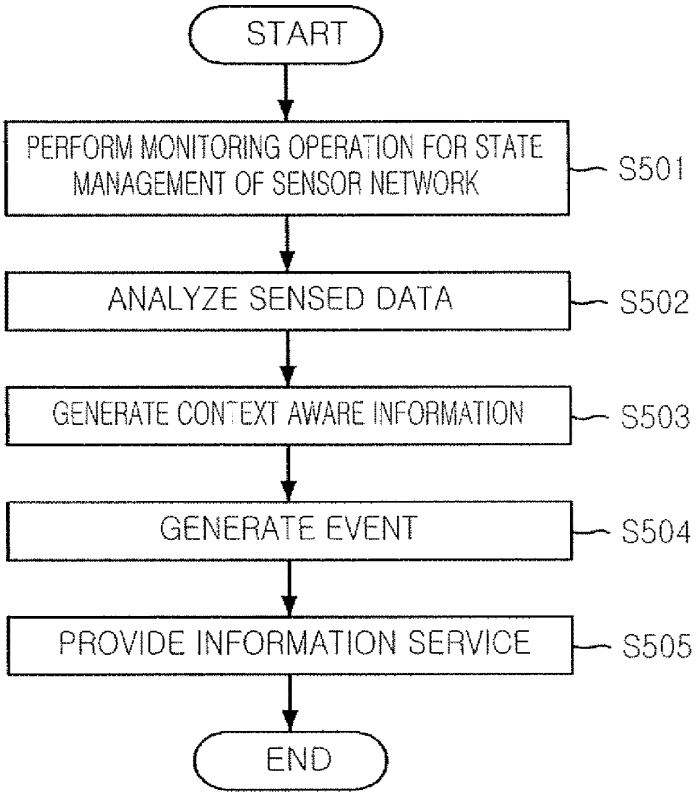
[Fig. 3]


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APPLICATION PROGRAM INTERFACE
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SENSOR NETWORK INTERFACE
SENSOR NETWORK ABSTRACTION UNIT
USN MIDDLEWARE APPARATUS

[Fig. 4]


START
COLLECT SENSED DATA RELATED TO ENVIRONMENT
S401
TRANSMIT SENSED DATA IN MESSAGE FORM
S402
EXTRACT SENSED DATA
S403
ANALYZE SENSED DATA
S404
EXTRACT OBJECT AND ENVIRONMENT INFORMATION
S405
GENERATE EVENT AND CONTEXT AWARE INFORMATION
S406
PROVIDE INFORMATION SERVICE
S407
END

[Fig. 5]


START
PERFORM MONITORING OPERATION FOR STATE MANAGEMENT OF SENSOR NETWORK
S501
ANALYZE SENSED DATA
S502
GENERATE CONTEXT AWARE INFORMATION
S503
GENERATE EVENT
S504
PROVIDE INFORMATION SERVICE
S505
END

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2006/005715

A. CLASSIFICATION OF SUBJECT MATTER

H04L 12/24(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)
IPC8 H04L 12/24

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility models since 1975
Japanese Utility models and applications for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKIPASS (KIPO Internal) : "Keyword : USN, sensor, network, environment, abstract"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US2006149905AA (Seung-Min Park et al.) 06.07.2006 see abstract; Figures 1,2; claim 1; Paragraphs [0026]-[0055].	1 - 12
Y	WO2006065098A1 (ETRI Korea) 22.06.2006 see abstract; Figures 2-4; Paragraphs [46] - [81].	1 - 12
A	KR2004108623A (SDLINE CO., LTD.) 24.12.2004 see abstract; Page2, line 15 - Page 3, line 2.	1 - 12
A	US2006095518AA (Jesse Harper et al.) 04.05.2006 see abstract; Figures 3,4; Paragraphs [0022]- [0036].	1 - 12
A	EP1545069A1 (SONY International) 22.06.2005 see abstract; Figure 4-1; Paragraphs [0056]-[0073].	1,6,10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"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
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"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	Date of mailing of the international search report
30 MAY 2007 (30.05.2007)	**30 MAY 2007 (30.05.2007)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer SHIN, Sung Kil Telephone No. 82-42-481-5688

Form PCT/ISA/210 (second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR2006/005715

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US2006149905AA	06.07.2006	KR20060685 18A	21.06.2006
WO2006065098A1	22.06.2006	JP18172422 JP2006172422A2 KR2006069170A	29.06.2006 29.06.2006 21.06.2006
KR2004108623A	24.12.2004	NONE	
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EP1545069A1	22.06.2005	EP01545069A1 WO2005060164A2 WO2005060164A3	22.06.2005 30.06.2005 09.02.2006

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PCT REQUEST

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0	**For receiving Office use only**	
0-1	International Application No.	
0-2	International Filing Date	
0-3	Name of receiving Office and "PCT International Application"	

0-4	**Form PCT/RO/101 PCT Request**	
0-4-1	Prepared Using	PCT-SAFE Version 3.51.005.180 MT/FOP 20060501/0.20.4rc.2.7
0-5	**Petition** The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	**Receiving Office (specified by the applicant)**	Korean Intellectual Property Office (RO/KR)
0-7	**Applicant's or agent's file reference**	P06E6020PCT
I	**Title of Invention**	USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME
II	**Applicant**	
II-1	This person is	applicant only
II-2	Applicant for	all designated States except US
II-4	Name	ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE
II-5	Address	161, Gajeong-dong, Yuseong-gu Daejon305-350 Republic of Korea
II-6	State of nationality	KR
II-7	State of residence	KR
II-11	Applicant's registration No. with the Office	3-1998-007763-8

PCT REQUEST

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III-1	**Applicant and/or inventor**	
III-1-1	This person is	applicant and inventor
III-1-2	Applicant for	US only
III-1-4	Name (LAST, First)	OH, Se-Won
III-1-5	Address	#301 Daewon, 144-2, Sinseong-dong, Yuseong-gu Daejon305-804 Republic of Korea
III-1-6	State of nationality	KR
III-1-7	State of residence	KR
III-2	**Applicant and/or inventor**	
III-2-1	This person is	applicant and inventor
III-2-2	Applicant for	US only
III-2-4	Name (LAST, First)	LEE, Yong-Joon
III-2-5	Address	#110-1504 Hanul Apt., Sinseong-dong, Yuseong-gu Daejon305-707 Republic of Korea
III-2-6	State of nationality	KR
III-2-7	State of residence	KR
III-3	**Applicant and/or inventor**	
III-3-1	This person is	applicant and inventor
III-3-2	Applicant for	US only
III-3-4	Name (LAST, First)	PARK, Jong-Hyun
III-3-5	Address	#1104-802 Yeolmae maeul, 552-3, Noeun-dong, Yuseong-gu Daejon305-325 Republic of Korea
III-3-6	State of nationality	KR
III-3-7	State of residence	KR

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IV-1	**Agent or common representative; or address for correspondence**	
	The person identified below is hereby/ has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	SHINSUNG PATENT FIRM
IV-1-2	Address	2-3F, Line Bldg., 823-30, Yeoksam-dong, Kangnam-ku Seoul135-080 Republic of Korea
IV-1-3	Telephone No.	82-2-2009-6100
IV-1-4	Facsimile No.	82-2-2009-6200
IV-1-5	e-mail	sspat@sspat.com
IV-1-6	Agent's registration No.	9-2000-100004-8
V	**DESIGNATIONS**	
V-1	**The filing of this request constitutes under Rule 4.9(a), the designation of all Contracting States bound by the PCT on the international filing date, for the grant of every kind of protection available and, where applicable, for the grant of both regional and national patents.**	
V-2	**Item V-2 may only be used to exclude (irrevocably) the designations concerned if, at the time of filing, the international application contains a priority claim to an earlier national application filed in the particular State concerned, in order to avoid the ceasing of the effect, under the national law, of this earlier national application. As to the consequences of such national law provisions in these States, see the PCT Applicant's Guide, Volume I/A, in the relevant Annex B1.**	KR
VI-1	**Priority claim of earlier national application**	
VI-1-1	Filing date	01 September 2006 (01.09.2006)
VI-1-2	Number	10-2006-0084353
VI-1-3	Country	KR
VI-2	**Priority document request**	
	The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1
VII-1	**International Searching Authority Chosen**	Korean Intellectual Property Office (ISA/KR)

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VIII	**Declarations**	Number of declarations	
VIII-1	Declaration as to the identity of the inventor	-	
VIII-2	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent	-	
VIII-3	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application	-	
VIII-4	Declaration of inventorship (only for the purposes of the designation of the United States of America)	-	
VIII-5	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	-	
IX	**Check list**	number of sheets	electronic file(s) attached
IX-1	Request (including declaration sheets)	5	✓
IX-2	Description	11	✓
IX-3	Claims	4	✓
IX-4	Abstract	1	✓
IX-5	Drawings	4	✓
IX-7	TOTAL	25	
	Accompanying Items	paper document(s) attached	electronic file(s) attached
IX-8	Fee calculation sheet	-	✓
IX-17	PCT-SAFE physical media	-	-
IX-19	**Figure of the drawings which should accompany the abstract**	3	
IX-20	**Language of filing of the international application**	English	
X-1	**Signature of applicant, agent or common representative**	(PKCS7 Digital Signature)	
X-1-1	Name	SHINSUNG PATENT FIRM	
X-1-2	Name of signatory	SHINSUNG PATENT FIRM	
X-1-3	Capacity		

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10-1	Date of actual receipt of the purported international application	
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/KR
10-6	Transmittal of search copy delayed until search fee is paid	

FOR INTERNATIONAL BUREAU USE ONLY

11-1	Date of receipt of the record copy by the International Bureau	

Docket No.: 2044.1022

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Se-Won OH, et al.

Serial No. To be assigned | Group Art Unit: To be assigned

Confirmation No. To be assigned

Filed: February 27, 2009 | Examiner: To be assigned

For: USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

PRELIMINARY AMENDMENT

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Sir:

Before examination of the above-identified application, please amend the application as follows:

AMENDMENT TO THE SPECIFICATION

Please AMEND the specification by inserting the following paragraph at page 1, line 5:

-- Cross Reference to Related Applications

This application claims the benefit under 35 U.S.C. Section 371, of International Application No. PCT/KR2006/005715, filed December 26, 2006, which claimed priority to Korean Application No. 10-2006-0084353, filed September 1, 2006 in the Korean Intellectual Property Office, the disclosures of all of which are hereby incorporated by reference. --

Ex.1002 / Page 55 of 414
AMAZON.COM, INC.

AMENDMENT TO THE CLAIMS

The text of all pending claims, (including withdrawn claims) is set forth below. Cancelled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~strikethrough~~. The status of each claim is indicated with one of (original), (currently amended), (cancelled), (withdrawn), (new), (previously presented), or (not entered). Please AMEND claims 10-12 in accordance with the following:

1. (Original) A system for providing an information service based on heterogeneous sensor networks, comprising:

a sensor node constructing a sensor network to sense environment information;

a sensor network data transmitter for collecting sensed data sensed by the sensor in real-time and transmitting the collected sensed data in a message form; and

a Ubiquitous Sensor Network (USN) middleware for extracting object and environment information by cleaning, classifying and integrating the message received from the sensor network data transmitter, generating conditional events, context aware information, and knowledge contents from the extracted object and environment information, and providing the information service to an application program, the application program providing a user with information related to environment where the sensor network is installed.

2. (Original) The system as recited in claim 1, wherein the ubiquitous sensor network middleware comprises:

a sensor network abstraction unit for extracting the sensed data from the message received from the sensor network data transmitter;

a sensor network intelligence unit for extracting the object and environment information by analyzing the sensed data extracted by the sensor network abstraction unit, and generating the conditional events including notification and alarm about a certain condition, and the context aware information from the extracted object and environment information; and

a service platform management unit for providing the events and the context aware information to the application program in a form suitable for the application program.

3. (Original) The system as recited in claim 2, wherein the sensor network abstraction unit comprises:

a sensor network interface for extracting the sensed data by referring to a message transfer protocol;

a sensor network interface protocol storage for managing a rule for the message transfer protocol; and

a sensor network monitor for monitoring a state of the sensor network, based on the data received from the sensor network interface.

4. (Original) The system as recited in claim 3, wherein the sensor network intelligence unit comprises:

a sensed data analyzer for performing an analysis operation to clean, classify and integrate the sensed data processed by the sensor network abstraction unit;

an event processor for generating the conditional events including notification and alarm according to a rule set by the application program and managing the generated events; and

a context information manager for sensing and generating the context aware information, based on the sensed data analyzed by the sensed data analyzer.

5. (Original) The system as recited in claim 4, wherein the service platform management unit comprises:

a directory service manager for identifying and searching resources of the sensor network;

a service process manager for scheduling and managing an operation sequence of the sensed data analyzer, the event processor, the context information manager, and the directory service manager in order to obtain a desired information service according to the application program; and

an application program interface for providing the application program with the results processed by the sensor network monitor, the sensed data analyzer, the event processor, the context information manager, and the directory service manager in an information service form suitable for the application program.

6. (Original) A Ubiquitous Sensor Network (USN) middleware apparatus for generating an information service based on heterogeneous sensor networks, comprising:

a sensor network abstraction unit for extracting sensed data from a message received from a sensor network;

a sensor network intelligence unit for extracting the object and environment information by performing an analysis operation to clean, classify and integrate the sensed data extracted by the sensor network abstraction unit, and generating an event, including notification and alarm, and context aware information from the extracted object and environment information; and

a service platform management unit for providing the event and the context aware information to the application program in a form suitable for the application program.

7. (Original) The ubiquitous sensor network middleware apparatus as recited in claim 6, wherein the sensor network abstraction unit comprises:

a sensor network interface for extracting the sensed data by referring to a message transfer protocol;

a sensor network interface protocol storage for managing a rule for the message transfer protocol; and

a sensor network monitor for monitoring a state of the sensor network, based on the data received from the sensor network interface.

8. (Original) The ubiquitous sensor network middleware apparatus as recited in claim 7, wherein the sensor network intelligence unit comprises:

a sensed data analyzer for performing an analysis operation to clean, classify and integrate the sensed data processed by the sensor network abstraction unit;

an event processor for generating the event including the knowledge contents according to a rule set by the application program and managing the generated event; and

a context information manager for sensing and generating the environment condition information, based on the sensed data analyzed by the sensed data analyzer.

9. (Original) The ubiquitous sensor network middleware apparatus as recited in claim 8, wherein the service platform management unit comprises:

a directory service manager for identifying and searching resources of the sensor network;

a service process manager for scheduling and managing an operation order of the sensed data analyzer, the event processor, the context information manager, and the directory service manager in order to obtain a desired information service according to the application program; and

an application program interface for providing the application program with the results processed by the sensor network monitor, the sensed data analyzer, the event processor, the context information manager, and the directory service manager in an information service form suitable for the application program.

10. (Currently Amended) A method for generating an information service based on heterogeneous sensor networks in a ubiquitous sensor network middleware apparatus, comprising ~~the steps of~~:

~~a)~~ extracting sensed data and monitoring a state management of a sensor network, based on the extracted sensed data;

~~b)~~ performing an analysis operation to clean, classify and integrate the extracted sensed data;

~~c)~~ extracting the object and environment information from the analyzed sensed data, and generating context aware information based on the extracted object and environment information;

~~d)~~ generating an event including notification event, alarm, and knowledge contents according to a rule set by an application program;

~~e)~~ scheduling an operation sequence for providing an information service to the application program; and

~~f)~~ providing the application program with the information service obtained according to the scheduled operation sequence, the information service including events and context aware information.

11. (Currently Amended) The method as recited in claim 10, wherein the ~~step b)~~ performing an analysis operation to clean, classify and integrate the extracted sensed data analyzes sensed data from a specific single sensor network, or analyzes sensed data from a plurality of sensor networks, or analyzes sensed data from the sensor network in association with predefined legacy data.

12. (Currently Amended) The method as recited in claim 10, wherein the ~~step f)~~ providing the application program with the information service obtained according to the scheduled operation sequence, the information service including events and context aware information provides the information service to the application program only one time, or periodically provides the information service during a request period of the application program, or provides the information service at a specific time point when a requirement from the application program is satisfied.

REMARKS

This Preliminary Amendment is submitted to amend claims 10-12. No new matter was added.

It is respectfully requested that this Preliminary Amendment be entered in the above-referenced application.

If there are any additional fees associated with filing of this Preliminary Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

Date: 2/21/9

By: _____
J. Randall Beckers
Registration No. 30,358

1201 New York Ave, N.W., 7th Floor
Washington, D.C. 20005
Telephone: (202) 434-1500
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Attorney Docket No. 2044.1022

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:

Se-Won OH, et al.

Application No.: To be assigned | Group Art Unit: To be assigned

Filed: February 27, 2009 | Examiner: To be assigned

For: USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Sir:

In accordance with the duty of disclosure provisions of 37 CFR § 1.56, there is hereby provided certain information which the Examiner may consider material to the examination of the subject U.S. patent application. It is requested that the Examiner make this information of record if it is deemed material to the examination of the subject application.

1. Enclosures accompanying this Information Disclosure Statement are:

1a. ☒ Form PTO-1449.
1b. ☒ Copy(ies) of IDS citation(s), except for U.S. Patents and U.S. Patent Application publications.
1c. ☒ English language copy of a communication(s) from a foreign Patent Office or a PCT International Search Report.
1d. ☒ English language translation (complete, Abstract or relevant portion(s)) attached to non-English language publications as indicated on the attached Form PTO-1449.
1e. ☒ Explanations of Relevancy of References (ATTACHMENT 1(e), hereto) for providing a concise explanation of non-English publications.
1f. ☐ List of Copending Applications (ATTACHMENT 1(f), hereto).
1g. ☒ List of Additional Submitted Documents (ATTACHMENT 1(g), hereto).

2. ☐ In accordance with 37 CFR § 1.98, a concise explanation of what is presently understood to be the relevance of each non-English language publication is

(Check appropriate Items 2a, 2b, 2c and/or 2d)

2a. ☐ satisfied for the non-English language publication(s) cited on the enclosed "English language version of the search report or action which indicates the degree of relevance found by the foreign office". (See MPEP § 609,

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Minimum Requirements for an Information Disclosure Statement, Part A(3): Concise Explanation of Relevance, 8th Ed., Rev. 2)

2b. ☐ set forth in the application.

2c. ☐ satisfied for the non-English language publication(s) indicated on the attached PTO-1449 as having an English language translation (complete or relevant portion(s)) attached thereto.

2d. ☐ enclosed as Attachment 1(e), hereto.

3. No admission is made that the information cited in this Statement is, or is considered to be, material to patentability nor a representation that a search has been made (other than search report(s) from a counterpart foreign application or a PCT International Search Report, if submitted herewith). 37 CFR §§ 1.97(g) and (h).

Respectfully submitted,

STAAS & HALSEY LLP

Dated: 2/21/9

By: _____

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FORM PTO-1449 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY DOCKET NO.	APPLICATION NO.
	2044.1022	
	FIRST NAMED INVENTOR	
	Se-Won OH, et al.	
INFORMATION DISCLOSURE STATEMENT *(Use several sheets if necessary)*	FILING DATE	GROUP ART UNIT
	February 27, 2009	

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NO.	DATE	NAME	CLASS	SUB-CLASS	FILING DATE
	AA	2006/0149905 A1	7/6/2006	Park et al.			
	AB	2006/0095518 A1	5/4/2006	Davis et al.			
	AC	6,801,943 B1	10/5/2004	Pavan et al.			
	AD	5,870,605	2/9/1999	Bracho et al.			
	AE	2005/0114493 A1	5/26/2005	Mandato et al.			
	AF						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NO.	DATE	COUNTRY	TRANSLATION YES	TRANSLATION NO	ABSTRACT
	AG	2006/065098 A1	6/22/2006	WIPO	Published in English		
	AH	10-2004-0108623	12/24/2004	Republic of Korea		X	X
	AI	1545069 A1	6/22/2005	Europe			
	AJ	10-0372788 B1	2/19/2003	Republic of Korea		X	X
	AK	10-2006-0009788	2/1/2006	Republic of Korea		X	X
	AL						

OTHER REFERENCES (INCLUDING AUTHOR, TITLE, DATE, PERTINENT PAGES, ETC.)

			TRANSLATION YES	TRANSLATION NO
	AM	Dae-Young Kim, et al. (Real-Time Embedded System Laboratory, Information & Communication College of Korea), "**Technical Trend of Sensor Network Operating System/Middleware**", *ITFIND*, Issue 1221, November 9, 2005, 10pp.	Partial	
	AN			

EXAMINER	DATE CONSIDERED

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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Revised April 2006

ATTACHMENT 1(e)

EXPLANATIONS OF RELEVANCY OF REFERENCES	ATTORNEY DOCKET NO.	APPLICATION NO.
	2044.1022	
	FIRST NAMED INVENTOR	
	Se-Won OH, et al.	
	FILING DATE	GROUP ART UNIT
	February 27, 2009	

References **AA**, **AB**, **AG**, **AH**, and **AI** are cited on the attached International Search Report.

ATTACHMENT 1(g)

LIST OF ADDITIONAL SUBMITTED DOCUMENTS	ATTORNEY DOCKET NO.	APPLICATION NO.
	2044.1022	
	FIRST NAMED INVENTOR	
	Se-Won OH, et al.	
	FILING DATE	GROUP ART UNIT
	February 27, 2009	

The following document(s) is/are listed in accordance with the duty of disclosure provisions of 37 CFR § 1.56, so that the Examiner may consider same should he deem any thereof to be material to examination of the subject application.

It is requested that the Examiner acknowledge his consideration of document(s) below-listed by initialling same in the space provided adjacent each such application and that the Examiner sign and date this form at the bottom thereof to confirm such consideration having been given.

This submission in no way represents an admission that any of the information listed herein constitutes prior art with respect to the subject application; and unless and until such prior art status is established, this submission is not a request that the information presented herein be printed on the face of any patent issuing from the subject application in which this information is being filed.

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NO.	DATE	NAME	CLASS	SUB-CLASS	FILING DATE
	BA						
	BB						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NO.	DATE	COUNTRY	CLASS	SUB-CLASS	TRANSLATION YES	TRANSLATION NO
	BC							
	BD							

OTHER DOCUMENTS **(Including Author, Title, Date, Pertinent Pages, Etc.)**			TRANSLATION YES	TRANSLATION NO
	BE	**International Search Report for International Application No. PCT/KR2006/005715, mailed May 30, 2007.**	**X**	

EXAMINER	DATE CONSIDERED
*EXAMINER: Initial if document considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

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17 December 2004 (17.12.2004) KR

(71) Applicant *(for all designated States except US)*: **ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE** [KR/KR]; 161, gajeong-dong, Yuseong-gu, Daejon 305-350 (KR).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **LEE, Chang-eun** [KR/KR]; #104-1307 Hansol Apt.,, Songgang-dong, Yuseong-gu, Daejeon 305-503 (KR). **PARK, Jun-hee** [KR/KR]; #407, Gung-dong 406-11, Yuseong-gu, Daejeon 305-335 (KR). **SON, Young-sung** [KR/KR]; #315-1204 Green Apt.,, Songgang-dong, Yuseong-gu, Daejeon 305-503 (KR). **KIM, Dong-hee** [KR/KR]; #201, Mannyeon-dong 102, Seo-gu, Daejeon 302-150 (KR). **MOON, Kyeong-deok** [KR/KR]; #209-703 Expo Apt.,, Jeonmin-dong, Yuseong-gu, Daejeon 305-390 (KR). **BAE, Yu-seok** [KR/KR]; #308-413 Cheongsol Apt.,, Songgang-dong, Yuseong-gu, Daejeon 305-503 (KR).

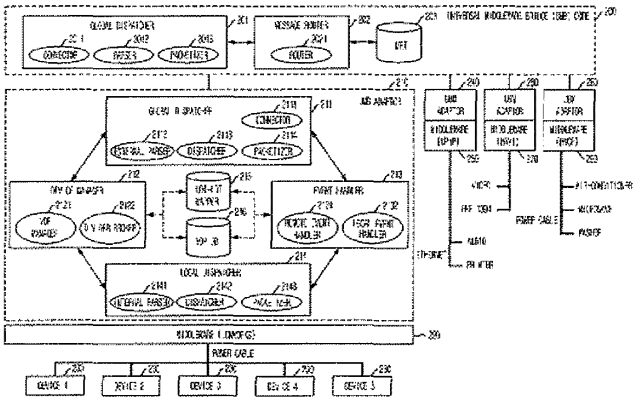
(74) Agent: **SHINSUNG PATENT FIRM**; 2-3f, Line Bldg., 823-30,, Yeoksam-dong, Kangnam-ku, Seoul 135-080 (KR).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT,

[Continued on next page]

(54) Title: HOMENETWORK UNIVERSAL MIDDLEWARE BRIDGE SYSTEM AND METHOD FOR HOME DEVICE'S INTEROPERABILITY IN HETEROGENEOUS HOMENETWORK MIDDLEWARE



(57) Abstract: Provided is a home-network UMB system and a method thereof for providing interoperability between devices connected one another through different types of middlewares in a home network. The home-network UMB system includes: a bridge core for establishing/releasing a connection between bridge adaptors of different types of middlewares and analyzing/transferring a universal middleware message in order to interoperate devices connected through different types of middlewares existed on a home network; and a plurality of bridge adaptor for connecting the bridge core to a corresponding middleware, and finding/releasing different types of devices, controlling/ monitoring different types of devices and registering/ creating an event for different types of devices through transforming a universal middleware bridge message to a local message of each middleware and vice versa.

WO 2006/065098 A1

RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Description

HOMENETWORK UNIVERSAL MIDDLEWARE BRIDGE SYSTEM AND METHOD FOR HOME DEVICE'S INTEROPERABILITY IN HETEROGENEOUS HOMENETWORK MIDDLEWARE

Technical Field

[1] The present invention relates to a home network universal middleware bridge system and a method thereof; and more particularly, to a home-network universal middleware bridge system for providing interoperability to home devices connected to a home-network middleware, and a method thereof.

[2]

Background Art

[3] Recently, there are numerous home network middlewares introduced such as home audio video interoperability (HAVI), JINI, LonWorks, home network control protocol and a universal plug and play.

[4] The HAVI was introduced on 1997 by home appliance manufacturers SONY, Phillips and Thomson, and the HAVI has been developed as a standard of audio and video (A/V) network based on high-speed bus employing IEEE 1394. The JINI was developed based on Java technology and requires JVM and RMI technology. The LonWorks was introduced by Echelon Company in U.S., and is a system providing total solution of automation technology supporting various communication medium. The HnCP is a protocol defined based on a power cable MODEM makers such as LG or SAMSUNG electronics in Korea. The UPnP is a middleware defined by an UPnP forum based on Microsoft and it employs TCP/IP based protocol.

[5] These conventional middlewares uses different physical medium and protocols. Therefore, the interoperability is not provided to various devices connected to the middlewares. In order to overcome such a drawback, a conventional gateway is introduced in Korea Patent 10-0413684 entitled "GATEWAY ENABLING DATA COMMUNICATION BETWEEN DEVICE SEARCH HAVING DIFFERENT MIDDLEWARE, HOME NETWORK SYSTEM THEREBY, AND GATEWAY RELAYING METHOD" issued at 12th Dec. 2003, and It will be described with reference to Fig. 1.

[6] Fig. 1 is a block diagram showing a conventional home-network system.

[7] As shown in Fig. 1, the conventional home-network system includes a first device 100, a second device 110 and a gateway 120. The first device 100 uses a first

middleware employing HAVI, and the second device 110 uses a second middleware employing UPnP.

[8] The first device 100 includes a first function module 101 performing own functions; a first middleware 102 for analyzing and transforming messages transmitted or received from/to the first function module 101 according to a predetermined specification; and a first network accessing unit 103 for accessing a network to transmit the message from the first middleware 102, and transferring message received from the network to the first middleware 102 based on IEEE 1394.

[9] The second device 110 includes: a second function module 111 for performing own functions; a second middleware 112 analyzing and transferring message to be transmitted or received to/from the second function module 110 according to a predetermined specification defined in UPnP; and a second network accessing unit 103 for accessing a network to transmit the message from the second middleware 112 and transferring message received from the network to the second middleware 112 based on TCP/IP.

[10] The gateway 120 relays messages to be exchanged between other devices by including middlewares employed by devices on the network. Such a relaying operation of the gateway 120 is classified into following three steps.

[11] At first step, the first device 100 generates a message to be transmitted to the second device 110 and transmits the generated message to the gateway 120. The gateway 120 includes an arbiter 121, a generic HAVI agent 122, a generic UPnP agent 123, an IEEE 1394 processor 124 and a TCP/IP processor 125. Then, the generic HAVI agent 122 of the gateway 120 analyzes the message from the first device 100, transforms the message to be suitable to the generic UPnP agent 123 and transmits the message to the second device 110 at second step. At third step, the second device 110 processes the message from the gateway 120 and returns the result thereof.

[12] The first device 100 employing the HAVI includes a first function module 100, a HAVI layer 102 and an IEEE 1394 layer. The first function module 101 creates a message that instructs a target function of the second device 110 and transfers the created message to the HAVI layer 102. Then, the HAVI layer 102 transforms the message to be suitable to HAVI specification and transmits the transformed message to the generic HAVI agent 122 of the gateway 120.

[13] The generic HAVI agent 122 of the gateway 120 inquires availability of the second device 110 to the arbiter 121. The arbiter 121 inquires to the generic UPnP agent 123 whether the second device 110 is on the network since the received message is HAVI type.

[14] The generic UPnP agent 123 searches a table in the IEEE 1394 processor 124 to find a name of the second device 110. If the name of the second device 110 is in the

table, the generic UPnP agent 123 creates a message denoting that the second device 110 is on the network and transmits the message to the arbiter 121. If the second device 110 is available, the arbiter 121 transmits the message having the command of target function and parameters to the TCP/IP processor 125. The TCP/IP processor 125 transforms the message to be suitable for UPnP middleware specification and transmits the transformed message to the second device 110.

[15] The UPnP layer 112 of the second device 120 analyzes the message received from the TCP/IP processor 125 and transmits the message to the second module 111. The second function module 111 performs the command of the message and returns the result to the arbiter 121 of the gateway 120. The arbiter 121 transmits the result to the first function module 101 of the first device 100.

[16] As described above, the conventional home-network system has following shortcomings although the conventional home-network system provides basic interoperability between devices.

[17] At first, there is no specification defined about how a target device is shown in a device that controls the target device and about the time automatically sensing the target device.

[18] Secondly, middleware messages are transformed through a template of the middleware agent through the middleware agent and the arbiter using various transformation methods. Such message transform may be achieved in various methods such as a 1:1 bridge method. The 1:1 bridge method is a suitable method when there are few middlewares existed on the network. However, complexity of a message transforming template dramatically increases in proportional to the number of the middlewares on the network. Therefore, the 1:1 bridge method is not suitable method to transform the middleware messages when there are many different types of middlewares existed. Herein, the complexity of message transforming is $\{n \times (n-1)\}/2$, where n denotes the number of the home-network middlewares.

[19] Thirdly, a method of finding a device through querying to all middleware agents generates the great number of the packets and causes greater load on the network.

[20] Beside of the three problems, there is no specification for connecting/releasing devices, registering events and generating events in the conventional method of controlling and monitoring devices.

[21]

Disclosure of Invention

Technical Problem

[22] It is, therefore, an object of the present invention to provide a home-network universal middleware bridge system for providing interoperability to home devices

connected one another through different types of home-network middlewares, and a method thereof.

[23] It is another object of the present invention to provides a home-network universal middleware bridge system and method for providing interoperability to home devices connected one anther through different types of home-network middlewares by allowing devices to virtually see all other devices accessing different home-network middlewares as devices connected on a same middleware and to process operations for a device accessing/releasing, a device control and an event registration/generation n oticing based on a corresponding middleware mechanism without transforming related middleware messages.

[24]

Technical Solution

[25] In accordance with one aspect of the present invention, there is provided a home-network universal middleware bridge system for providing interoperability between home devices connected one another through different types of home network middlewares, including: a bridge core for establishing/releasing a connection between bridge adaptors of different types of middlewares and analyzing/transferring a universal middleware message in order to interoperate devices connected through different types of middlewares existed on a home network; and a plurality of bridge adaptors for connecting the bridge core to a corresponding middleware, and finding/ releasing different types of devices, controlling/ monitoring different types of devices and registering/ creating an event for different types of devices through transforming a universal middleware bridge message to a local message of each middleware and vice versa.

[26] In accordance with another aspect of the present invention, there is provided a method of bridging for a home-network universal middleware bridge system, the method including the steps of: at a first bridge adaptor, generating a universal middleware bridge message by receiving a device local message from middlewares and creating a virtual/logical device for the device local message; at a bridge adaptor core, obtaining routing information by analyzing the universal middleware bridge message and transferring the universal middleware bridge message to a second bridge adaptor using the routing information; and at second bridge adaptor, transforming the universal middleware bridge message to a local message by analyzing the universal middleware bridge message.

[27]

Advantageous Effects

[28] A home-network universal middleware bridge system and method thereof according

to the present invention provide interoperability between various devices connected one another through different home network middleware without modifying a typical middleware. Accordingly, devices connected to the different middleware networks are recognized as devices connected to own network. Therefore, the devices connected to the different middleware networks are controlled and monitored as like as the devices connected to the own network.

[29] The home-network universal middleware bridge system according to the present invention allows various types of middlewares and various different types of devices to be connected a single home network without any limitation. Therefore, a digital home can be achieved conveniently and efficiently.

[30]

Brief Description of the Drawings

[31] Fig. 1 is a block diagram showing a conventional home-network system;

[32] Fig. 2 is a block diagram illustrating a home network universal middleware bridge system in accordance with a preferred embodiment of the present invention;

[33] Fig. 3 is a table showing definitions of a UMB message in accordance with a preferred embodiment of the present invention;

[34] Fig. 4 is a middleware routing table (MRT) of a UMB core 200 in accordance with a preferred embodiment of the present invention;

[35] Fig. 5 is a flowchart showing a method of bridging in a LonWorks adaptor when a new LonWorks device is plugged in a LonWorks middleware in accordance with a preferred embodiment of the present invention;

[36] Fig. 6 is a table of information describing a universal device, i.e., a light device in accordance with a preferred embodiment of the present invention;

[37] Fig. 7 shows a virtual device proxy (VDP) database (DB) in accordance with a preferred embodiment of the present invention;

[38] Fig. 8 shows UDT-LDT mapping tables in accordance with a preferred embodiment of the present invention;

[39] Fig. 9 is a flowchart showing a method of bridging in a UMB core when a device is plugged in a UMB adaptor in accordance with a preferred embodiment of the present invention;

[40] Fig. 10 is a flowchart showing a method of bridging in an UPnP adaptor when a LonWorks device is plugged in accordance with a preferred embodiment of the present invention;

[41] Fig. 11 is a flowchart showing a method of bridging in an UPnP adaptor when an UPnP control point controls a LonWorks device at a remote location in accordance with a preferred embodiment of the present invention;

[42] Fig. 12 is a flowchart showing a method of bridging in a LonWorks adaptor when a device at a remote location requests to control a LonWorks device in accordance with a preferred embodiment of the present invention;

[43] Fig. 13 is a flowchart showing a method of bridging in a LonWorks adaptor when a device at a remote location request to register events for a LonWorks device in accordance with a preferred embodiment of the present invention; and

[44] Fig. 14 is a flowchart showing a method of bridging in a LonWorks adaptor when a registered event is generated in a LonWorks device in accordance with a preferred embodiment of the present invention.

[45]

Best Mode for Carrying Out the Invention

[46] Other objects and aspects of the invention will become apparent from the following description of the embodiments with reference to the accompanying drawings, which is set forth hereinafter.

[47] The present invention relates to a home-network universal middleware bridge system for providing interoperability to home devices connected one another through different types of home-network middlewares such as an Home Audio Video Interoperability (HAVI), JINI, LonWorks, Home network control protocol (HnCP) and an universal plug and play (UPnP), and a method thereof.

[48] Fig. 2 is a block diagram illustrating a home network universal middleware bridge system in accordance with a preferred embodiment of the present invention.

[49] Referring to Fig. 2, the home network universal middleware bridge system includes a single universal middleware bridge (UMB) core 200 and universal middleware bridge (UMB) adaptors 210, 240, 260 and 280 located over the middleware layers.

[50] As shown, the home-network UMB system according to the present invention virtually expresses physical devices plugged in a home network middleware domain as logical devices plugged in a UMB domain. Also, the home-network UMB system according to the present invention allows the logical devices to be registered on corresponding middlewares. As result, the home-network UMB system according to the present invention allows a device to see all other devices connected on different middleware domains as virtual logical devices connected on a same middleware domain. Therefore, the UMB system according to the present invention can process events, control devices and monitor devices based on a typical middleware mechanism without transforming messages according to corresponding middlewares.

[51] In order to provide interoperability between home devices connected through different types of home network middlewares, the home network UMB system according to the present invention includes a UMB core 200 for interoperating devices

connected through different middlewares on a home network, establishing/releasing the connected bridge adaptors of different middlewares and analyzing/transferring UMB messages; and a plurality of universal middlewares bridge adaptors 210, 240, 260 and 280 for connecting corresponding middlewares to the UMB core 200, finding/releasing devices connected through different middlewares, controlling/monitoring the devices, registering/noticing generations of events by transforming local messages of each middleware to the UMB message and vice versa.

[52] Hereinafter, the home network UMB system according to the present invention will be described in detail.

[53] The UMB middleware core 200 includes a global dispatcher 201, a message router 202, and a middleware routing table (MRT) 203.

[54] The global dispatcher 201 includes a connector 2011 for managing the UMB adaptors 210, 240, 260 and 280 to be connected and disconnected; a parser 2012 for analyzing UMB messages and transferring the UMB messages to the message router 202; and a packetizer 2013 for transferring the UMB message using routing information. That is, the global dispatcher 201 receives the UMB messages from the UMB adaptors, analyzes the received UMB messages and transfers the UMB messages to the message router 202. Also, the global dispatcher 201 transfers the UMB messages to a destination which is a target UMB adaptor according to routing information received from the message router 202.

[55] The message router 202 routes the UMB messages to a corresponding UMB adaptor. The MRT 203 stores information about connection IDs and middleware IDs between devices and UMB adaptors. For example, the message router 202 transfers routing information about a target UMB adaptor to the global dispatcher 201 using the MRT 203.

[56] The UMB core 200 performs operations of basic functions such as establishing/releasing connections between devices and UMB adaptors 210, 240, 260 and 280, analyzing the UMB messages and routing the UMB messages, and related operations thereof in order to provide interoperability between devices connected through different middlewares by connecting the different middlewares 220, 250, 20 and 290 through the universal middleware bridge in a wireless/wired integrated home network environment.

[57] The UMB adaptors 210, 240, 260 and 280 perform operations related to find/release devices, control/monitor devices and register/create events. Each of the UMB adaptors includes a global dispatcher 211, a device manager 212, an event handler 213, a local dispatcher 214, a universal device template to local device template (UDT-LDT) mapper 215, a virtual device proxy (VDP) database 216, a sequence table and a global and local event table. Detail operations thereof will be described with reference to Fig.

5 in later.

[58] The UMB adaptors 210, 240, 260 and 280 are a module for connecting the UMB core 200 and a lower level middleware network. That is, the UMB adaptors provide services of connecting/releasing devices, controlling /monitoring devices and registering/generating events.

[59] Each of the UMB adaptors 210, 240, 260 and 280 includes a local dispatcher 214, a device manager 121, an event handler 213, a mapping information storing unit 215 such as a mapper, a VDP storing unit 216 and a global dispatcher 211. Since all of the UMB adaptors have same structure, the UMB adaptor 210 is used as the representative one to describe the UMB adaptors 210, 240, 260 and 280.

[60] The local dispatcher 214 receives local messages to be transmitted to other external bridge adaptors from a corresponding middleware and transfers the received local message to the device manager 212 or the event handler 213 using a local message routing table (LRT). The device manager 212 or the event handler 213 receives a transformed LDT information message, create a local message and transfers the created local message to a corresponding middleware.

[61] The device manager 121 transforms the local message to a message having the UDT information, and transfers the transformed message to the global dispatcher 211. Or, the device manager 121 receives the UMB message from the global dispatcher 211, transforms the received message to a local device information message, and transfers the transformed message to the local dispatcher 213. In particular, the device manager 212 includes a device manager 2121 and a device broker 2122. The device manager 2121 transforms the local device information to the UMB information or vise versa using the UDT-LDT mapping information and stores the transformed information in the VDP database 216. The device broker 2122 sends a command message to the VDP manager 2121 to transform the information and receives the transformed information as a response from the VDP manager 2121. The device broker 2122 transmits the transformed information to the global dispatcher 211 or the local dispatcher 214.

[62] The event handler 213 includes a remote event handler 2131 and a local event handler 2132. The event handler 213 receives a request of registering an event from external devices through other bridge adaptor, analyzes the event registering request of a UMB message and registers the event. The event handler 213 also transforms an even generation local message received through an own middleware to an UDT information message.

[63] The global dispatcher 211 receives a UMB message from the UMB core 200 and transfers the received UMB message to the device manager 212 or the event handler 213 using a global routing table (GRT). Also, the global dispatcher 210 receives an

UDT information message from the device manager 212 or the event handler 213, transforms the received UDT information message to an UMB message, and transfers the UMB message to the UMB core 200.

[64] The UDT-LDT mapping information storing unit 215 stores mapping information between local device information and virtual universal device information. The VDP database 216 stores local device information and virtual universal device (UD) information.

[65] Fig. 3 is a table showing definitions of a UMB message in accordance with a preferred embodiment of the present invention.

[66] As shown, the UMB adaptors 210, 240, 260 and 280 transform middleware messages to UMB messages and transfer the UMB messages to other UMB adaptors through the UMB core 200.

[67] Fig. 4 is a middleware routing table (MRT) of a UMB core 200 in accordance with a preferred embodiment of the present invention. That is, Fig. 4 shows data structure of MRT which is only data structure managed by the UMB core.

[68] The MRT is configured of three fields, an index field, a file descriptor field and a middleware ID.

[69] The index field denotes how many data in the MRT. For example, if the index = 3, there are three data included in the MRT.

[70] The file descriptor field denotes a connection point of a network socket of UMB adaptors that are currently connected to the UMB core 200. For example, if a LonWorks adaptor has a connection point to the UMB core as Fd0, the value of Fd is an integer as like as Fd0=3540. In order to transfer a message to the LonWorks Adaptor, a function 'send(Fd0, message)' is executed. Then, a message is transmitted from the UMB core to the LonWorks Adaptor through the network.

[71] The middleware ID field denotes identifications (ID) of adaptors currently connected to the UMB core. For example, if Index=1, Fd1=3555 and LonWorks is in the MRT, it means that data having an index 1 which is a second data has a 3555 of connection point to the UMB core and the adaptor is the LonWorks adaptor.

[72] Fig. 5 is a flowchart showing a method of bridging in a LonWorks adaptor when a new LonWorks device is plugged in a LonWorks middleware in accordance with a preferred embodiment of the present invention.

[73] That is, when the new LonWorks device is plugged in a LonWorks middleware, operations for noticing information about new device to UMB adaptors 240, 260 and 280 through a LonWorks UMB adaptor 210 are shown in Fig. 5.

[74] Hereinafter, operation mechanism of the UMB system according to the present invention will be described using interoperation mechanism between LonWorks devices and UPnP devices as an example. Other devices connected to other

middleware can also have same interoperation services through following operation mechanism.

[75] At first, if a new LonWorks device is plugged in a LonWorks middleware 220, an internal parser 2141 of a local dispatcher in a LonWorks UMB adaptor 210 receives a message "Service Pin Msg" noticing the connection of new device through a LonWorks middleware 220 at step S501.

[76] The internal parser 2141 of the local dispatcher analyzes the corresponding local message and transfers a message having parameters in the analyzed local message such as a SPIN, LID and PID to a dispatcher 2142 of the local dispatcher at step S502. Herein, the SPIN denotes the message "Service Pin Msg," the LID denotes a local ID and the PID denotes a program ID.

[77] The dispatcher 1242 of the local dispatcher transfers the received parameters to the device manager 212 or the event handler 213 using the local message routing table (LRT). Herein, a message related to the device event is transferred to the event handler 213 and other messages are transferred to the device manager 212.

[78] When a device broker 2122 of the device manager 212 receives the message having the parameters such as the SPIN, LID and PID, which denotes that a new device is connected, at step S503, the device broker 2122 transmits a message having CREAT, LID and LDType to a VDP manager 2121 in order to instruct the VDP manager 2121 to register physical device information on the VDP database and corresponding virtual device information used in the UMB at step S504.

[79] The VDP manager 2121 transforms the LonWorks physical device to a virtual device through the UDT-LDT mapper 215 and generates a VDP DB 216 (refer to Fig. 7).

[80] Then, the VDP manager 2121 transfers an UDT information including GID, GDType to the device broker 2122 at step S505. The UDT information is information about transformation of newly connected physical device to the virtual device. Herein, the GID represents a Global ID and the GDType denotes a global device type.

[81] After receiving the UDT information, the device broker 2122 transmits a message including the UDT information which also includes All denoting a multicasting, notifyOnlineStatus, GID, ONLINE, GDType, Function List, and Action List to the packetizer 2114 of the global dispatcher 211 at step S506. The packetizer 2114 transforms the received message to UMB message ("notifyOnlineStatus" in Fig. 3) and transmits the transformed UMB message to the UMB core 200 ate step S507.

[82] Fig. 6 is a table of information describing a universal device, i.e., a light device in accordance with a preferred embodiment of the present invention. That is, Fig. 6 shows information about an UD of a light device that is a virtual device transformed from the physical device, i.e., the light device.

[83] That is, Fig. 6 shows fields of virtual device defined to be recognized by all of middlewares on a home network through a UMB through transforming a physical device to a virtual device.

[84] The UDT is a set of information about all virtual universal devices. Therefore, the UDT includes UDs of various devices, i.e., a dimmer, a television, an audio system, a switch and a valve as well as an UD of a light.

[85] As shown, each of UD includes a device type, a function ID, an action ID, an event ID and a parameter.

[86] Devices on all of middleware networks are transformed as an UD shown in Fig. 6 and used as virtual logical devices on the UMB system.

[87] Fig. 7 shows a virtual device proxy (VDP) database (DB) in accordance with a preferred embodiment of the present invention, and Fig. 8 shows UDT-LDT mapping tables in accordance with a preferred embodiment of the present invention.

[88] As shown in Fig. 7, The VDP DB includes information about physical devices and information about universal devices expressed on the UMB. Therefore, a real physical device is transformed to a virtual universal device through the VDP DB when a new real device is plugged in the home network. On the contrary, when a universal device of a universal middleware bridge (UMB-UD) is connected to the UMB adaptor through the UMB core 200, the UMB-DB can be transformed to a local device (LD) which is a real device through the VDT DB. Also, the controlling and the monitoring of the UDs and the Local devices can be performed using the VDP DB.

[89] As shown in Fig. 6, because the universal devices are defined as a global function, a global action and a global event, the controlling and the monitoring can be achieved through real-time message transformation during a run time by registering the real local function, the real local action and the real local event in the VDP DB table.

[90] As shown Fig. 8, the universal device type (UDT)-local device type (LDT) mapper includes transform tables for transforming a universal device (UD) to a local device (LD) or vice versa.

[91] Fig. 9 is a flowchart showing a method of bridging in a UMB core when a device is plugged in a UMB adaptor in accordance with a preferred embodiment of the present invention. That is, Fig. 9 shows operations of the universal middleware bridge core.

[92] A SSDP step in Fig. 9 denotes a step for finding information about a location of the UMB core 200 such as IP and Port at the UMB adaptor 210.

[93] The message transformed through the step S507 in Fig. 5 is transferred to a parser 2012 of the UMB core 200 at step S801.

[94] The parser 2012 analyzes the transferred message and transfers parameters of the analyzed message to the router 202 at step S802.

[95] The router 202 determines whether the transferred message is a multicast message

or a unicast message at step S803. Herein, the multicast message denotes a device connection/releasing message and the unicast message denotes a device control/ monitor message or an event registering/creation message. If the message is the multicast message, the router 202 transfers the received message to all of universal middleware bridge adaptors registered in the middleware routing table (MRT) through the packetizer 2013 at step S804.

[96] On the contrary, if the message is the unicast message, the router 202 transfers corresponding messages to universal middleware adaptors having a same ID to the middleware ID in the parameter transferred from the MRT.

[97] Fig. 10 is a flowchart showing a method of bridging in an UPnP adaptor when a LonWorks device is plugged in accordance with a preferred embodiment of the present invention.

[98] When a parser of the global dispatcher of the UPnP adaptor 240 receives a UMB message transferred through the steps shown in Fig. 9 at step S901, the parser analyzes the corresponding message and transfers the parameters to the dispatcher of the global dispatcher at step S902.

[99] The dispatcher of the global dispatcher transfers the messages with the parameters from the parser to the device manager, for example, the device manager 212, or the event handler, for example, the event handler 213, with reference to a global message routing table (GRT). Herein, the messages related to the event are transferred to the event handler and other messages are transferred to the device manager.

[100] Since the currently transmitted messages are related to the device connection, these messages are transferred to the device broker of the device manager at step S903.

[101] The device broker determines whether the received messages are related to the device connection and instructs the VDP manager to create a virtual device on the VDP DB at step S904.

[102] The VDP manager transforms a universal device template (UMT), which is a virtual device of the LonWorks physical device, to a local device on the UPnP network through the UDT-LDT mapper, and creates a VDP DB thereof. When a remote virtual device is created at the VDP DB, the created virtual device is recognized by all other UPNP devices as a real physical device connected to the UPnP network. Therefore, such a remote virtual device can be controlled and monitored by a conventional UPnP middleware controlling mechanism.

[103] When the new device information is created in the VDP DB, the VDP manager transfers a message having a local ID and a local device type (LD type) to the device broker at step S905.

[104] Then, the device broker transfers an advertisement message to a middleware of UPnP adaptor through a local dispatcher to notice that a newt device is plugged-in at

steps S906 and S907.

[105] The steps shown in Figs. 5, 9 and 10 are one cycle of operating mechanism of the adaptors of the home network UMB system when new device is connected. Meanwhile, the device release operation is similar to the device connection operation. But, information related a released device is deleted from the VDP DB when the device is released.

[106] The bridge methods for the device controlling/ monitoring message and for the event registering/creation message are similar to the bridge methods for the device connection shown in Figs. 5, 9 and 10. Therefore, the bridge methods for the device controlling/monitoring and for the event registering/creation will be explained in brief with reference to Figs. 11 to 14.

[107] Fig. 11 is a flowchart showing a method of bridging in an UPnP adaptor when an UPnP control point controls a LonWorks device at a remote location in accordance with a preferred embodiment of the present invention.

[108] When the UPnP control point 250 controls the LonWorks device 230 at a remote location, a local UPnP message is transformed to a universal middleware bridge (UMB) control message (queryAction) by the UPNP adaptor 240 and the UMB control message is transferred to the UMB core 200 at steps S1001 to S1005.

[109] Fig. 12 is a flowchart showing a method of bridging in a LonWorks adaptor when a device at a remote location requests to control a LonWorks device in accordance with a preferred embodiment of the present invention.

[110] When devices, i.e., devices in adaptors 240, 260 and 280, requests to control a LonWorks device 230, a common bridge message transmitted through the UMB core 200 to the LonWorks adaptor 210 is transformed to a local LonWorks message and the LonWorks device 230 is controlled according to the transformed local LonWorks message at steps S1101 to S1105.

[111] Fig. 13 is a flowchart showing a method of bridging in a LonWorks adaptor when a device at a remote location request to register events for a LonWorks device in accordance with a preferred embodiment of the present invention.

[112] When a device in a remote location, i.e., devices in the adaptors 240, 260 and 280, requests to register an event of the LonWorks device 230, the steps S1201 to S1205 denote operation mechanism of the LonWorks adaptor 210. The event transferred through the UMB core 200 is registered at a local event table and the event registered at the local event table is regularly checked whether a corresponding event value is modified or not through an event method or a poling method.

[113] Fig. 14 is a flowchart showing a method of bridging in a LonWorks adaptor when a registered event is generated in a LonWorks device in accordance with a preferred embodiment of the present invention.

[114] As shown in Fig. 14, the registered event is transferred to a UDT through the LonWorks adaptor 210 and the UDT is transferred to the remote devices in the adaptors 240, 260 and 280 through the LonWorks adaptors 210 at steps S1301 to S1305.

[115] The methods according to the present invention can be embodied as a program, and the program can be stored in a computer readable recording medium such as a compact disk read only memory (CD-ROM), a random access memory (RAM), a read only memory (ROM), a floppy disk, a hard disk or an optical magnetic disk.

[116] The present application contains subject matter related to Korean patent application No. 2004-0108285, filed with the Korean Intellectual Property Office on December 17, 2004, the entire contents of which is incorporated herein by reference.

[117] While the present invention has been described with respect to certain preferred embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

Claims

[1] A home-network universal middleware bridge system for providing interoperability between home devices connected one another through different types of home network middlewares, comprising:
bridge core means for establishing/releasing a connection between bridge adapting means of different types of middlewares and analyzing/transferring a universal middleware message in order to interoperate devices connected through different types of middlewares existed on a home network; and
a plurality of bridge adapting means for connecting the bridge core means to a corresponding middleware, and finding/releasing different types of devices, controlling/ monitoring different types of devices and registering/ creating an event for different types of devices through transforming a universal middleware bridge message to a local message of each middleware and vice versa.

[2] The home-network universal middleware bridge system as recited in claim 1, wherein the bridge core means includes:
first global dispatching means for receiving a universal middleware bridge message from the bridge adapting means, analyzing the received universal middleware bridge message, transferring the analyzed universal middleware bridge message to a message routing means and transfers the universal middleware bridge message according to routing information received from a message routing means to a target bridge adapting means; and
the message routing means for transferring routing information of a target bridge adapting means using a middleware routing table (MRT) to the first global dispatching means.

[3] The home-network universal middleware bridge system as recited in claim 2, wherein the message routing means determines whether the universal middleware bridge message is a multicast message or a unicast message; transfers the universal middleware bridge message to all of bridge adaptors registered at the MRT through the first global dispatching means when the universal middleware bridge message is the multicast message; and finds a bridge adaptor having a same middleware ID in the universal middleware bridge message, and transfers the universal middleware bridge message to the found bridge adaptor through the first global dispatching means.

[4] The home-network universal middleware bridge system as recited in claim 3, wherein the multicasting message includes a device connecting/releasing message; and the unicast message includes a device controlling/ monitoring message and an event registering/creating message.

[5] The home-network universal middleware bridge system as recited in claim 2, wherein the first global dispatching means includes:
connecting means for managing operations for establishing and releasing connections between the bridge adapting means;
parsing means for analyzing the universal middleware bridge message and transferring the analyzed universal middleware bridge message to the message routing means; and
packetizing means for transferring the universal middleware bridge message to the target bridge routing means using the routing information.

[6] The home-network universal middleware bridge system as recited in claim 1, wherein the bridge adapting means includes:
first local dispatching means for receiving a local message to be transmitted to other external bridge adapting means from a corresponding middleware, transferring the local message to a device managing means or an event handling means using a local routing table (LRT), or receiving a LDT information message that is transformed at the device managing means or the event handling means, generating a local message and transferring the local message to a corresponding middleware;
the device managing means for transforming the local message to a message including UDT information and transferring the message to a second global dispatching means, or transferring a universal middleware bridge message from the second global dispatching means to a local device information message and transferring the local device information message to the first local dispatching means;
the event processing means for analyzing a universal middleware bridge message for requesting an event registering transferred through other external bridge adapting means and registering an event, and transforming an event creation local message transferred through middleware of the bridge adapting means to a UDT information message;
the second global dispatching means for receiving the universal middleware bridge message from the bridge core means, transferring the received universal middleware bride message to the device managing means or the event handling means using a global message routing table (GRT), or receiving a UDT information message from the device managing means or the event handling means, transforming the UDT information message to a universal middleware bridge message and transferring the universal middleware bridge message to the bridge core means;
UDT-LDT mapping information storing means for storing mapping information

between real local device information and virtual universal device information; and

VDP storing means for storing information about real local devices and information about virtual universal devices.

[7] The home-network universal middleware bridge system as recited in claim 6, wherein the device managing means includes:

VDP managing means for transforming real local device information to virtual universal device information or vice versa using the UDT-LDT mapping information and storing the transformed information in the VDP storing means; and

device broker means for sending a command message to transform information to the VDP managing means, receiving the transformed information as a response, and transferring the received information to the second global dispatching means or the first local dispatching means.

[8] The home-network universal middleware bridge system as recited in claim 6, wherein the universal middleware bridge message includes a device finding noticing/releasing message, a device controlling/monitoring message and an event registering/creating noticing message.

[9] The home-network universal middleware bridge system as recited in claim 6, wherein the middleware routing table (MRT) includes an index field, a file descriptor field and a middleware ID field.

[10] The home-network universal middleware bridge system as recited in claim 6, wherein the UDT information includes a device type, a function ID, an action ID, an event ID and parameter.

[11] The home-network universal middleware bridge system as recited in claim 6, wherein the VDP storing means includes an index field, a virtual/physical field, a global identification (GID) field, a local identification (LD type) field, a local address field, a function list field, and an action list field.

[12] The home-network universal middleware bridge system as recited in claim 6, wherein the mapping information of the UDT-LDT mapping information storing means includes a device mapping table, a function mapping table, an action/event mapping table and a parameter mapping table.

[13] A method of bridging for a home-network universal middleware bridge system, the method comprising the steps of:

at a first bridge adaptor, generating a universal middleware bridge message by receiving a device local message from middlewares and creating a virtual/logical device for the device local message;

at a bridge adaptor core, obtaining routing information by analyzing the universal

middleware bridge message and transferring the universal middleware bridge message to a second bridge adaptor using the routing information; and
at second bridge adaptor, transforming the universal middleware bridge message to a local message by analyzing the universal middleware bridge message.

[14] The method as recited in claim 13, wherein in the step of the creating of the virtual/logical device, a physical device is transformed to a virtual logic device using mapping information between real local device information and universal device information.

[15] The method as recited in claim 13, wherein the device local message includes a device connecting/releasing message, a device controlling/monitoring message and an event registering/noticing message.

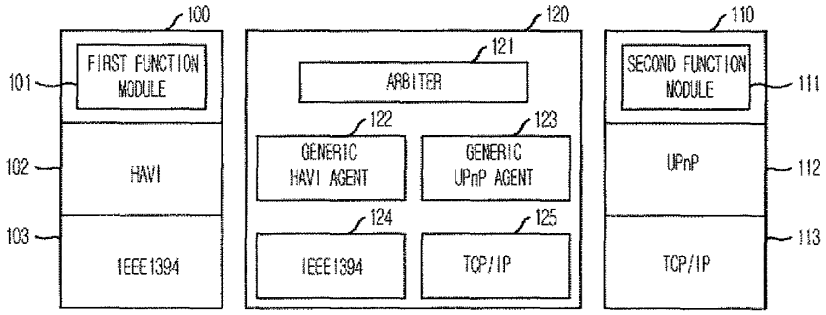
[16] The method as recited in claim 13, wherein the step of transferring the universal middleware bridge message includes the steps of:
analyzing the universal middleware bridge message;
transferring the universal middleware bridge message to all of second bridge adaptors registered in a middleware routing table (MRT) if the universal middleware bridge message is a multicast message; and
finding second bridge adaptors having a same ID to a middleware ID included in the universal middleware bridge message from the MRT and transferring the universal middleware bridge message to the found second bridge adaptor.

[17] The method as recited in claim 16, wherein the multicast message includes a device connecting/releasing message; and the unicast message includes a device controlling/monitoring message and an event registering/ noticing message.

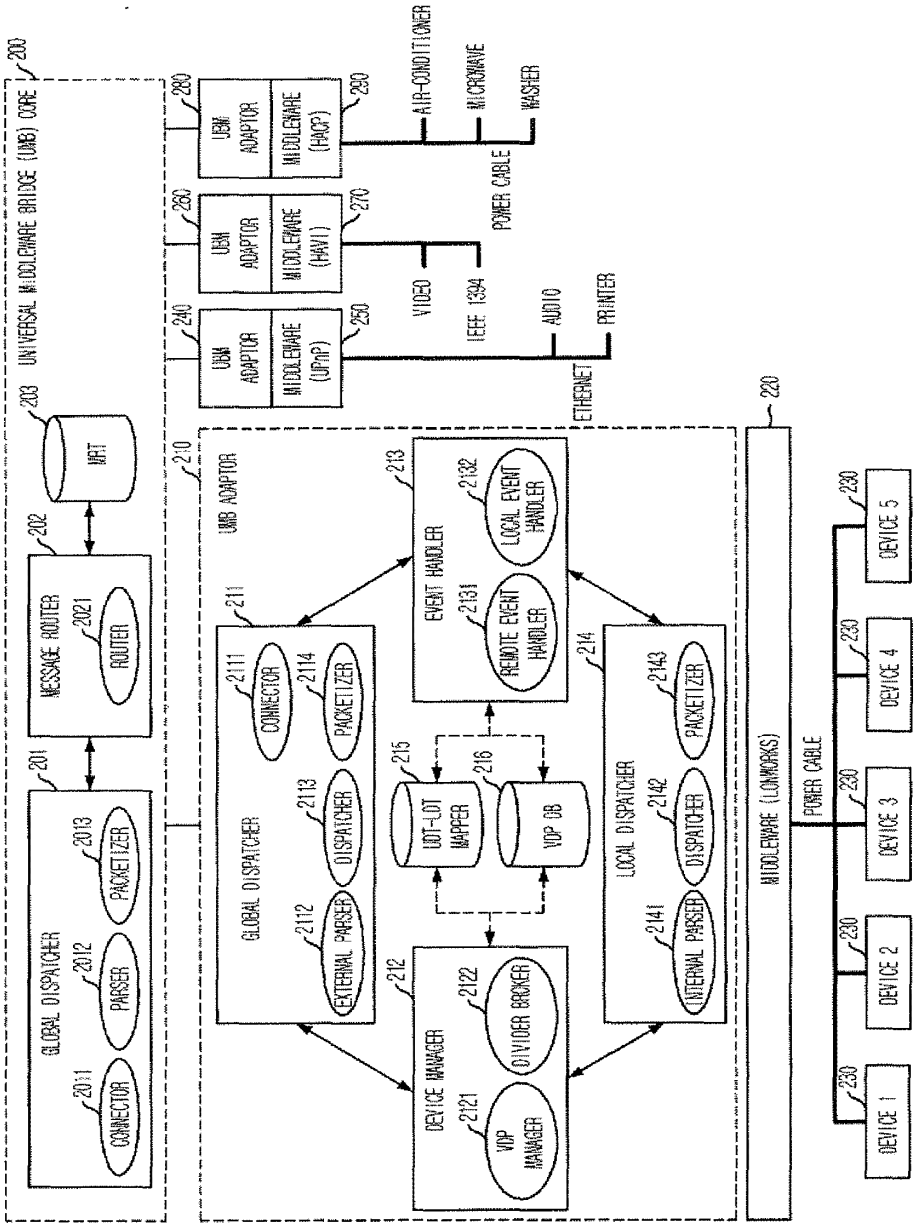
[18] The method as recited in claim 16, wherein in the step of the transforming the universal middleware bridge message, the universal middleware bridge message is registered without transforming to the local message and transferring to a corresponding middleware if the universal middleware bridge message is an event registering message, and it regularly checks whether a registered event is generated or not.

WO 2006/065098 PCT/KR2005/004345

[Fig. 1]



[Fig. 2]


UNIVERSAL MIDDLEWARE BRIDGE (UMB) CORE
200
GLOBAL DISPATCHER
201
CONNECTOR
2011
PARSER
2012
PACKETIZER
2013
MESSAGE ROUTER
202
ROUTER
2021
MRT
203
UMB ADAPTOR
210
GLOBAL DISPATCHER
211
CONNECTOR
2111
EXTERNAL PARSER
2112
DISPATCHER
2113
PACKETIZER
2114
DEVICE MANAGER
212
VDP MANAGER
2121
DIVIDER BROKER
2122
EVENT HANDLER
213
REMOTE EVENT HANDLER
2131
LOCAL EVENT HANDLER
2132
LOCAL DISPATCHER
214
INTERNAL PARSER
2141
DISPATCHER
2142
PACKETIZER
2143
UDT-LOT MAPPER
215
VDP DB
216
UBM ADAPTOR
280
MIDDLEWARE (HAVI)
270
UBM ADAPTOR
260
MIDDLEWARE (UPnP)
250
UBM ADAPTOR
240
MIDDLEWARE (HAVC)
290
AIR-CONDITIONER
MICROWAVE
WASHER
POWER CABLE
VIDEO
IEEE 1394
AUDIO
PRINTER
ETHERNET
MIDDLEWARE (LOWWORKS)
220
POWER CABLE
DEVICE 1
230
DEVICE 2
230
DEVICE 3
230
DEVICE 4
230
DEVICE 5
230

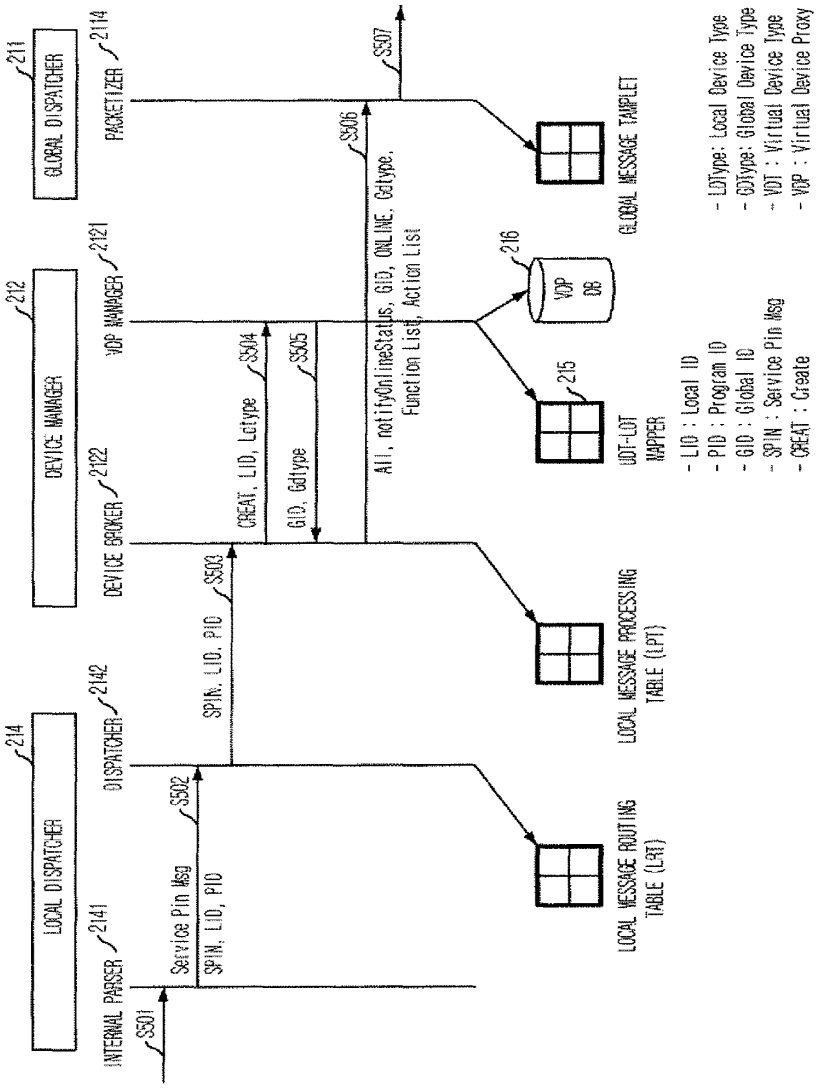
[Fig. 3]

	MESSAGE TYPE	MAJOR FACTOR (Target/ReQ/Resp)	DESCRIPTION
MIDDLE WARE	SSDP FIND MESSAGE (USING SSDP)	IP Port	UMB ADAPTOR FINDS UMB CORE SOCKET MODULE. UMB CORE TRANSMITS NOTICE MESSAGES TO UMB ADAPTORS
	QueryDeviceList		CONNECTED TO OTHER MIDDLE NETWORKS AND REQUEST LIST OF ALL DEVICES
EVENT	NotifyOnlineStatus	MiddleWare ID Device ID Online status	NOTICE CONNECTION STATES OF UMB ADAPTOR OR DEVICE EVENT GENERATED WHEN UMB ADAPTOR OR DEVICE ARE CONNECTED TO NETWORK OR DISCONNECTED FROM NETWORK
	NotifyDeviceState	Device ID Function ID Event ID parameters	TRANSMIT WHEN STATE OF DEVICE IS CHANGED
	SubscribeDeviceEvent	Device ID Function ID Event ID	REGISTER EVENT IF IT WANTS TO RECEIVE EVENT OF SELECTED DEVICE
CONTROL/ MONITOR	QueryDeviceState	Device ID Function ID Action ID parameters	INQUIRE CURRENT STATE OF SERVICE FROM SELECTED DEVICE
	QueryAction	Device ID Function ID Action ID parameters	CONTROL SELECTED MODULE AND DEVICE

[Fig. 4]

INDEX	FILE DESCRIPTOR	MIDDLEWARE ID
0	Fd0	CORE
1	Fd1	LONWORKS
2	Fd2	UPnP
3	Fd3	HnCP

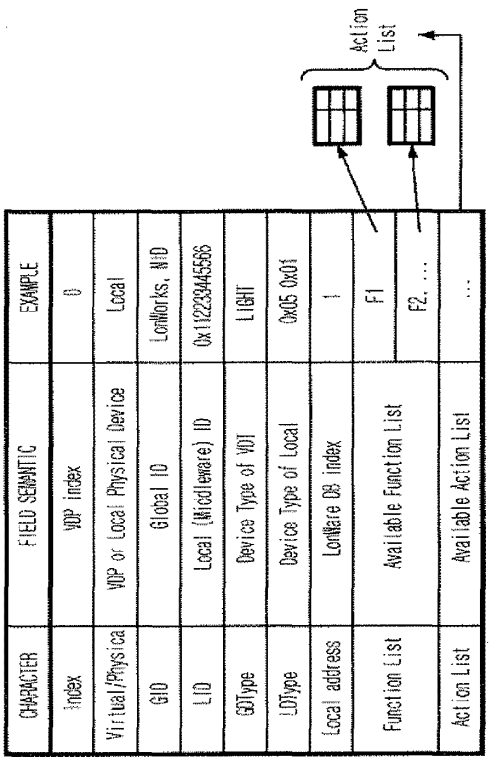
[Fig. 5]



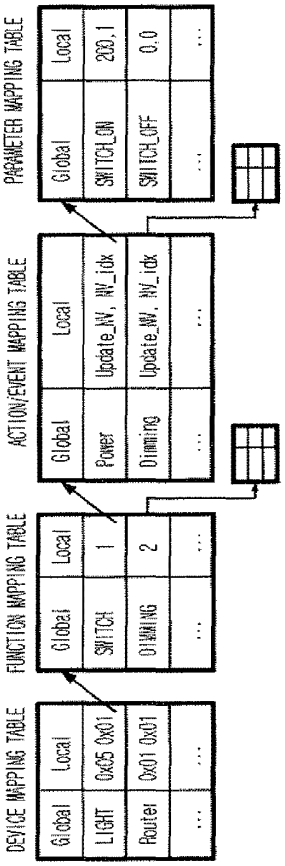
[Fig. 6]

DEVICE TYPE	Light
FUNCTION ID	Switch
ACTION ID	Power_Control Get_Status
EVENT ID	powerStatus
PARAMETER	ON, OFF(in) ON, OFF[out]

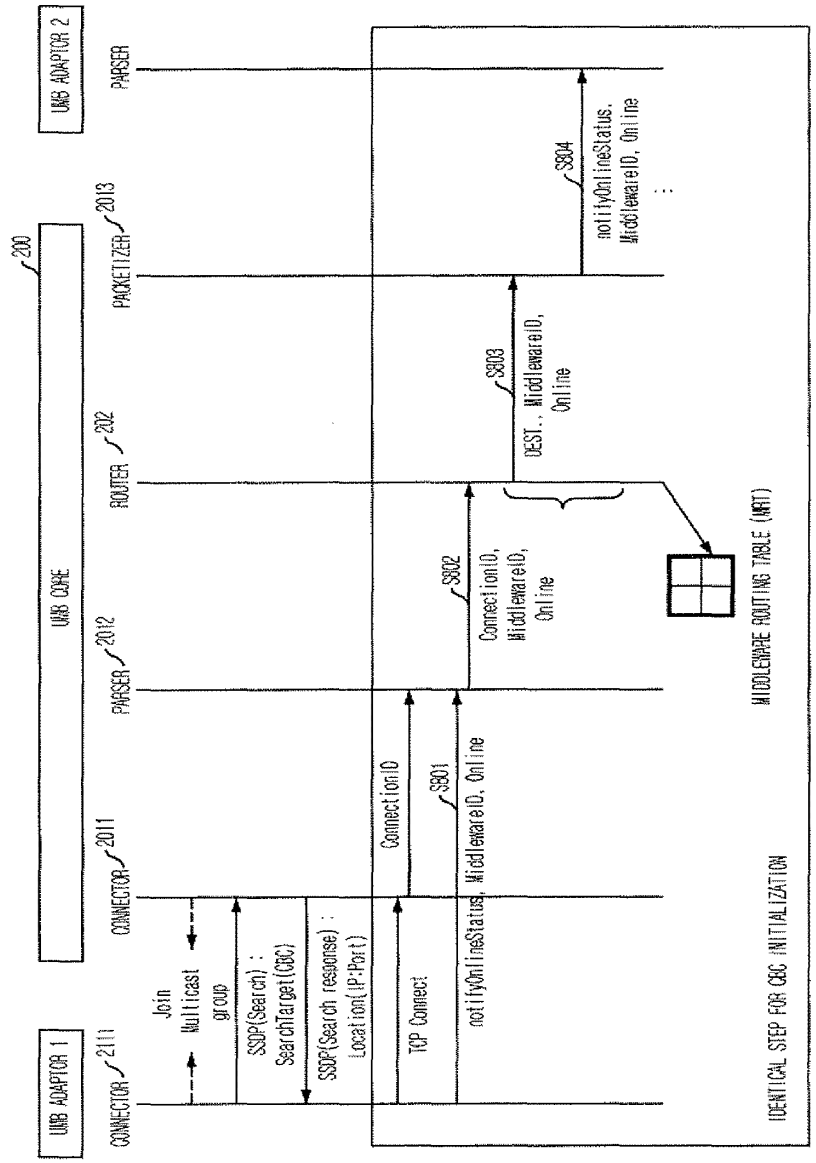
[Fig. 7]


Action List
CHARACTER
FIELD SEMANTIC
EXAMPLE
Index
VDP index
0
Virtual/Physica
VDP or Local Physical Device
Local
GID
Global ID
LonWorks, NID
LID
Local (Middleware) ID
0x1122334455
GDType
Device Type of VDI
LIGHT
LDType
Device Type of Local
0x05 0x01
Local address
LonWare DB index
1
Function List
Available Function List
F1
F2, ...
Action List
Available Action List
...

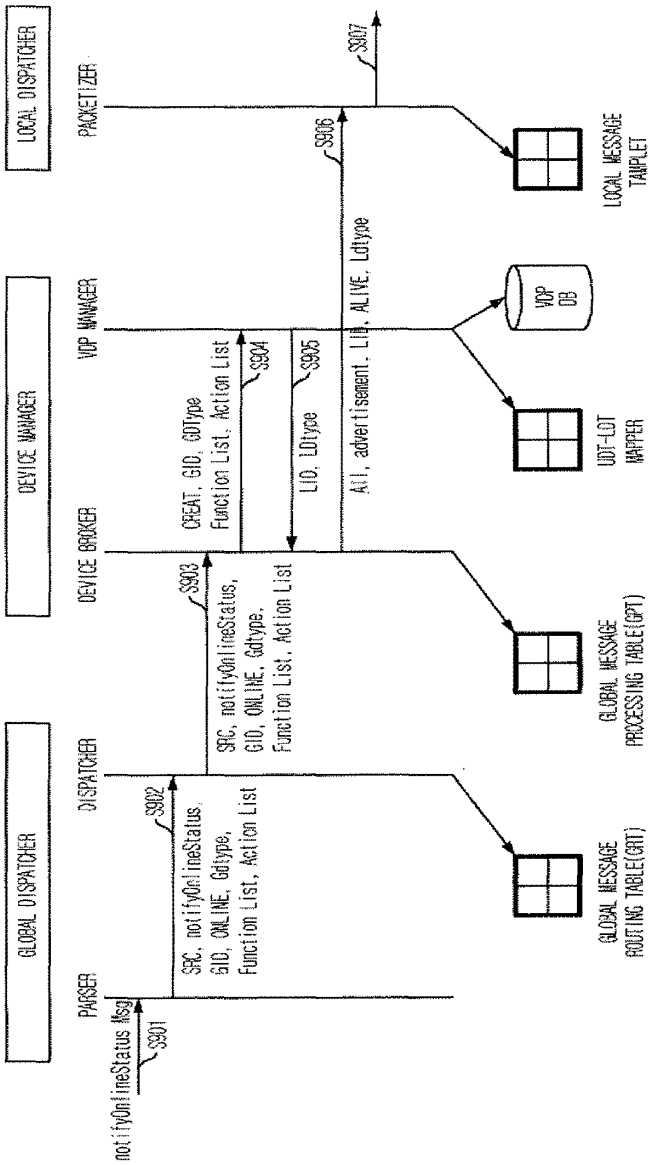
[Fig. 8]


DEVICE MAPPING TABLE
Global
Local
LIGHT
0x05 0x01
Router
0x01 0x01
FUNCTION MAPPING TABLE
Global
Local
SWITCH
1
DIMMING
2
ACTION/EVENT MAPPING TABLE
Global
Local
Power
Update_NV_ NV_idx
Dimming
Update_NV_ NV_idx
PARAMETER MAPPING TABLE
Global
Local
SWITCH_ON
200.1
SWITCH_OFF
0.0

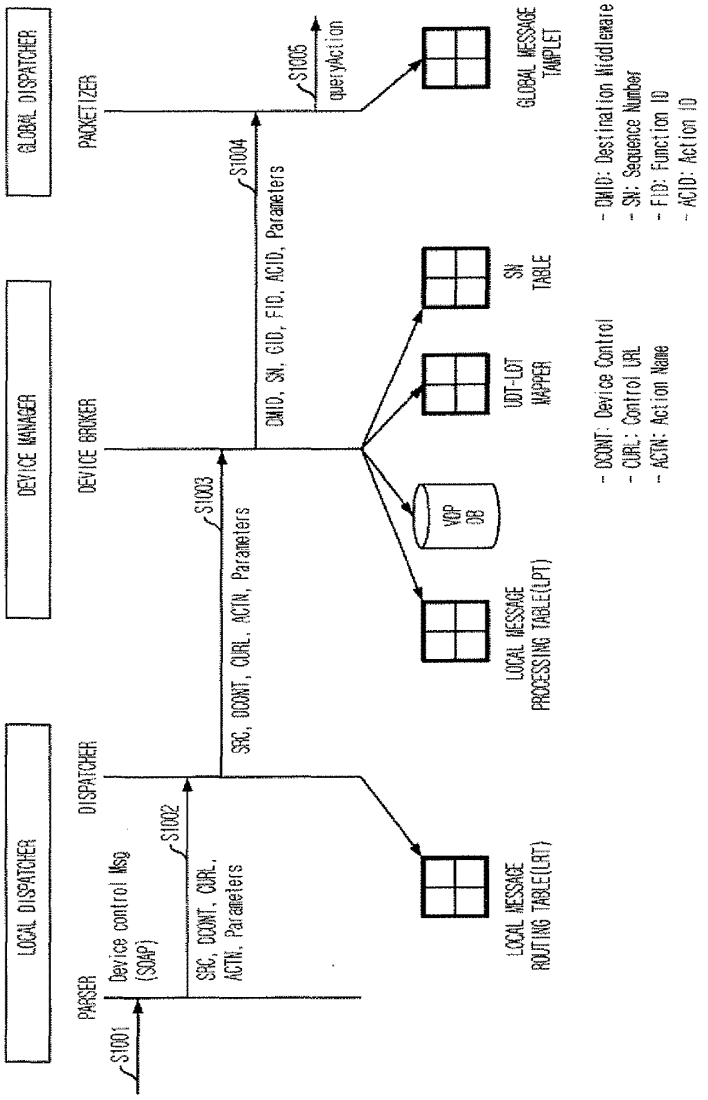
[Fig. 9]


UMB ADAPTOR 1
UMB ADAPTOR 2
200
UMB CORE
CONNECTOR 2111
CONNECTOR 2011
PARSER 2012
ROUTER 202
PACKETIZER 2013
PARSER
Join Multicast group
SSDP(Search) : SearchTarget(CGC)
SSDP(Search response) : Location(IP:Port)
TCP Connect
notifyOnlineStatus, MiddlewareID, Online
S801
ConnectionID
S802
ConnectionID, MiddlewareID, Online
S803
DEST., MiddlewareID, Online
S804
notifyOnlineStatus, MiddlewareID, Online
...
MIDDLEWARE ROUTING TABLE (MRT)
IDENTICAL STEP FOR CGC INITIALIZATION

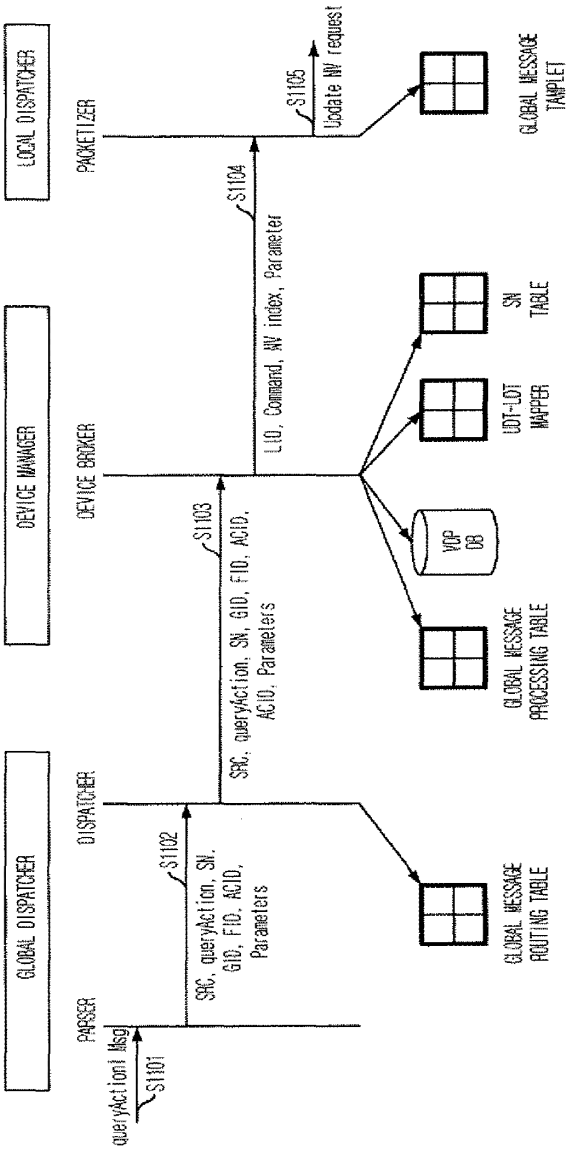
[Fig. 10]


GLOBAL DISPATCHER
DEVICE MANAGER
LOCAL DISPATCHER
PARSER
DISPATCHER
DEVICE BROKER
VDP MANAGER
PACKETIZER
notifyOnlineStatus Msg
S901
S902
SRC, notifyOnlineStatus, GID, ONLINE, Gdtype, Function List, Action List
S903
SRC, notifyOnlineStatus, GID, ONLINE, Gdtype, Function List, Action List
S904
CREAT, GID, GDType Function List, Action List
S905
LID, LDtype
S906
All, advertisement, LID, ALIVE, LDtype
S907
GLOBAL MESSAGE ROUTING TABLE(GRT)
GLOBAL MESSAGE PROCESSING TABLE(GPT)
UDT-LDT MAPPER
VDP DB
LOCAL MESSAGE TAMPLET

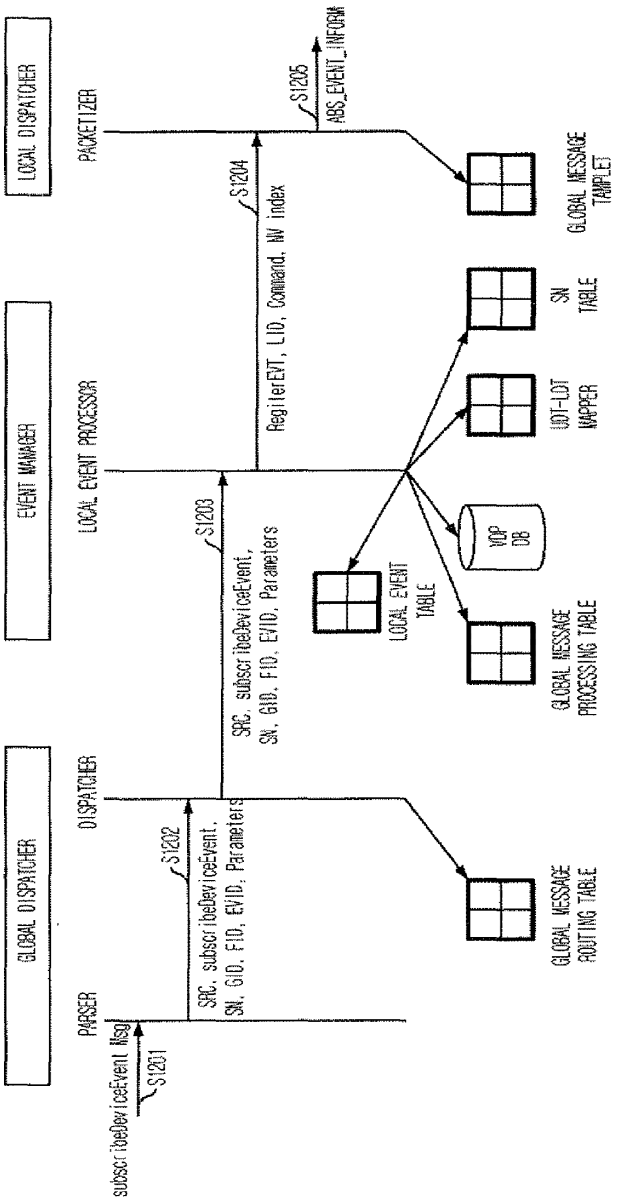
[Fig. 11]


LOCAL DISPATCHER
DEVICE MANAGER
GLOBAL DISPATCHER
PARSER
DISPATCHER
DEVICE BROKER
PACKETIZER
S1001
Device control Msg (SOAP)
S1002
SRC, DCONT, CURL, ACTN, Parameters
S1003
SRC, DCONT, CURL, ACTN, Parameters
S1004
DMID, SN, GID, FID, ACID, Parameters
S1005
queryAction
LOCAL MESSAGE ROUTING TABLE(LRT)
LOCAL MESSAGE PROCESSING TABLE(LPT)
VOP DB
UDT-LDT MAPPER
SN TABLE
GLOBAL MESSAGE TAMPLET
- DCONT: Device Control
- CURL: Control URL
- ACTN: Action Name
- DMID: Destination Middleware ID
- SN: Sequence Number
- FID: Function ID
- ACID: Action ID

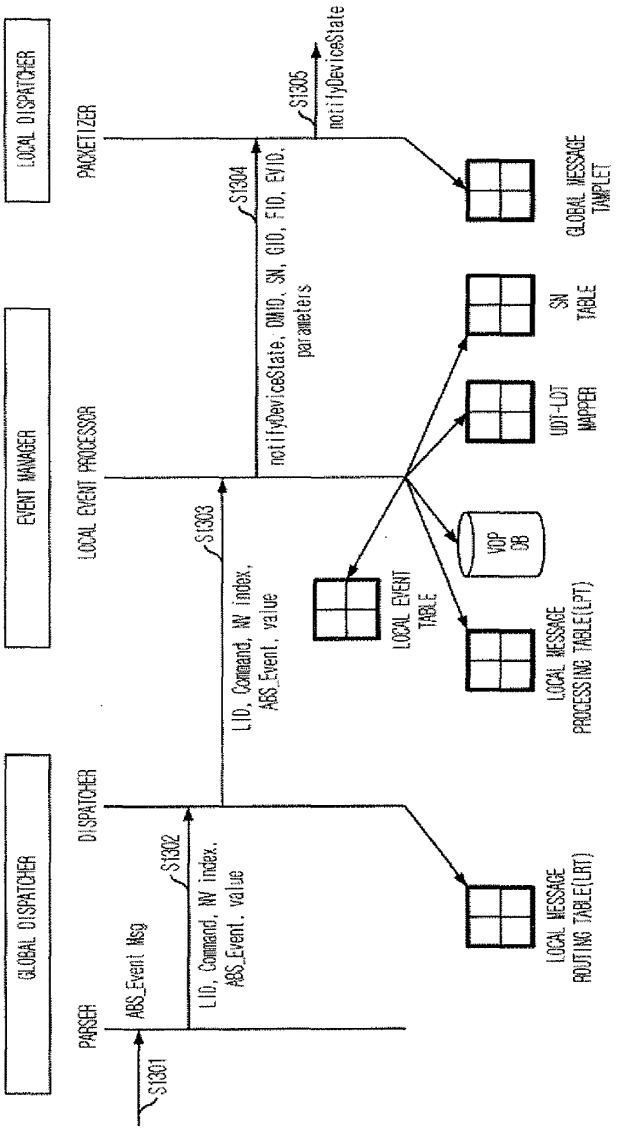
[Fig. 12]


GLOBAL DISPATCHER
DEVICE MANAGER
LOCAL DISPATCHER
PARSER
DISPATCHER
DEVICE BROKER
PACKETIZER
queryAction/ Msg
S1101
S1102
SRC, queryAction, SN, GID, FID, ACID, Parameters
S1103
SRC, queryAction, SN, GID, FID, ACID, ACID, Parameters
S1104
LID, Command, NV index, Parameter
S1105
Update NV request
GLOBAL MESSAGE ROUTING TABLE
GLOBAL MESSAGE PROCESSING TABLE
VOP DB
UDT-LDT MAPPER
SN TABLE
GLOBAL MESSAGE TAMPLET

[Fig. 13]


GLOBAL DISPATCHER
EVENT MANAGER
LOCAL DISPATCHER
PARSER
DISPATCHER
LOCAL EVENT PROCESSOR
PACKETIZER
subscribeDeviceEvent Msg
S1201
S1202
SRC, subscribeDeviceEvent, SN, GID, FID, EVID, Parameters
S1203
SRC, subscribeDeviceEvent, SN, GID, FID, EVID, Parameters
S1204
RegiterEVT, LID, Command, NW index
S1205
ABS_EVENT_INFORM
GLOBAL MESSAGE ROUTING TABLE
LOCAL EVENT TABLE
VOIP DB
GLOBAL MESSAGE PROCESSING TABLE
UDT-LDT MAPPER
SN TABLE
GLOBAL MESSAGE TAMPLET

[Fig. 14]


GLOBAL DISPATCHER
EVENT MANAGER
LOCAL DISPATCHER
PARSER
DISPATCHER
LOCAL EVENT PROCESSOR
PACKETIZER
S1301
ABS_Event Msg
S1302
LID, Command, NV index, ABS_Event, value
S1303
LID, Command, NV index, ABS_Event, value
S1304
notifyDeviceState, DMID, SN, GID, FID, EVID, parameters
S1305
notifyDeviceState
LOCAL MESSAGE ROUTING TABLE(LRT)
LOCAL EVENT TABLE
VOP DB
LOCAL MESSAGE PROCESSING TABLE(LPT)
UDI-LOT MAPPER
SN TABLE
GLOBAL MESSAGE TAMPLET

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2005/004345

A. CLASSIFICATION OF SUBJECT MATTER

H04L 12/28(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)

IPC8 : H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Patents and applications for inventions since 1975
Korean Utility models and applictions for Utility models since 1975
Japanese Utility models and application for Utility models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2003/0016682 A1 (SamSung Electronics Co., Ltd.) 23 January 2003 (see abstract, figure 4, claim 1)	1 ~ 18
A	US 2004/0139177 A1 (Samsung Electronics Co., Ltd.) 15 July 2004 (see abstract, figure 6, claim 1)	1 ~ 18

☐ Further documents are listed in the continuation of Box C. ☒ 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 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
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 MARCH 2006 (31.03.2006)	**31 MARCH 2006 (31.03.2006)**

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR2005/004345

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US2003016682A1	23.01.2003	CN1492647A	28.04.2004
		JP15134142	09.05.2003
		JP2003134142A2	09.05.2003
		KR1020030004540	15.01.2003
		KR2003004540A	15.01.2003
		US20030016682A1	23.01.2003
		US2003016682AA	23.01.2003
US2004139177A1	15.07.2004	CN1516008A	28.07.2004
		JP16213612	29.07.2004
		JP2004213612A2	29.07.2004
		US20040139177A1	15.07.2004
		US2004139177AA	15.07.2004

(19) KOREAN INTELLECTUAL PROPERTY OFFICE

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(21)Application number: 1020040100691
(22)Date of filing: 02.12.2004
(30)Priority: ..

(51)Int. Cl G06F 17/60
G06K 19/00

(71)Applicant: SDLINE CO., LTD.
(72)Inventor: HAN, JONG SEON

(54) SYSTEM FOR MAINTAINING/MONITORING FACILITIES USING RFID AND USN AT REAL TIME

(57) Abstract:

PURPOSE: A system for maintaining/monitoring facilities using the RFID(Radio Frequency ID) and the USN(Ubiquitous Sensor Network) is provided to enhance reliability and availability of the facilities by enhancing accuracy for obtaining facility information, understanding a status of the facilities in real-time, and monitoring state change particulars for the facilities in a remote place. CONSTITUTION: A transponder(110) is attached to the facility. A transceiver(120) reads/writes facility management information to the transponder. A server(130) processes the facility information obtained through the transponder and the transceiver. A facility management application program(140) stores the facility information and analyzes the status/history of the facility.

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Legal Status
Date of request for an examination (20041202)
Notification date of refusal decision (00000000)
Final disposal of an application (rejection)
Date of final disposal of an application (20050602)
Patent registration number ( )
Date of registration (00000000)
Number of opposition against the grant of a patent ( )
Date of opposition against the grant of a patent (00000000)
Number of trial against decision to refuse ( )
Date of requesting trial against decision to refuse ( )

(19)대한민국특허청(KR)
(12) 공개특허공보(A)

(51) 。Int. Cl.[7]
G06F 17/60H0
G06K 19/00

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(22) 출원일자 2004년12월02일

(71) 출원인 (주)에스디라인
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심사청구 : 있음

(54) RFID/USN 기반의 시설물관리 시스템

요약

본 발명은 시설물에 대한 유지보수 및 상태감시를 위하여 무선인식태그(RFID)와 유비쿼터스 센서네트워크(USN : Ubiquitous Sensor Network)를 이용하는 응용기술에 관한 것이다.

보다 세부적으로는 시설물에 RFID를 부착하여 시설물에 대한 관리 이력정보를 손쉽게 갱신, 참조하며 USN 기반의 통신을 통하여 원격지에서 시설물의 상태정보를 파악하고 조정통제함으로써 시설물 관리를 위한 개선된 방법을 제공하는 것이 본 발명의 특징이다.

위와 같은 기능을 구현하기 위하여 본 발명은 관리대상 시설물에 부착하는 RFID Transponder, RFID 태그에 정보를 읽고 쓰기 위한 송수신기, 각각의 RFID별로 보유하고 있는 데이터를 통합 관리하는 서버, 시설물관리 응용프로그램과 네트워크로 구성되어 있다.

대표도

도 1

색인어

RFID, USN, 시설, 설비, 기자재

명세서

도면의 간단한 설명

도 1은 RFID/USN를 이용한 시설물관리 시스템 전체 구성도이다.

도 2는 Passive RFID Transponder를 사용한 시설물관리시스템의 개념도이다.

도 3은 USN 기반의 Active RFID Transponder를 사용한 시설물관리시스템 개념도이다

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<도면의 주요부분에 관한 상세한 설명>

110 : Transponder - 일반적으로 RFID Tag라 명칭하며 전원포함여부에 따라 Active 타입과 Passive 타입으로 분류된다. 정보를 저장하고 전송하는 기능이 있다.

120 : 송수신기 Transponder에 정보를 읽거나 기록하는 장치로 컨트롤러와 안테나로 구성된다.

130: 서버 수집된 RFID의 정보를 처리하기 위한 응용프로그램을 구동하기 위한 컴퓨터

140: 시설물관리응용프로그램 - 수집된 RFID의 정보를 처리하는 처리기와 자료를 저장하는 데이터베이스, 사용자와의 정보교환을 위한 유저인터페이스로 구성된다.

150: 네트워크 Transponder와 송수신기 송수신기와 서버 간의 통신을 담당하며 유선(Line Interface)네트워크와 무선네트워크(Air Interface)로 분류된다.

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 시설물에 대한 유지보수 및 상태감시를 위하여 무선인식태그(RFID)와 유비쿼터스 센서네트워크 (USN) 이용하는 응용기술에 관한 것이다.

일반적으로 다양한 형태로 넓은 공간에 분포된 건축물 및 건축물에 부착된 시설, 설비, 기자재 등을 관리하기 위하여 바코드, 자기코드, IC카드 등의 다양한 인식도구를 사용하고 있으며 그 중 바코드 시스템은 낮은 도입비용이라는 장점으로 광범위하게 사용되고 있다. 하지만 바코드 시스템은 인식거리(0 ~ 50 Cm), 인식속도(4초), 인식율(95% 이하), 투과력 없음, 정보저장량(1 ~ 100 byte), 정보갱신불가능, 높은 손상율, 낮은 보안성 등의 매체 측면의 한계를 가지고 있고 시설물의 상태정보의 취득면에서 사람이 직접 바코드가 부착된 장소로 이동하여 상태정보를 확인하는 것을 통해서만 시설물에 대한 정보를 취득할 수 있다는 공간적 제약성을 가지고 있다. 따라서 종래의 기술로는 시설물 관리자가 시설물에 대한 실시간 정보취득을 할 수가 없고 유지보수, 변경, 개량, 폐기 등의 관리이력을 실물과 정보를 분리하여 관리 함으로 불일치로 인한 관리상의 어려움이 존재한다.

발명이 이루고자 하는 기술적 과제

RFID 시스템은 무선접속 방식에 따라 상호유도(Inductively coupled) 방식과 전자기파(Electromagnetic wave) 방식으로 나눌 수 있다. 상호유도 방식은 근거리(1m 이내), 전자기파 방식은 중장거리용 RFID로 사용되며, 상호유도방식은 코일 안테나를 이용하며 전자기파 방식은 고주파 안테나를 이용해서 서로 무선접속을 한다.

상호유도 방식의 태그는 거의 수동으로 작동된다. 즉 태그의 IC칩이 동작하는데 필요한 모든 에너지는 리더기에 의해 공급되어진다. 따라서 리더기기의 안테나 코일은 주변지역에 강한 자기장을 발생한다. 방출된 자기장의 일부분이 리더기와 떨어져 있는 태그의 코일 안테나에 유도성 전압을 발생, 정류된 후 IC를 위한 에너지로 공급된다. 전자기파 방식의 태그는 IC칩을 구동하기 위한 충분한 전력을 리더기로 부터 공급받지 못하므로 장거리 인식을 위한 추가적인 전지를 포함하는 경우(능동형)도 있다. 리더기와 태그는 여러 가지 디지털 방식의 부호화(coding)를 이용 기저대역의 데이터를 처리한다. 무선신호는 주로 기본적인 세 개의 디지털 변조방식 즉 ASK(Amplitude shift keying), FSK(Frequency shift keying) PSK(Phase shift keying)를 이용, 기저신호를 고주파 신호로 변환하여 전송된다. 그러나 특정 주파수 대역(미국의 UHF 대역)에서는 전자파의 인체영향이나 다른 통신시스템과의 간섭을 줄이기 위하여 특정 변조방식만을 쓰도록 요구 되는데 가장 많이 쓰이는 것이 주파수 확산(spread spectrum, SS) 방식이다. SS 중 CDMA 모바일 폰이나 무선랜에 이용되는 직접 시퀀스(direct sequence, DS)와 블루투스에 이용되는 주파수 호핑(frequency hopping, FS)이 주로 사용된다. 그러나 이러한 변조방식을 태그에 적용하면 그만큼 복잡한 회로가 필요하여 가격이 상승하므로 실제적으로는 리더기만이 이러한 변조방식을 사용하고 태그는 SS의 전체 주파수를 커버하도록 광대역으로 만들고 ASK 등을 이용하여 신호를 전송한다. 기타 데이터 정보의 신뢰성을 높이기 위한 여러 신호처리가 수행되는데, CRC(cyclic redundancy check) 등의 방법을 사용하는 에러율 감소방법, 여러 개의 태그를 구별하기 위하여 무선랜 등에서 사용되는 Aloha나 CSMA(Carrier Sense Multiple Access)와 비슷한 방식을 사용하는 충돌방지(anti-c

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ollision) 방법, 데이터의 보호를 위하여 대칭 또는 비대칭 암호 알고리즘을 사용하는 데이터 보안방법 등이 적용된다. 특히 이러한 신호처리는 태그의 메모리의 기능성에 의존한다.

위와 같은 특성의 RFID를 시설물관리 업무에 적용하여 시스템화하는 것이 본 발명의 핵심주제이며 구현하기 위한 방법으로 대상 시설물에 RFID를 부착하고 시설물의 이동, 변경, 개량, 폐기 등의 이력정보를 RFID Tag에 효과적으로 갱신한다. 투과가 가능하고 높은 안정성을 지닌 RFID의 특성을 활용하여 시설이 위치한 공간의 온도, 습도, 분진발생 등의 열악한 환경에서도 원활한 관리가 가능하도록 한다. 사람의 손이나 시야가 미치지 않는 시설물에 대해서는 센서 네트워크 기반의 능동형 RFID를 사용하여 상태정보를 취득하고 통제하게 된다.

취득된 시설물에 대한 정보는 상태기준의 시설물관리(CBM : Condition Based Management)를 위하여 다양한 방법으로 집계, 분석, 활용하고 인터넷/인트라넷 망을 통해 사용자에게 서비스를 제공한다.

발명의 구성 및 작용

RFID/USN기반의 시설물관리시스템은 흔히 태그(Tag)라 불리는 고유 정보를 저장하는 Transponder, 판독 및 해독 기능을 하는 송수신기, 호스트 컴퓨터(서버), 네트워크, 시설물관리 응용프로그램의 5가지 부분으로 구성된다.

이하 첨부된 도면을 참고하여 실시 예를 상세하게 설명한다.

도면1은 RFID/USN을 이용한 시설물관리시스템의 전체 구성도이다.

Transponder(110)은Tag Physical Memory(111)와 Sensor(112)로 구성되어 있으며 Tag Physical Memory(111)는 송수신기(120)의 Logical Memory(125)와 1:1 Mapping되는Logical Memory Map(112)을 포함하고 있다. 센서(113)은 시설물 부착되어 상태값(Condition)을 정기적으로 수집하여 Tag Physical Memory(111)에 현재값을 저장한다.

서버(130)에 탑재된 시설물관리 응용프로그램(140)에서 Application Command를 송수신기(120)로 전달하면 송수신기(120)는 Command Response Unit(124)에서 Decoder(123)로 수행할 Action을 판단하고 Encoder(122)로 Transponder(110)를 위한 Command를 생성한 후 Tag Driver and Mapping Rule(121)을 적용하여 Transponder에(110) 전송한다. Transponder(110)는 Command 종류에 따라 Tag Physical Memory(111) 값을 갱신하거나 또는 저장된 현재값을 송수신기(120)로 Response하고 송수신기는 Command와 Mapping 된 Logical Memory(125) 내용을 조합하여 서버(130)로 결과를 Response한다. 서버(130)는 Response된 결과를 시설물관리응용프로그램(140)에 통보하고 시설물관리응용프로그램(140)은 결과를 알림 또는 데이터베이스에 저장하는 후속처리를 수행한다. 시설물관리 응용프로그램(140)을 통하여 사용자는 시설물의 현황을 참조하고 시설물이력을 분석하고 시설물을 조정하게 된다.

Transponder와 송수신기 간의 네트워크(150)로 RF통신을 사용하며 그 종류는Bluetooth, IEEE802.15.4, Zigbee, P1415.5(Wireless Sensor Interface Standard) 등이 될 수 있다.

도면2은 Passive RFID Transponder를 사용한 시설물관리의 간단한 예시이다.

설치, 이동, 보전, 개량, 폐기 등의 시설물 에 대한 관리를 수행(201)한 후 송수신기에 관리이력번호와 관리이력내용을 입력(202)한다. 입력된 내용은 네트워크를 통해 서버(130)로 전송(203)되며 데이터를 전송받은 서버는 시설물 관리응용프로그램에 데이터를 저장(204)한다. 현장에서 시설물에 대한 관리정보를 취득하기 위하여 Transponder(110)를 송수신기(120)로 스캔하여 관리이력번호를 Reading(211)한 후 서버의 시설물관리응용프로그램에 저장된 관리이력번호를 결합하여 관리이력내용을 취득한다.

사용자는 시설물관리응용프로그램(140) 축적된 데이터베이스를 통하여 시설물에 대한 정보 추출하고 추출된 내역을 분석(221)한다.

도면3은 USN 기반의 Active RFID Transponder를 사용한 시설물관리의 간단한 예시이다.

Transponder(110)에 내장된 온도, 습도, 진동, 압력센서를 통하여 주기적으로 시설물에 대한 상태값을 수집(301)하고 수집된 정보를 네트워크(150)를 통하여 송수신기(120)로 전송(302)한다. Transponder(110)는 내장된 통신 모듈을 이용하여 다른 Transponder와 Air Interface(150)를 통하여 수집값을 통신(303)한다. 송수신기(120)는 전송된 상태값 중 유효한 값을 추출하여 그 내용을 다시 서버로 전송(304)한다. 서버는 전송받은 데이터를 시설물관리응용프로그램에 전달(305)하고 사용자를 시설물관리응용프로그램을 통하여 설비에 대한 상태정보를 감시(306)한다. 전송

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된 자료에 대한 저장규칙에 의해 축적된 데이터베이스 를 통해 시설물에 대한 상태이력을 분석(311)한다.

발명의 효과

USN 기반의 RFID를 이용한 시설물관리시스템을 통하여

첫째, 시설물 정보취득의 정확도를 향상시킨다.

둘째, 시설물의 현황을 실시간으로 파악한다.

셋째, 원격지에서 시설물에 대한 상태 변경사항을 감시한다.

넷째, 네트워크 비용을 감소시킨다.

다섯째, 시설물 관리를 위한 시간과 비용을 절감한다.

위와 같은 개선된 시설물관리를 통하여 궁극적으로 시설물의 가용성 및 신뢰성을 향상 시키는 것이 본 발명의 주요효과라 하겠다.

(57) 청구의 범위

청구항 1.
시설물에 부착하는 Passive RFID Transponder, RFID Transponder에 시설물관리정보를 Read/Write하는 이동 또는 고정형 RFID 송수신기,

Transponder 및 송수신기를 통하여 취득된 시설물의 정보처리를 위한 서버,

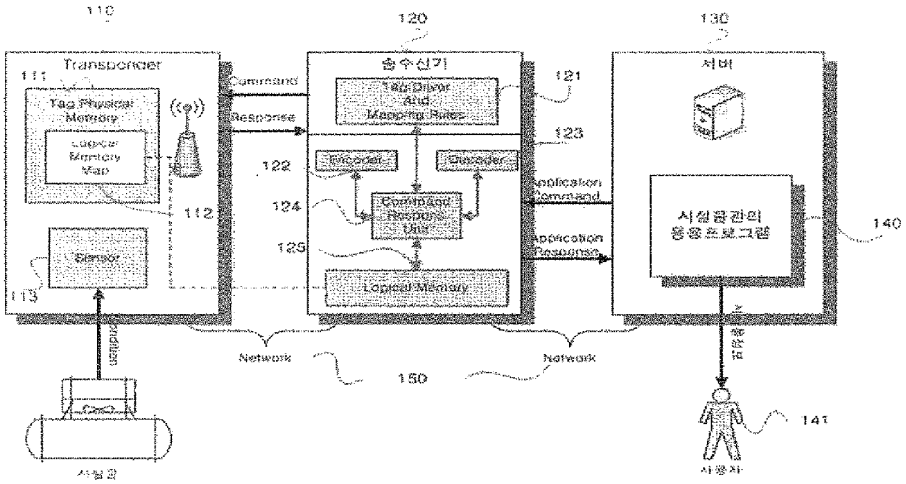
시설물정보를 저장하고 시설물의 현황 및 이력을 분석하기 시설물관리 응용프로그램으로 구성된 'RFID를 이용한 시설물관리시스템'

청구항 2.
센서 및 네트워크 모듈이 포함된 Active RFID Transponder, USN을 사용하여 Transponder 간의 데이터통신 및 취득된 시설물의 정보를 서버로 중계하는 RFID 송수신기, 중계된 시설물의 정보를 처리를 위한 서버, 시설물의 현황을 감시하고 설정된 규칙에 따라 경보를 발생시키고 데이터베이스에 자료를 저장하는 시설물관리 응용프로그램으로 구성된 'RFID/USN 기반의 시설물관리시스템'

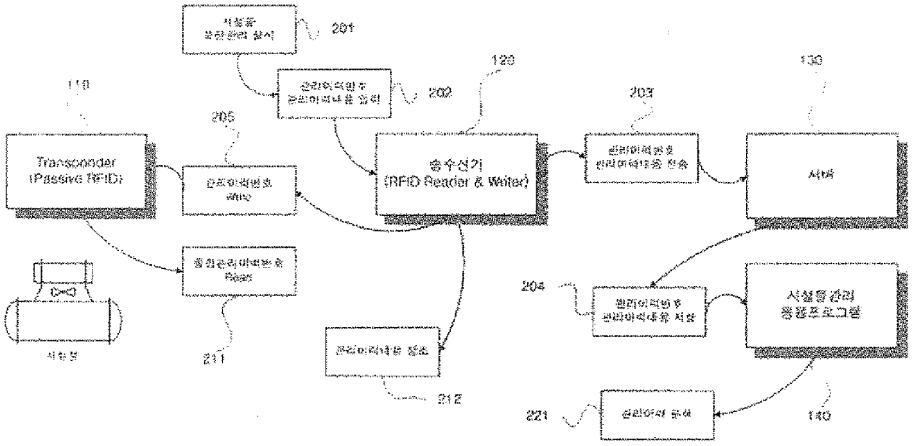
청구항 3.
제 2항에 있어서, 오폐수장, 정배수 등 수처리시설을 대상으로 건축물 및 부대설비에 RFID/USN 기반의 시설물관리시스템을 적용한 'RFID/USN 기반의 수처리시설물 관리시스템'

도면

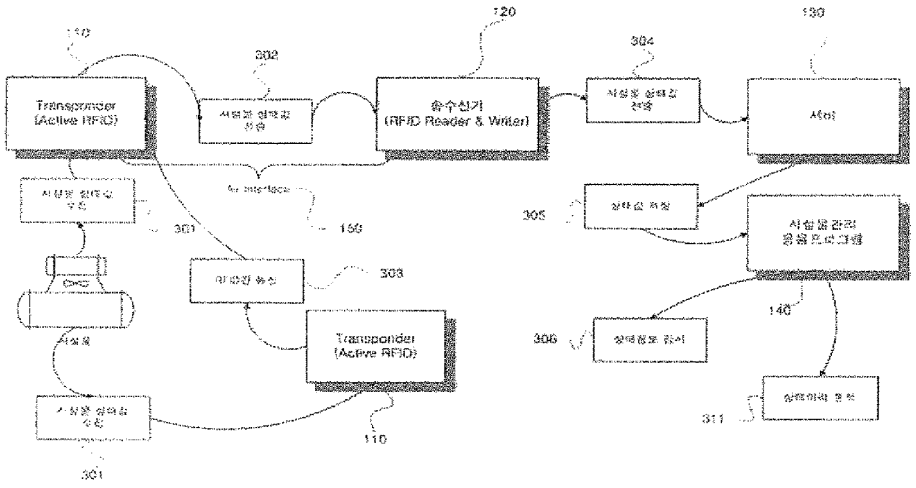
도면1


110
120
130
Transponder
111
송수신기
서버
Tag Physical Memory
Logical Memory Map
Sensor
112
113
Command
Response
Tag Driver And Mapping Rules
121
123
122
Encoder
Decoder
124
Command Response Unit
125
Logical Memory
Application Command
Application Response
사설물관리 응용프로그램
140
Network
150
Network
141
사용자

도면2


201
202
120
130
110
205
203
Transponder (Passive RFID)
송수신기 (RFID Reader & Writer)
서버
204
211
212
221
140

도면3


110
120
130
302
304
Transponder (Active RFID)
송수신기 (RFID Reader & Writer)
서버
150
301
303
305
306
140
Transponder (Active RFID)
110
311

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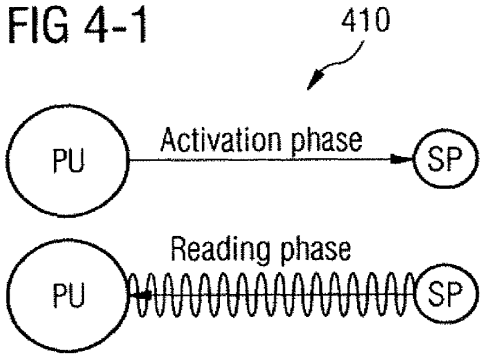
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(54) Remote polling and control system

(57) A remote polling and control system (430,450,460, or 470) in a heterogeneous wireless sensor network (WSN) comprises a master node (PU) having an RF transceiver (aTx and aRx) for sending (S0a) a wake-up signal to at least one remote slave node (SP, SA) of a first and/or second type for polling (S0b) information detected by said slave node (SP) or triggering functions to be executed, sending (S0c) control information for triggering a function to be executed by at least one remotely controllable slave node (SA) of a second type and receiving (S0d) feedback information from the remotely controllable slave node (SA) of said second type, said slave nodes (SAs,SPs) being in a stand-by mode before and after being called by the master node (PU).

FIG 4-1



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Description

FIELD AND BACKGROUND OF THE INVENTION

[0001] The present invention generally relates to the field of heterogeneous, wireless ad-hoc networks suitable for low-power, short-range and ubiquitous ad-hoc communication for fixed, embedded or portable devices, e.g. a wireless sensor network (WSN) for use e.g. in health care, intelligent household, industry, distributed computing or related applications.

[0002] A wireless ad-hoc communication network is typically based on ad-hoc multi-hop communications. The typical mode of communication in a sensor network is from multiple data sources to a data sink. During the lifetime of the network, the information collected by the sensors is periodically transmitted to the sink nodes, which can either be mobile or fixed. These sink nodes can be used by external operators to retrieve the information gathered by the network (gateway functionality). In addition, the wireless communication network enables communication and information exchange between any of the nodes participating in the network.

[0003] Since the data being collected by multiple sensors is often based on common phenomena, there is likely to be some redundancy in the raw or pre-processed data being communicated by the various nodes in sensor networks. Third, in most envisioned scenarios the sensors are not mobile (though the sensed phenomena may be), so the nature of the dynamics in both network types is different.

[0004] The single major resource constraint is that of energy for a small, embedded node hosting sensing and communication functions. The scale of sensor networks and the necessity of unattended operation for months at a time means that energy resources have to be managed even more carefully. This, in turn, typically precludes high data rate communication, long range wireless communication and any other type of complex data pre-processing

[0005] As described in "Ember Networks" (http://www.ember.com/) and "Millennial Networks" (http://www.millennial.net/), current systems typically employ conventional low-power radio technology or Bluetooth radio systems, which require a substantial amount of energy for transmission and reception. Therefore, even if the traffic pattern is very sporadic, both units (receiver and transmitter) are turned on from time to time, need to be synchronized and finally exchange information (if there is any information to be exchanged). Typically for short-range wireless devices, the reception unit takes the same power (or even higher power) as the transmission unit. Even if no information needs to be received, substantial power is wasted just to be able to receive data. In order to save as much power as possible, complex duty-cycle radio protocols are employed. Duty cycling raises another problem: Information can only be exchanged during 'on' time, where both the transmitter and the corresponding receiver are activated at the same instance of time. Therefore, in a typical duty-cycle protocol - e.g. with a 1 % duty cycle, which means that e.g. a transceiver is switched on for 0.1 seconds and turned off for 9.9 seconds - messages may need to be delayed substantially.

[0006] Said low-power radio technology and said Bluetooth radio systems are typically employed for each type of node within a wireless sensor network. Therefore, even the simplest nodes (and those maybe deployed massively) use the same kind of radio technology (which consumes substantial power and imposes a certain system cost). A more suitable wireless network system would allow scaling of the radio subsystem and the radio protocol according to the respective node's task. At least the scaling of the radio protocol and routing protocol is partially used in current systems (e.g. by defining end points, routers and gateways, cf. "Millennial Networks", http://www.millennial.net/).

[0007] A suitable radio technology for certain nodes in a wireless network for wireless sensor applications can be "Modulated Backscatter" (MBS), which is currently used for short-range radio frequency identification (RFID) applications (e.g. smart card access control systems). As there is no need for a complicated radio (passive transmission), both the cost and energy consumption can be very low (for many nodes within a wireless network). However, current MBS applications are limited to RFID style operation and therefore do not support the following points:

- Efficient networking: Currently, a single "reader" talks to a group of RFID tags, information is not provided within a network and "tag-to-tag" communication is not supported.
- Only a fixed, pre-programmed ID is provided by the tag, which means that there is no dynamic information generated, processed and communicated from the tag.
- MBS range and data rate are limited due to the limited application scenario of RFID and the technology implemented.
- Interworking (both on radio and radio protocol) with other "longer-range" radio technologies (e.g. ISM band short-range radio systems such as Bluetooth). Thereby, sensor information can not be propagated across different radio technologies. In addition, both radio technologies have been designed with different scenarios in mind and are thus not compatible.

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BRIEF DESCRIPTION OF THE PRESENT STATE OF THE ART

[0008] In order to understand the central idea of the present invention, it is necessary to give a brief survey of RFID systems, passive and active RFID tags.

[0009] Conventional wireless sensor networks utilize proprietary radio access technologies (or a modification of standard radio devices such as Bluetooth) and proprietary radio access protocols. As their network topology is typically meshed, they are able to support ad-hoc features (e.g. node detection, node identification and routing) without a central controlling device and can be tailored for a specific application (e.g. military surveillance, production or process surveillance). For further background information on sensor networks and specifically wireless sensor networks the interested reader is referred to the following articles: "Wireless Sensor Networks: A Survey" (Computer Networks 38 (2002), pp. 393-422, 2002, published by Elsevier Science B.V.) by I.F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, "A Survey on Sensor Networks" (IEEE Communication Magazine, August 2002) by the same authors, and "Wireless Sensors. Streamline Data Distribution" (Communication System Design, July/August 2003, http://www.CommsDesign.com) by T. Riedel.

[0010] For the scope of the present invention, the following topics shall briefly be discussed here: wireless network topologies (suitable for sensor applications), radio access technologies and radio protocol architectures.

[0011] To allow simple deployment, typically ad-hoc network topologies are supported, where each node can participate within the network and furthermore assume different roles within the network. Thereby, a wireless node equipped with a sensor device acts as a data collector (for sensing local information) or utilizes the wireless interface to receive and retransmit ("forwarding" or "routing") information from remote wireless nodes. Other specific nodes (routers) which are not equipped with sensing devices are used to route the traffic through the network. Furthermore, a so-called gateway node provides an interface between the sensor network and the outside world (e.g. towards an observer). Another scenario is constructed using a single observer/gateway node and multiple wireless (sensor) nodes. In this case, the gateway node acts as a central controller and polls the wireless sensor nodes (star topology, centralized master-slave type of operation).

[0012] Current wireless (sensor) networks usually apply bidirectional radio technology, thereby targeting low-power operation while fulfilling regional radio regulatory constraints. For example, ISM radio bands are utilized to allow rapid deployment of such systems.

[0013] A typical example are the Bluetooth radio interface or other technologies fulfilling the regulatory conditions described in "FCC 15.247 Operation within the Bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz" (http://www.access.gpo.gov/nara/cfr/waisidx_01/47cfr15_01.html) and "Electromagnetic Compatibility and Radio Spectrum matters (ERM); Wideband Transmission Systems, Data Transmission Equipment Operating in the 2.4-GHz ISM Band and Using Spread-Spectrum Modulation Techniques; Harmonized EN Covering Essential Requirements under Article 3.2 of the R&TTE Directive" (ETS 300 328, November 2002, http://www.etsi.org/).

[0014] In RFID applications according to the state of the art MBS is a typically used radio technology for the communication link between a variety of passive "tags" and a "reader" unit (a so-called "interrogator"). The reader unit is typically more complex and supports a larger number of tags within the radio range of the reader. The principle of operation is as follows: The reader sends an activation signal (or a continuous wave signal) to the tags, thereby providing an electromagnetic field in an area around the reader, whereupon the tags identify the presence of the electromagnetic field and use a passive transmission technology (e.g. a variation of the antenna impedance matching) to slightly influence (modulate) the electromagnetic field (EM field disturbance). The reader is able to detect the variation of the electromagnetic field, which contains the information transmitted from the tags. To allow a simple communication link to the tags, typically a high-power signal (e.g. an amplitude-modulated signal) is transmitted from the reader to the tags in range and demodulated on the tag side by means of e.g. a simple diode detector (which does not require an active down-conversion stage comprising at least one down-conversion mixer and a local oscillator). However, sensitivity and selectivity of the diode detector are limited, thus limiting the range.

PROBLEMS TO BE SOLVED BY THE INVENTION

[0015] A major problem is that integrated network topologies and radio technologies have not yet been adapted to the requirements of heterogeneous wireless networks, e.g. usable for sensor network applications.

[0016] Although having balanced radio complexity in each node, conventional active-radio based sensor networks do not address the need to include very low-cost wireless nodes in the network. At the same time, power consumption can be significant or has to be compensated by complex (duty-cycle) access protocols (which may introduce significant message delays). However, these networks may allow a significant communication range (less dense sensor networks, as the radio may allow transmission over typically up to 100 meters in free space). On the other hand, RFID technology is limited in network topology (star only), networking (tag-reader only), range (typically less than one meter) and limitation to short, fixed/static (pre-programmed) information (e.g. ID).

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OBJECT OF THE PRESENT INVENTION

[0017] In view of the explanations mentioned above, it is the object of the invention to propose a technique which is specially adapted to the requirements of heterogeneous low data rate wireless networks, e.g. suitable for sensor applications.

[0018] This object is achieved by means of the features of the independent claims. Advantageous features are defined in the dependent claims. Further objects and advantages of the invention are apparent in the following detailed description.

SUMMARY OF THE INVENTION

[0019] The present invention is basically dedicated to a wireless network, in particular to a wireless sensor network (WSN) supporting three different node types and communication technologies. Thereby, a node is basically defined by its role in the network (e.g. coordinator unit in a star topology) and its communication possibilities (defined by the capabilities of the utilized radio units). In addition, the applied radio communication protocol elements differ according to the respective node type. The network can be heterogeneous and operated according to the master-slave or ad-hoc principle. Said nodes can have different wireless communication means tailored to their individual role in the network and other constraints, thus allowing different communication patterns.

[0020] In contrast to conventional wireless ad-hoc systems and wireless sensor systems, where typically a single node type (when defined by a radio communication unit and its associated radio protocol) is supported (e.g. Bluetooth or Zigbee) and certain nodes may additionally provide a gateway function to interconnect to e.g. the Ethernet or another wireless technology (e.g. WLAN), the proposed network architecture supports three distinct node types using different wireless communication units and different protocol components.

[0021] The present invention further proposes a wake-up signaling method for activating a group of nodes or a single node when required, e.g. for polling information from activated nodes, remotely controlling an activated node or indicating a need to send data to an activated node. For this purpose, said network comprises at least one node of a first class of nodes which is adapted to transmit a wake-up signal through the network and at least one node of a second class of nodes which is adapted to receive said wake-up signal by means of a low-power consumption receiver and to initiate a data transfer following the wake-up signal.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] Further advantages and possible applications of the underlying invention result from the subordinate claims as well as from the following description of the preferred embodiment of the invention which is depicted in the following drawings:

Fig. 1 shows different types of communication links between the nodes in a wireless sensor network,

Fig. 2 shows that communication units need to be activated by each node taking part in a wireless sensor network, thereby identifying three distinct node types defined by different communication units and capabilities,

Fig. 3 is a table showing different types of data being exchanged between polling units, simple active and passive units in a wireless sensor network,

Fig. 4-1 shows the activation and reading phases of a polling process in a wireless sensor network where a single polling unit and one simple passive unit are involved in a modulated backscatter procedure,

Fig. 4-2 shows the activation, coordination and reading phases of a polling process in a wireless sensor network where two polling units and one simple passive unit are involved in a modulated backscattering procedure,

Fig. 4-3 shows a wireless sensor network, said network being configured in a star topology, encompassing a variety of simple active and passive nodes communicating with a polling unit via active-to-active (A2A), active-to-passive (A2P) and modulated backscatter communication links, respectively,

Fig. 4-4 shows a message sequence chart of a passive nodes polling example,

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Fig. 4-5 is a diagram showing a wireless sensor network scenario, said network being configured in a meshed topology, encompassing a variety of simple active nodes communicating with each other,

Fig. 4-6 is a diagram showing a wireless sensor network, said network being configured in a hybrid star and meshed topology, encompassing a variety of simple active nodes communicating with a polling unit via active-to-active (A2A) and asymmetric communication links and communicating with a variety of simple passive nodes via active-to-passive (A2P) communication links,

Fig. 4-7 is a diagram showing a wireless sensor network, said network being configured in a hybrid star and meshed topology, encompassing a variety of simple active nodes communicating with a polling unit via active-to-active (A2A) and asymmetric communication links,

Fig. 4-8 is a diagram showing the phases of the polling procedure,

Fig. 4-9 shows a "smart bookshelf" scenario where a wireless sensor network is used to identify which books are in its shelves and furthermore to provide some information about their positions in the bookshelf,

Fig. 4-10 is a diagram which illustrates how a first wireless sensor network deployed in a body area network (BAN) style can automatically be linked to a second wireless sensor network deployed in the home of the BAN's user,

Fig. 5-1 is a block diagram showing the basic node architecture (valid for all applied node types),

Fig. 5-2 is a further block diagram showing a special node architecture featuring a gateway unit which serves as an interface between heterogeneous networks (valid for polling units),

Fig. 5-3 shows four block diagrams illustrating different configurations of remotely controllable nodes equipped with sensor and/or actuator elements,

Fig. 5-4 is a block diagram showing the configuration of a radio communication unit realizing a polling unit according to the present invention,

Fig. 5-5 is a further block diagram showing the configuration of a radio communication unit realizing a remotely controllable simple passive node according to the present invention,

Fig. 5-6 is a still further block diagram showing the configuration of a radio communication unit realizing a remotely controllable simple active node according to the present invention,

Fig. 5-7 is a timing diagram showing the process of stepwisely activating a remotely controllable simple passive or simple active node being in a stand-by mode before being activated and detecting ID information and control data,

Fig. 5-8 is a state transition diagram illustrating the steps of node activation, ID information and control data detection performed by a remotely controllable simple passive or simple active node, and

Figs. 6-1 to 6-4b are five flow charts illustrating the procedure of enabling at least one master node (PU) of a remote polling and control system in a heterogeneous wireless network according to the present invention to remotely control at least one slave node (SA, SP).

DETAILED DESCRIPTION OF THE PRESENT INVENTION

[0023] In the following, the preferred embodiment of the underlying invention as depicted in Figs. 1 to 6-4b shall be explained in detail.

[0024] The proposed network can be e.g. a wireless network described by different node types (classes), node communication possibilities, communication technologies employed (in different scenarios and configurations), radio features and Media-Access-Control Layer (MAC-layer) technologies.

[0025] In the proposed network nodes are characterized by their role within the network, their communication capa-

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bilities, and their supported wireless (radio) technology (which comprises e.g. the applied modulation scheme) or utilized wireless communication units.

[0026] According to the invention, e.g. four different node classes (defined by their radio communication unit configuration) can be used, which are not mutually exclusive: active transmitters (aTx), active receivers (aRx), passive transmitters (pTx) and passive receivers (pRx).

[0027] An active transmitter (aTx) is a transmission unit which is capable of transmitting a modulated RF signal by its own. By contrast, a passive transmitter (pTx) is only capable of modulating and reflecting external RF signals based on MBS principle. A passive receiver (pRx) is a low-power consumption but low-sensitivity reception unit which can e. g. be realized as a diode detector, whereas an active receiver (aRx) is a reception unit with high sensitivity capable of demodulating backscattered signals as well as any modulated RF signal received from an active transmitter.

[0028] Furthermore, two special units are available in particular nodes within the network: a so-called "wake-up whistle" unit and a so-called "wake-up listener" unit.

[0029] A wake-up whistle unit is a radio transmitter sending a specific signal to "wake-up" nodes in its vicinity - a signal received by means of a passive receiver which indicates the start of any communication to the receiver. A wake-up listener unit is typically implemented as a passive receiver which is tuned and capable of receiving or identifying a wake-up whistle signal. This wake-up signaling scheme is an essential means to allow communication based on an "always-on" receiver network architecture. In this connection, a stepped node activation mechanism is used:

[0030] First, said nodes are typically in a "sleep" state and waiting to receive a wake-up signal. After detection of a wake-up signal the receiver switches to an "ID identification" mechanism. After successful detection of a valid identification (e.g. node address match) the nodes then turn into a data reception mode. If an invalid ID is detected, the node immediately returns to the sleep state. During data reception mode further stages may be turned active in the receiver. Thereby, power consumption is kept minimal and only increases in a stepwise manner during the reception of a wake-up signal sequence.

[0031] The whole step-by-step activation scheme is designed to support the following important features:

- minimum power consumption during idle times (when waiting for a wake-up),
- "always-on" receiver mode, wherein each node can be activated via a remote wake-up signal at any time (without duty cycling of the receiver, which means toggling between insensitive and sensitive state), and
- stepwise activation of different units with the receiver after detection of a wake-up signal, thereby tailoring the power consumption and stepwise increasing the power consumption as needed during wake-up, ID detection, and data detection.

[0032] The proposed network architecture supports the following communications in different nodes: unidirectional reception mode (a receiver-only functionality), unidirectional transmission mode (a transmitter-only functionality), bidirectional transmission mode (a switchable transceiver functionality supporting both transmission and reception, but not at the same time), and a switchable transmitter functionality (using one or another transmitter in a specific node type depending on the topology).

[0033] Concerning data handling, the following entities have to be distinguished: producer, aggregator and observer.

[0034] A producer is a device which generates data by its own (e.g. a device with integrated sensors or any other type of dynamic information created in the node) or by means of user interactions (e.g. a device with a push button). An aggregator is a device which is able to collect and process data received from other devices. Said collection can be intelligent (e.g. data fusion support) or simple (e.g. concatenation of individual measurements to bigger packets). An observer is a device which uses the data provided by the producers for some useful application.

[0035] Furthermore, nodes with different capabilities within the network have to be distinguished: forwarders and non-forwarders. A forwarder is a node which is capable of forwarding (routing) other nodes' data. By contrast, a non-forwarder is a node which is not capable of forwarding data.

[0036] In the proposed wireless sensor network the following three node classes, each having different capabilities, have to be identified: polling units (PUs), simple passive nodes (SPs) and simple active nodes (SAs).

[0037] A polling unit (PU) is a node which is equipped with an active transceiver unit (aTx and aRx). It is able to send and receive data by its own and demodulate the backscattered signals coming from simple passive nodes (SPs) as well as any transmission from an active transmitter (aTx). It can also use its active transmitter to provide an electromagnetic field which is necessary for an MBS communication. In this case the PU is acting as an ether provider. Thereby, said ether is an unmodulated carrier provided by the PU, which is modulated by a remotely controllable simple passive node using a passive transmitter (see explanations below). With the aid of an integrated wake-up whistle unit a PU can wake up any device having a wake-up listener unit in its range.

[0038] PUs may also come with an additional module (e.g. a bridge B) to talk with other PUs that are out of their

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immediate range. A bridge may consist of a long-range wireless module (different RF technology than the one used in the PUs) or even a wired connection to e.g. interface with the Ethernet.

[0039] A simple passive node (SP) is a short-range device or node equipped with a passive transmitter (pTx) based on MBS technology and a passive receiver (pRx), e.g. a diode detector. An SP uses MBS technology to transmit its information and is thus not able to work without the presence of a PU. A signal coming from the PU is modulated with the dynamic information generated and stored in its memory and then modulated in the passive radio transmission unit of the SP. As an integrated wake-up listener unit is active all the time, the SP can be awaked by any device having a wake-up whistle unit if the SP is within its range. The information transfer from an SP to the PU thus happens after an initial data transfer from the PU to the SP, which involves sending a wake-up signal and e.g. a command signal to the SP. During the data transfer between the SP and the PU, which is based on MBS technology, an ether (provided by the PU) is modulated by the SP, thereby using a passive transmitter (pTx).

[0040] It should be noted that these SPs are not similar to RFID tags. RFID tags are typically energized during the communication by a reader signal, thereby generating the power required to modulate the tag antenna by the received interrogation signal by using MBS technology. In the proposed network SPs have their own power (which is provided e.g. by a small battery) and do not use the interrogating signal to generate energy required in order to modulate the interrogating signal (ether). However, the ether is still needed as a modulation-carrying medium. The SP nodes in the proposed network contain processing means to generate and process dynamic information. Typical RFID tags, however, usually do not contain any processing means to process and generate dynamic information; the information is a fixed, pre-programmed code.

[0041] A simple active node (SA) is a medium-range device or node which is equipped with an active transmitter (aTx), a passive receiver (pRx), e.g. a diode detector, and a passive transmitter (pTx) based on MBS technology. An SA may further comprise a wake-up listener unit and an optional wake-up whistle unit. It is able to transmit data actively or by using MBS technology. An SA further comprises processing means for executing (S3d) a remotely controllable application running on said node, e.g. for monitoring (S3e) and gathering (S3e') information sensed by integrated sensor elements (SSA) and/or controlling (S3e") integrated actuator elements (ASA).

[0042] Since SPs may also contain processing means, they have a very similar architecture as SA nodes. This means that both SAs and SPs require an own energy supply (e.g. a battery, a solar cell or other means) and basically differ in their radio communication means and communication capabilities as well as in their networking means: An SA has the same communication means as an SP and in addition some further means (e.g. an active transmitter and a wake-up whistle). Moreover, an SP can only communicate to a PU, whereas an SA is able to communicate to other SA nodes. Besides the basic radio means this mainly affects the implemented radio protocol components.

[0043] Fig. 5-1 shows the basic node architecture 510 according to the present invention, which is valid for all applied node types (PUs, SPs, and SAs). It comprises a processing unit 512 and a radio communication unit 514. Said processing unit is capable of creating, handling and processing dynamic information (not just a fixed, pre-programmed ID).

[0044] A special PU node architecture 520 providing a gateway unit serving as an interface between heterogeneous networks is shown in Fig. 5-2.

[0045] Four block diagrams 530a-d illustrating typical node type configurations of SPs and SAs equipped with sensor and/or actuator elements are depicted in Fig. 5-3. However, an SP or SA may also be configured without any sensing element or actuator element (see Fig. 5-1).

[0046] Fig. 5-4 is a block diagram 540 showing the configuration of a radio communication unit realizing a PU according to the present invention. As can be taken from this figure, a PU comprises the following four components:

- an active transmitter 542 (aTx) to actively generate a modulated carrier and thereby communicate to any other node in the network (including other PUs),
- an ether generator 548 to enable other nodes (only SAs or SPs) in the vicinity of the PU to utilize their passive transmitter (pTx) for communication to the PU,
- an active receiver 544 (aRx) to receiver either MBS-type communication while e.g. receiving information from an SP, which uses its passive transmitter (pTx), MBS-type communication while e.g. receiving information from an SA, which uses its passive transmitter (pTx), active transmitter type communication coming from another PU or active transmitter type communication coming from another SA, which in this case uses its active transmitter (aTx), and
- a wake-up whistle 546a to wake-up SAs and/or SPs (not PUs) in order to indicate the need to communicate to an SP or SA (or to a multiplicity thereof).

[0047] It should be noted that the active transmitter 542 (aTx) and the ether generator 548 can also be one common

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but reconfigurable unit as they would have common elements (e.g. power amplifiers, local oscillators, etc.) and are used mutually exclusive.

[0048] Fig. 5-5 is a further block diagram 550 showing the configuration of a radio communication unit realizing an SP according to the present invention. As can be taken from this figure, an SP comprises the following three elements:

- a passive receiver 554 (pRx), which means a simple low-power receiver being able to receive data from a PU communicating to the SP or from an SA communicating to the respective SP,
- a passive transmitter 552 (pTx), capable of performing MBS-type of communication to a PU which provides the ether to allow MBS communication and uses its active receiver (aRx) to detect the RF signal sent from the passive transmitter 552 (pTx) of said SP, wherein ether generation and active reception are not necessarily confined to the same PU, and
- a wake-up detector 546b, used to wake-up the node, which is remotely triggered by another PU or SA to initiate an action in the SP (or e.g. to indicate the start of a communication sequence to/from the SP).

[0049] Fig. 5-6 is a still further block diagram 560 showing the configuration of a radio communication unit realizing an SA according to the present invention. As can be taken from this figure, an SA is equipped with the same radio communication elements as an SP and comprises some further elements. Thus, an SA comprises the following five components:

- a passive receiver 554 (pRx), which means a simple low-power receiver being able to receive data from a PU communicating to the SA or from an SA communicating to the respective SA,
- a passive transmitter 552 (pTx), capable of performing MBS-type of communication to a PU which provides the ether to allow MBS communication and uses its active receiver (aRx) to detect the RF signal sent from the passive transmitter 552 (pTx) of said SA,
- a wake-up detector 546b, used to wake-up the node, which is remotely triggered by another PU or SA to initiate an action in the SA (or e.g. to indicate the start of a communication sequence to/from the SA),
- a wake-up whistle 546a to wake-up SAs and/or SPs (not PUs) in order to indicate the need to communicate to an SP or SA (or to a multiplicity thereof), and
- an active transmitter 542 (aTx) to actively generate a modulated carrier and thereby communicate to any other node in the network (including other PUs).

[0050] It should be noted that said wake-up whistle 546a is a similar unit as the one available in the PU but may e. g. have some limitation compared to a PU's wake-up whistle unit. For example, an SA wake-up whistle implementation may have a limited output power compared to the one of a PU, thereby limiting the wake-up range. The active transmitter 542 (aTx) is a similar unit as the one available in the PU but may e.g. have some limitation compared to the active transmitter unit used in a PU. For example, an SA active transmitter implementation may have a limited output power compared to the one of a PU, thereby limiting the communication range of the active transmitter.

[0051] To save power, SAs and SPs are typically in a stand-by mode and activated by a remote wake-up signal received from a PU or SP. Fig. 5-7 is a timing diagram showing the process of stepwisely activating an SP or SA and detecting ID information and control data for executing an application running on said SP or SA.

[0052] Once a receiver node detects a such a wake-up signal, it will switch from the stand-by mode to an 'on' mode and receive the signal, which in a second part comprises said ID information. This ID is analyzed, and in case the respective node recognizes its ID it will receive the control data. Otherwise, it will immediately return to the stand-by mode in order to save power. A state transition diagram illustrating the steps of node activation, ID information and control data detection performed by an SP or SA is depicted in Fig. 5-8.

[0053] In a heterogeneous network, different devices using different communication techniques are combined together to improve or extend the overall network capabilities. In a WSN according to the present invention, three communication techniques are considered: active-to-active (A2A) communication, active-to-passive (A2P) communication, and modulated backscatter (MBS) communication.

[0054] Active-to-active (A2A) communication is the standard active wireless communication where a source is using an active transmitter (aTx) and the destination is using an active receiver (aRx). The symbol used in a WSN for this link is shown in the table depicted in Fig. 1. Since a PU node is the only device in a WSN implementing an active

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receiver, a PU must always be part of an A2A communication scenario. Active communication from an SA to a PU is also possible. Fig. 2 shows which parts of the communication units need to be activated by each node taking part in an A2A link. The type of data being exchanged and a graphical representation can be taken from Fig. 3.

[0055] Active-to-passive (A2P) communication is used to activate and send information to nodes (SPs or SAs) operating a passive receiver (pRx). A passive receiver can be based on an analog diode detector or similar technology that, since it consumes very low power, can be 'on' (listening) all the time, while the digital parts of the receiver are inactive. Therefore, nodes with a passive receiver (pRx) can remotely be activated by nodes having an active transmitter (aTx). The symbol used in a WSN for this link is shown in Fig. 1. Fig. 2 shows which parts of the communication units need to be activated by each node taking part in an A2P link. The type of data being exchanged as well as a graphical representation can be taken from Fig. 3.

[0056] One of the features that makes a WSN unique is the use of MBS technology to transmit information. Devices having a passive transmitter (pTx) - SPs and SAs - are able to modulate, with the data they want to transmit, and reflect (backscatter) an electromagnetic field ("Ether", see Fig. 1) received by its antenna. Since the reflected signal is relatively weak, an active receiver (aRx) is necessary to demodulate it. A PU node is the only device in the proposed wireless network which is capable of generating the ether and also the only one implementing an active receiver, so at least one PU must always be part of an MBS communication. A WSN using this technology differs from other existing MBS systems, which use e.g. RFID tags, in the following points:

1. The data being transmitted can be any, not only identification (ID) information. Unlike the fixed, pre-programmed ID, data can be dynamic.

2. The PU providing the ether may not take part in the communication. Instead, it may just provide the channel to make the communication between other two devices possible.

3. The data being transmitted may be received by more than one PU simultaneously.

[0057] The symbol used in the wireless network for this link is shown in Fig. 1. Fig. 2 shows which parts of the communication unit need to be activated by each node (a passive backscatter modulator and an active receiver) taking part in an MBS link. The type of data being exchanged and a graphical representation can be taken from Fig. 3.

[0058] There are basically two possible scenarios when MBS technology is used in the wireless network, depending on the case whether the PU providing the ether and the one receiving the modulated backscatter signal are the same or different devices.

[0059] In the first scenario, only one PU and an SP are involved in an MBS communication. As shown in Fig. 4-1, the process of reading an SP device in a WSN is done in two phases: As an SP node is inactive by default and only its wake-up listener is active, the PU first activates the SP by sending a wake-up signal via an A2P link in an activation phase. In a response phase after having activated the SP the PU starts to generate the ether which is then modulated by the SP with data to be transmitted (identification, dynamic data, e.g. sensor data, etc.). The activation and reception of SP node information can be aggregated in order to reduce the transmission time. This means that during one reading phase multiple SP nodes may transmit information to the PU while the ether is provided.

[0060] In the second scenario more than one PU are involved in the MBS transmission. The simplest case is the one represented in Fig. 4-2 with only two PUs and one SP. As in the previous scenario, also two phases are utilized here, but in this case a coordination between the two PUs is also necessary for two reasons: to decide who is going to act as ether provider during the response phase (solutions A and B in diagrams 420a and 420b depicted in Fig. 4-2) and to ensure that the PU not triggering the activation phase has its active receiver (aRx) running at the right time.

[0061] As can also be taken from Fig. 4-2, there are three possible solutions for the response phase in this scenario:

1. Solution A: The PU initiating the communication (PU1) is providing the ether and both PUs (PU1 and PU2) are receiving the modulated data sent by the SP (see diagram 420a). For this solution, the coordination phase may only be a notification from the PU providing the ether (PU1), or even not exist at all.

2. Solution B: The second PU (PU2) is providing the ether and both PUs (PU1 and PU2) are receiving the modulated data.

3. Solution C: The PU initiating the communication (PU1) is providing the ether but not interested in the data sent by the SP. Only the second PU (PU2) is receiving that data.

[0062] Solution A offers more advantages because it provides data redundancy. The benefits of the other two solutions (B and C) may depend on the specific application or topology, etc.

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[0063] A first embodiment of the present invention refers to a remote polling and control system in a heterogeneous wireless network as depicted in Figs. 4-3, 4-5, 4-6 and 4-7. Said system is organized according to the master-slave principle and suitable for ubiquitous communication between a variety of wireless nodes PUs, SAs and/or SPs interconnected via said network, said nodes having an asymmetric complexity and sporadic, asymmetric data transfer requirements. According to the invention, a polling and/or control means PU is provided for polling (S1b) e.g. sensor data detected by remotely accessible nodes of a first type (SPs) located anywhere in said network and/or remotely activating (S1c), controlling (S1c') and/or deactivating (S1c") functions executable by remotely controllable nodes of a second type (SAs). Thereby, said nodes (SAs and SPs) are in a stand-by mode before and after being triggered by said polling and/or control means.

[0064] Said polling and/or control means PU, which acts as a master node, comprises an RF transceiver (aTx and aRx) for sending (S0a) a wake-up signal to at least one remote slave node SP or SA of a first or second type, respectively, for polling (S0b) information sensed by said slave node SP, sending (S0c) control information for triggering a function to be executed by at least one remotely controllable slave node SA of a second type and receiving (S0d) feedback information from said slave nodes SA and/or SP as shown in the flow chart depicted in Fig. 6-1. Said master node PU can be connected to a bridge B providing a wireless or wired communication link to at least one other master module PU'.

[0065] According to the invention, a remote slave node of said first type (SP) comprises receiving means pRx for wirelessly receiving (S2a) a wake-up signal indicating a need for transmitting a polling request message from said master node PU to said slave node SP and transmitting means pTx for wirelessly transmitting (S2b) sensor data or requested status information to said master node PU upon reception of said polling request message by backscattering an RF signal obtained by modulating an electromagnetic field provided by said master node PU or any other node with an encoded signal representing said status information.

[0066] The remotely controllable slave node SA of said second type comprises receiving means pRx for wirelessly receiving (S3a) a wake-up and remote control signal from the master node PU, optional sensor elements SSA for detecting (S3b) operational parameters of said slave node SA and/or environmental data and/or remotely controllable actuator elements ASA for executing (S3c) programmable actions, processing means for executing (S3d) a remotely controllable application running on said slave node SA for monitoring (S3e) and gathering (S3e') sensor data detected by said sensor elements SSA and/or controlling (S3e") said actuator elements ASA, and transmitting means aTx for wirelessly transmitting (S3f) feedback information from said application to said master node PU upon reception of said wake-up and remote control signal.

[0067] According to a further embodiment of the invention, said remotely controllable slave node of said second type (SA) additionally comprises transmitting means pTx for wirelessly transmitting (S3g) sensor data or requested status information upon reception of a polling request message from a further node SA' by backscattering an RF signal obtained by modulating an electromagnetic field provided by said master node PU or any other node with an encoded signal representing said status information to said further node SA' when communicating with said further node SA' on a peer-to-peer basis. In a meshed scenario said node SA can also use its active transmitter aTx to communicate to the further node SA', the latter using its passive receiver pRx'.

[0068] According to one embodiment of the invention, nodes in said network can be organized in a star or meshed topology or a combination of both, based on the types of nodes being used as well as the respective deployment scenario in a self-organizing, ad-hoc manner.

[0069] SP nodes can only be deployed in a star topology as they are not able to initiate a communication on their own. Furthermore, they need a PU to be able to transmit their data. The PU acts as the center of the star topology as shown in Fig. 4-3. The area a PU ether covers with its active transmitter (aTx) is called "aura" (see reference number 432 used in Fig. 4-3). A PU can only demodulate MBS signals if they are coming from an SP or SA within its aura. Moreover, the wake-up whistler only works with devices inside the aura of the PU.

[0070] According to the present invention, a PU is responsible of polling the SP and SA nodes within its range by using an interrogation algorithm that is executed periodically. The PU may uniquely address a single SP or globally broadcast all the SPs in its aura to answer. In the first case, the SP requested will answer immediately, but in the second case a distributed anti-collision algorithm running in the SPs must control that the access to the medium is done in an organized way. A third option could be to address only SPs with common features (e.g. only temperature sensors) by coding the SP type as a part of its own address (capability awareness). A simple example of how this algorithm could work is using a different waiting time (timeout) in every SP before any data are transmitted (see timers T_1 to T_5 in the message sequence chart depicted in Fig. 4-4). To ensure this waiting time is different in every SP, a unique internal number (e.g. network address) can be used to calculate the timeout.

[0071] As shown in Fig. 4-5, SA nodes are able to communicate with each other by using A2P links. Before any data are transmitted, an SA sends a wake-up signal to activate the nodes to which it wants to transmit data. This deployment is adequate for scenarios where the presence of a PU can not be granted, as e.g. in a body area network (BAN) scenario (see Fig. 4-5) or other type of small mobile network deployments.

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[0072] A more general WSN scenario can be a combination of both star and mesh topologies where A2A links are used to coordinate two or more PUs or to connect a group of SAs running a meshed topology with the rest of the network via a PU. SA-to-SP communication is also considered, e.g. in case the SP nodes are actuators (switches, displays, etc.) or for management purposes. The network can also be extended by using the bridge modules (B) of the PUs (see Fig. 4-6).

[0073] It is worth to note that the A2A links in an SA-to-PU communication are unidirectional links. Therefore, an SA using this kind of link may be in three different situations:

1. The SA is within the range of one PU: If the PU has already made a polling of its aura 432, the SA knows that it is close to one PU and may want to use its active transmitter (aTx) to initiate a communication (e.g. an alarm) requesting a confirmation from the reception side. The PU can then selectively wake-up this SA and use an A2P link to send an acknowledgment (ACK) message back to the SA (see No. 1 in Fig. 4-7).

2. The SA is out of the immediate range of one PU but can reach the PU by doing some hops through other SAs. With the neighbors' information received from other nodes, the SA knows that a PU is close but not enough to receive data directly from it. The SA tries to use its active transmitter to send data to that PU. When a PU receives data and a receipt confirmation request from a SA that is out of its aura 432, it tries to send an ACK message by using multi-hopping via a known path or discovering a new one to that SA. (It should be noted that this path may go not only through SAs but also through PUs.) While the SA receives the ACK message, it knows that it is possible to use an asymmetric bidirectional link with that PU (see Nos. 2 and 3 in Fig. 4-7).

3. The SA is out of range and can not reach a PU except by using its active transmitter (see No. 4 in Fig. 4-7). In this case, the communication is unidirectional. The SA may periodically transmit its data, which will be received by the PU but without any confirmation about successful reception from the PU received at the SA passive receiver side.

[0074] The present invention thus pertains to a method for enabling at least one master node PU of a remote polling and control system 430, 450, 460 or 470 in a heterogeneous WSN as described above to remotely control at least one slave node SA or SP. As shown in the flow chart depicted in Fig. 6-2, said master node PU performs the step of transmitting (S1a)a wake-up and control signal for polling (S1b) data detected, created and/or processed by a remotely accessible slave node SP of a first type located in the range of said master node PU or any other node providing an electromagnetic field to be modulated by said slave node SP and/or remotely activating (S1c), controlling (S1c') and/or deactivating (S1c") functions executable by a slave node of a second type (SA), said slave nodes (SA and SP) being in a stand-by mode before and after being called by the master node PU.

[0075] The slave node of said first type (SP) thereby performs the steps of wirelessly receiving (S2a) a wake-up signal indicating a need for transmitting a polling request message from said master node PU to said slave node SP and wirelessly transmitting (S2b) data or requested status information to said master node PU upon reception of said polling request message by backscattering an RF signal obtained by modulating an electromagnetic field provided by said master node PU or any other node with an encoded signal representing said information (cf. Fig. 6-3).

[0076] The slave node of said second type (SA) performs the steps of wirelessly receiving (S3a) digitally encoded polling and/or control information from said master node (109), after having detected (S3a') a valid identification code of said master node PU in the header of the received polling and/or control information, executing (S3d) a remotely controllable application running on said slave node SA for monitoring (S3e) and gathering (S3e') operational parameters of said slave node SA and/or environmental data detected by sensor elements SSA connected to said slave node SA, in the following referred to as "status information", and/or controlling (S3e") actuator elements ASA controllable by said slave node SA, and wirelessly transmitting (S3f) a digitally encoded version of said status information as a feedback signal to the master node (cf. Fig. 6-4a).

[0077] While not being in vicinity of a master node PU, the slave node of said second type (SA) performs the step of wirelessly transmitting (S3f) feedback information from an application running on said slave node SA to a further node SA' upon reception of a wake-up and/or remote control signal from said further node SA'. Otherwise (while in the vicinity of a master node PU), said slave node SA performs the step of wirelessly transmitting (S3g) data or requested status information upon reception of a polling request message from the master node PU by backscattering an RF signal obtained by modulating an electromagnetic field provided by said master node PU with an encoded signal representing said status information to said master node (cf. Fig. 6-4b).

[0078] According to the invention, nodes in a WSN can use a listen-before-talk mechanism to get access to the physical medium. A simplified version of CSMA/CA is a valid option. The PUs are the nodes demanding more channel use, so some kind of negotiation between these devices is considered to avoid collisions. Since in a WSN different types of nodes with different communication capabilities and needs are sharing the same channel, a separate analysis

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for each type of node is more suitable.

[0079] As SPs do not implement an active transmitter (aTx), their transmission has to be managed by a PU, which is transmitting the ether the SPs need for communication. The only medium access problem appears when more than one SP is required by a PU to transmit data. To avoid multiple backscatter signals being received in the PU's receiver at the same time, an anti-collision algorithm is utilized. The algorithm may run completely in the SP, working in a fully distributed manner, or may run partially in the SPs and the PU which is performing the data request.

[0080] An SA may need access to the medium to talk with another SA or with a PU. In the first case, the SA first listens the medium. If it is free, the SA just sends a wake-up signal selecting the destination SAs, followed by the data it wants to transmit. If the medium is busy, the SA will backoff for some time before trying again.

[0081] When talking with a PU, an SA may use an MBS link if the SA is inside a PU's aura 432. Sending data by using an MBS link works in the same way as for the SP nodes. If the SA is outside the PU's aura 432, it may use either A2P links enabling a multi-hopping via other SA nodes or an A2A link (see Fig. 4-7) to the PU directly.

[0082] In the second case, the A2A link only works if the active receiver in the PU side and the active transmitter in the SA side are synchronized in time and tuned in frequency. As the PU node preferably has its active receiver off when it is not transmitting for saving power, the SAs out of the PU's aura 432 must then be informed at least about the frequency the PU's active receiver (aRx) is using and when the PU will have its active receiver on again. This is done in the PU by broadcasting a beacon 482 with this information. This beacon may also be retransmitted by each SA, e. g. by using their neighbor lists, to cover a wider area. To use the A2A link, the SA uses also a listen-before-talk mechanism (e.g. CSMA/CA) and transmits only when the medium is free.

[0083] The PU is the most complete node in a WSN and also the one that will make a more intensive use of the physical medium. Depending on the deployed topology, it may need to manage up to six types of communication: A2A links with other PUs, A2A links from SAs, A2P links to activate SPs or SAs, MBS links to read signals coming from the passive receivers SPs or SAs, provide the ether for the MBS links, or long links using a PU's bridge module (B). The medium access in a PU is also preferably based on a listen-before-talk mechanism (e.g. CSMA/CA), similar to the one used in the SAs nodes.

[0084] Each PU in a WSN is responsible for polling (interrogating) all the SPs and SAs within its aura 432. During this polling procedure the PU must synchronize the utilization of its active transmitter (aTx), active receiver (aRx) and electromagnetic field generator (ether provider). The PU divides the polling time into two phases (see Fig. 4-8):

1. Selection phase (reference number 484): In this phase the PU generates the wake-up signals for the nodes it wants to interrogate. The PU may select all the nodes in its aura 432 (broadcast wake-up), a group of nodes sharing common characteristics (multicast wake-up) or a specific node (unicast wake-up) to answer the request.

2. Response phase (reference number 486): During this phase said PU generates an electromagnetic field (ether) to be modulated with the data from the SPs and SAs. As already mentioned above, an anti-collision algorithm (CSMA/CA) should preferably be used.

[0085] When the number of passive nodes to interrogate is high, the polling procedure uses the channel for relatively long time compared with the duration of a peer-to-peer transmission. To avoid collisions with other PUs in its vicinity, a PU transmits a beacon 482 at the beginning of the polling time (see Fig. 4-8). This beacon informs other PUs, among other things, about the duration of the polling procedure and optionally about the frequency/channel occupancy. PUs receiving the beacon will backoff for at least the polling time duration before trying to get access to the medium again. PU nodes in close vicinity may also be able to share the medium by using different radio frequencies, however, in this scenario a suitable protocol must ensure that an SP or SA node is not interrogated at the same time from two different PUs.

[0086] To illustrate how the mixed topology can be applied to a real scenario, two examples of using WSNs shall be presented in the following. The first one is a "smart bookshelf" 490 where a WSN is used to identify which books are in its shelves and even to provide some information about their positions in the bookshelf (see Fig. 4-9). The second example illustrates how a WSN deployed in a body area network (BAN) can automatically be linked to another WSN deployed in the home of the BAN's user (see Fig. 4-10).

[0087] In the smart bookshelf example a user has deployed several SAs around a bookshelf 490 that will be used as reference points to locate the SPs which are attached to the books (CDs, video tapes, etc.) in the shelves (see Fig. 4-9). Moreover, a PU needs to be part of the scenario and located close enough to the bookshelf 490 such that the latter is at least inside the PU's aura (ether range) 432. The PU may operate in the following way:

1. First, The PU polls all the nodes within its aura 432 and identifies and classifies the nodes as SAs and SPs, respectively.

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2. Afterwards, the PU individually scans a first SA by requesting it to send short-range wake-up signals to the SPs in its vicinity. The PU then generates the ether and reads the data backscattered from all SPs woken up by the respective SA.

3. This procedure is then repeated for every SA detected in step 1.

4. After some data processing, the PU can provide information about which SPs are in the booksheif and close to which SAs they are.

[0088] By this procedure the system is able to detect objects on the shelf in step (1) and subsequently detect proximity relationships between the objects in steps (2) to (4).

[0089] Alternatively, the procedure can be stopped after step (1) if the observer is only interested in whether a desired media is located at the shelf at all and does not need any further fine-grained proximity information.

[0090] The problem outlined in Fig. 4-10 is how to link two parts of the same WSN: a WSN home network 493 and a "take-away WSN" or BAN 494. This link is automatically established when a user enters his/her home and walks close to some SA or PU nodes of the WSN home network 493. From the network point of view there is no difference between these two versions of a WSN.

[0091] The main advantageous differences of the proposed approach according to the present invention can be summarized as follows:

[0092] The invention provides an integrated network topology for wireless networks, especially for high-density wireless sensor networks with heterogeneous node classes. It thereby allows different types of wireless nodes to be integrated in the network (simple and/or complex, low-power and/or medium-power nodes). Furthermore, the invention provides a specific radio technology based on the usage of active and passive transmitters and receivers for different types of nodes and communication links within the network, thereby using the principle of "always-on" receivers in selected nodes of the network in order to simplify radio and protocol complexity in each of the nodes and in the entire network. Finally, a unique wake-up signaling scheme is provided to activate nodes or a single node when required, e. g. for requesting data from the activated node or indicating a need to send data to the activated node.

[0093] The overall network topology, different node classes with different radio technologies employed, enabling different communication links/features and the unique wake-up signaling scheme (for stepwise node receiver activation) allow the deployment of high-density heterogeneous wireless networks in a wide variety of new application areas (including sensor network applications).

Terms and Definitions	
Active Receiver (aRx)	A node having a down-conversion chain for demodulating received RF signals.
Active Transmitter (aTx)	A node employing a wireless transmission technique, thereby generating and modulating RF signals for conveying information to one or a multiplicity of other nodes within a wireless network.
Carrier	A radio frequency (RF) signal generated by a PU unit to transmit energy to the SP/SA and retrieve data from a node.
CSMA	CSMA (Carrier-Sense Multiple Access) is a radio access scheme where the occupancy of the carrier is measured and detected before utilization of the medium to reduce the probability of collisions and subsequent data loss or need for data re-transmission.
MBS	MBS (Modulated Backscatter) is a radio transmission technology wherein a node is modulating a radio carrier provided by another node. Instead of creating radio energy, the information-emitting node modulates externally provided radio energy (by modulating an electromagnetic field).
Passive Receiver (pRx)	A node equipped with a detecting means that does not require an active conventional radio down-conversion chain, thus consuming almost no power. For wake-up whistle reception preferably a diode detector can be utilized whose detection sensitivity and selectivity are limited.
Passive Transmitter (pTx)	A node equipped with a radio interface capable of modulating an external electromagnetic field which provides a modulated reflection of a radio wave, thus conveying information to a remote node (or multiple remote nodes).

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(continued)

Terms and Definitions	
Reader (RFID)	A microcontroller-based unit with a wound output coil, peak detector hardware, comparators, and firmware designed to transmit energy to a tag and read information back from it by detecting the backscatter modulation, which is limited to operation at 13.56 MHz. By contrast, the proposed system is operated at 2.4 GHz, uses a planar antenna instead of a coil and a modulation scheme suitable for MBS (e.g. DPSK-OOK).
RFID Tag	An RFID device incorporating a memory chip (usually with an on-board rectification bridge and other RF front-end devices), a wound or printed input/output coil, and (at lower frequencies) a tuning capacitor.

Claims

1. A remote polling and control system in a heterogeneous wireless data transmission network for communication between a variety of wireless nodes (PUs, SAs and/or SPs) interconnected via said network,
characterized by
control means (PU) for polling (S1b) data from remotely accessible nodes (SPs) of a first type located in said network and/or remotely controlling (S1c') functions executable by remotely controllable nodes (SAs) of a second type, said nodes (SAs, SPs) being in a stand-by mode before and after being called by said control means (PU).

2. A remote polling and control system according to claim 1, wherein said communication is organized according to the master-slave principle,
characterized by
at least one master node (PU) comprising an RF transceiver (aTx and aRx) designed to

- send (S0a) a wake-up signal to at least one remote slave node (SP, SA) of a first and/or second type for polling (S0b) information detected by said slave node (SP, SA),
- send (S0c) control information for triggering a function to be executed by at least one remotely controllable slave node (SA) of said second type, and
- receive (S0d) feedback information from said slave nodes (SA and/or SP).

3. A remote polling and control system according to anyone of the claims 1 or 2,
characterized in that
said network (WSN) is configured in a meshed, star or hybrid star and meshed topology.

4. A remote polling and control system according to claim 3, said network (WSN) having a meshed topology for a peer-to-peer-based ad-hoc communication between wireless nodes (PU, SA, SP),
characterized by
a CSMA-based MAC protocol for guaranteeing collision avoidance when different nodes (PUs, SAs and/or SPs) are trying to simultaneously transmit data.

5. A remote polling and control system according to claim 2,
characterized in that
the remote slave node (SP) of said first type comprises

- receiving means (pRx) for wirelessly receiving (S2a) a wake-up signal indicating a need for transmitting a polling request message from said master node (PU) to said slave node (SP),
- transmitting means (pTx) for wirelessly transmitting (S2b) sensor data or requested status information to said master node (PU) upon reception of said polling request message by backscattering an RF signal obtained by modulating an electromagnetic field provided by said master node (PU) or any other node with an encoded signal representing said status information, and
- processing means for processing (S2c) and creating (S2c') dynamic data.

6. A remote polling and control system according to claim 2,
characterized in that

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the remotely controllable node (SA) of said second type comprises

- receiving means (pRx) for wirelessly receiving (S3a) a wake-up and remote control signal from the master node (PU) or another node of said second type (SA),
- optional sensor elements (SSA) for detecting (S3b) operational parameters of said slave node (SA) and/or environmental data and/or remotely controllable actuator elements (ASA) for executing (S3c) programmable actions,
- processing means for executing (S3d) a remotely controllable application running on said node (SA) for monitoring (S3e) and gathering (S3e') sensor data detected by said sensor elements (SSA) and/or controlling (S3e") said actuator elements (ASA), and
- transmitting means (aTx) for wirelessly transmitting (S3f) information from said application to said master node (PU) upon reception of said wake-up and remote control signal.

7. A remote polling and control system according to claim 2, 5 or 6,
characterized by
said remotely controllable slave node (SA) of said second type additionally comprises
transmitting means (pTx) for wirelessly transmitting (S3g) data or requested status information upon reception of a polling request message from a further node (SA') by backscattering an RF signal obtained by modulating an electromagnetic field provided by said master node (PU) or any other node with an encoded signal representing said status information to said further node (SA') when being operated in a mobile ad-hoc network having a meshed topology and communicating with said further node (SA') on a peer-to-peer basis.

8. A remote polling and control system according to anyone of the claims 2 or 5 to 7,
characterized in that
said master node (PU) is connected to a bridge (B) providing a wireless or wired communication link to at least one other master module (PU').

9. A method for enabling at least one master node (PU) of a remote polling and control system (430, 450, 460 or 470) in a heterogeneous wireless network according to anyone of the claims 2 to 8 to remotely control at least one slave node (SA, SP),
characterized in that
said master node (PU) performs the steps of

- transmitting (S1a) a wake-up and control signal for polling (S1b) sensor data detected and/or data created and/or processed by a remotely accessible slave node (SP) of a first type located in the range of said master node (PU) or any other node providing an electromagnetic field to be modulated by said slave node (SP) and/or
- remotely activating (S1c), controlling (S1c') and/or deactivating (S1c") functions executable by a slave node (SA) of a second type, said slave nodes (SA, SP) being in a stand-by mode before and after being called by the master node (PU).

10. A method according to claim 9,
characterized in that
the slave node (SP) of said first type performs the steps of

- wirelessly receiving (S2a) a wake-up signal indicating a need for transmitting a polling request message from said master node (PU) to said slave node (SP),
- wirelessly transmitting (S2b) data or requested status information to said master node (PU) upon reception of said polling request message by backscattering an RF signal obtained by modulating an electromagnetic field provided by said master node (PU) or any other node with an encoded signal representing said status information, and
- executing (S2c) commands upon reception of a wake-up and control message.

11. A method according to anyone of the claims 9 or 10,
characterized in that
the slave node (SA) of said second type performs the steps of

- wirelessly receiving (S3a) digitally encoded polling and/or control information from said master node (109),
- after having detected (S3a') a valid identification code of said master node (PU) in the header of the received

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polling and/or control information, executing (S3d) a remotely controllable application running on said slave node (SA) for monitoring (S3e) and gathering (S3e') operational parameters of said slave node (SA) and/or environmental data detected by sensor elements (SSA) connected to said slave node (SA), in the following referred to as "status information", and/or controlling (S3e") actuator elements (ASA) controllable by said slave node (SA), and

- wirelessly transmitting (S3f) a digitally encoded version of said status information as a feedback signal to said master node (PU).

12. A method according to anyone of the claims 9 or 10,
characterized in that
the slave node (SA) of said second type performs the steps:

- while not being in vicinity of a master node (PU), wirelessly transmitting (S3f) feedback information from an application running on said slave node (SA) to a further node (SA') upon reception of a wake-up and/or remote control signal from said further node (SA') and,
- while being in vicinity of a master node (PU), wirelessly transmitting (S3g) data or requested status information upon reception of a polling request message from the master node (PU) by backscattering an RF signal obtained by modulating an electromagnetic field provided by said master node (PU) or any other node in said network with an encoded signal representing said status information to said master node (PU).

13. Use of a remote polling and control system according to anyone of the claims 1 to 8 for controlling applications running on nodes of a wireless sensor network (WSN).

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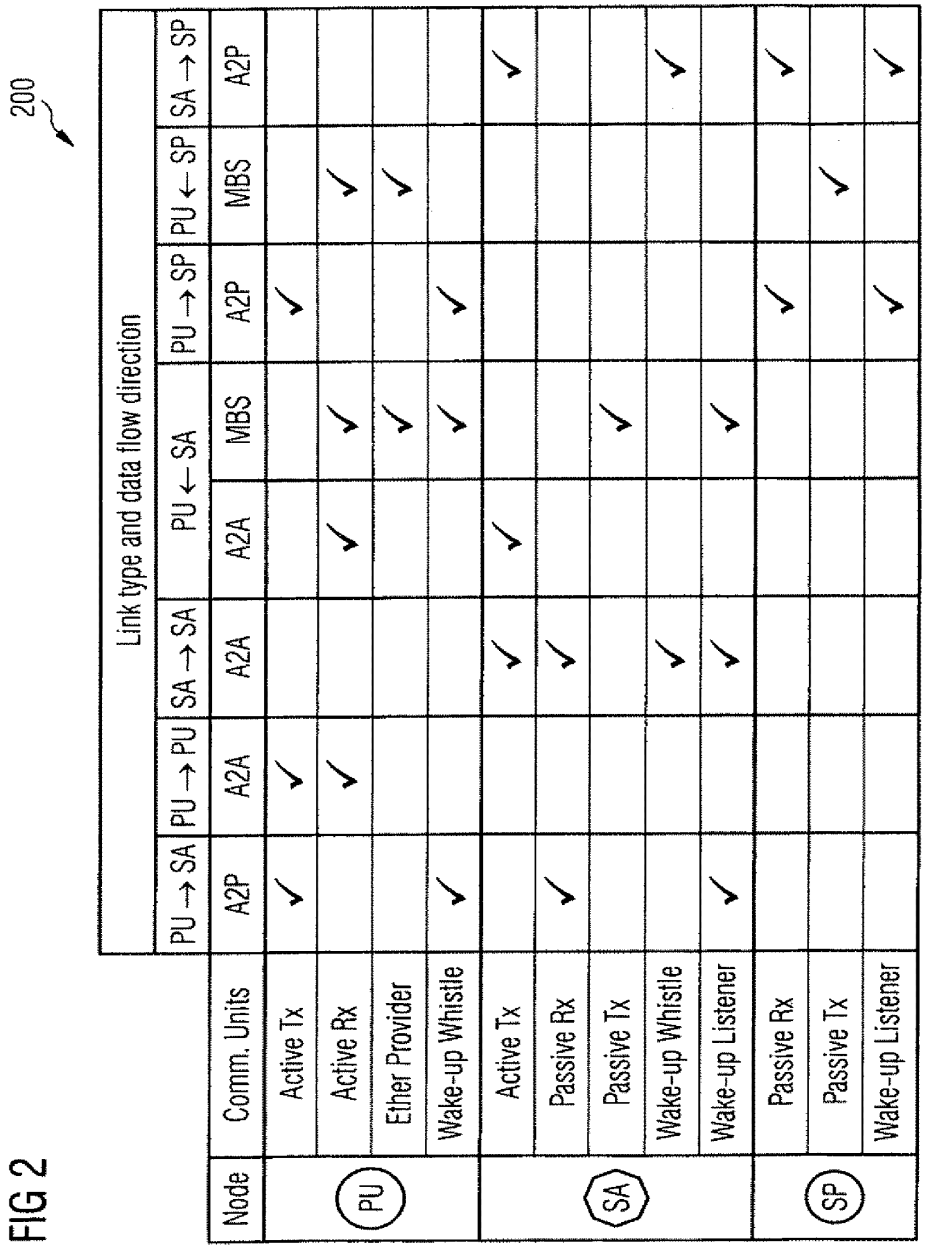
FIG 1



Symbol	Name	Description
	A2A Link	Medium-range communication (< 5 meters) that requires an active transmitter and an active receiver.
	A2P Link	Short-range communication (< 3 meters) that requires an active transmitter and a passive receiver (diode detector). The wake-up signals to activate a SP or SA node are transmitted in this link before the data.
	MBS Link	Short-range communication that requires an active transmitter (to provide the Ether), a passive transmitter (MBS) and an active receiver.
	Ether	Electromagnetic field generated by a PU to provide the signal necessary to be used by the passive transmitters (MBS).
	Long Link	Long-range communication (> 5 meters) that links Polling Units by using a Bridge.

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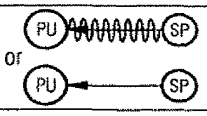
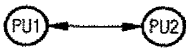
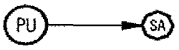
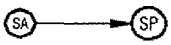
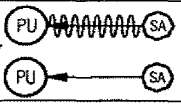
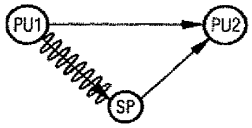
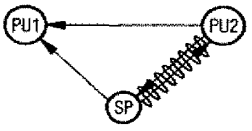
FIG 2



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FIG 3

300

Link	Range	Type of Data	Communication Units	Graphical Representation
PU→SP (A2P)	Short	Configuration and operation data. Activation messages (wake up).	PU: Active Tx PU: Wake-up Wh. SP: Passive Rx SP: Wake-up L.	
PU←SP (MBS)	Short	Sensor data. Identification data.	PU: Ether provider PU: Active Rx SP: Passive Tx	
PU↔PU (A2A)	Medium	Network management messages. Sensor data.	PU: Active Tx PU: Active Rx	
PU→SA (A2P)	Short	Configuration and operation data. Activation messages (wake up). Sensor data	PU: Active Tx PU: Wake-up W. SA: Passive Rx SA: Wake-up L.	
SA↔SA (A2P)	Short	Activation messages (wake up). Sensor data.	SA1: Active Tx SA1: Wake-up W. SA2: Passive Rx SA2: Wake-up L.	
SA→SP (A2P)	Short	Configuration and operation data. Activation messages (wake up).	SA: Active Tx SA: Wake-up W. SP: Passive Rx SP: Wake-up L.	
SA→PU (A2A)	Medium	Sensor data. Identifikacion data.	SA: Active Tx PU: Active Rx	
SA→PU (MBS)	Short	Sensor data. Identifikacion data.	PU: Ether provider PU: Active Rx SA: Passive Tx	
SP→PU (MBS)	Short	Sensor data. Identifikacion data.	PU: Wake-up W. PU1: Ether provider PU2: Active Rx PU1: Active Tx SP: Passive Rx SP: Wake-up L. SP: Passive Tx	
SP→PU (MBS)	Short	Sensor data. Identifikacion data.	PU2: Wake-up W. PU2: Ether provider PU2: Active Rx PU2: Active Tx PU1: Active Rx SP: Passive Rx SP: Wake-up L. SP: Passive Tx	

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FIG 4-1

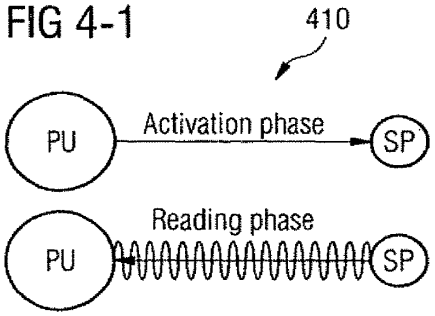

410
PU
Activation phase
SP
Reading phase
PU
SP

FIG 4-2

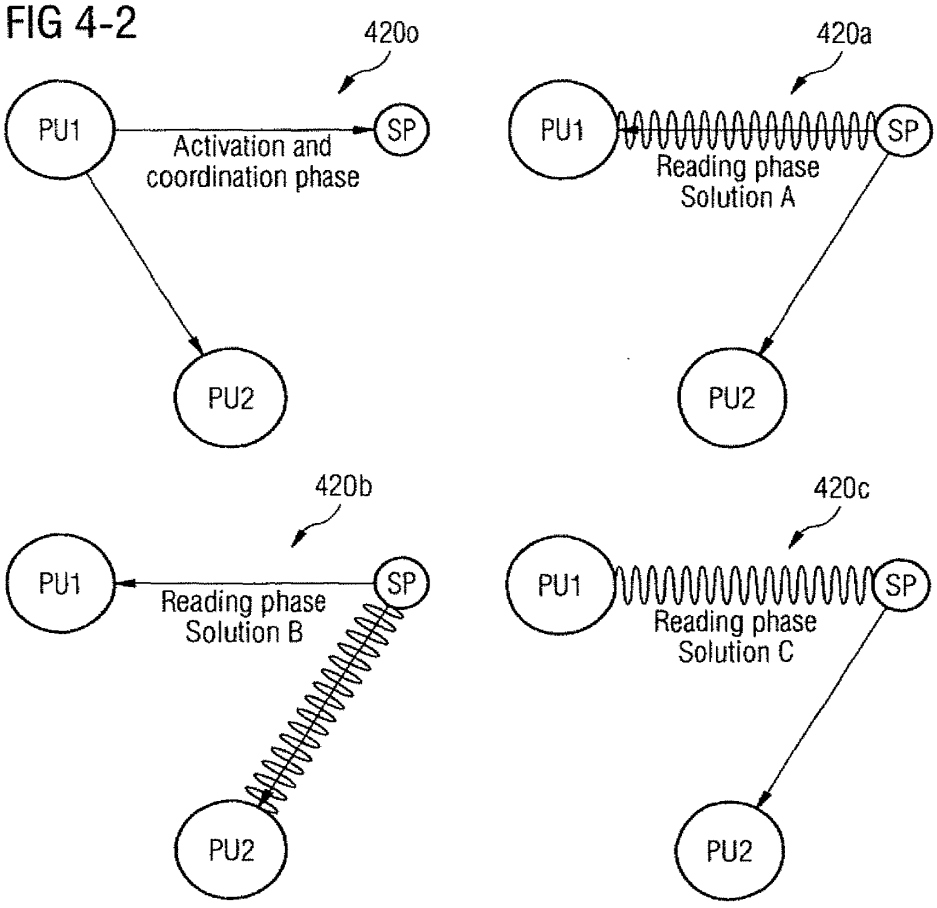

420o
PU1
Activation and
coordination phase
SP
PU2
420a
PU1
Reading phase
Solution A
SP
PU2
420b
PU1
Reading phase
Solution B
SP
PU2
420c
PU1
Reading phase
Solution C
SP
PU2

FIG 4-3

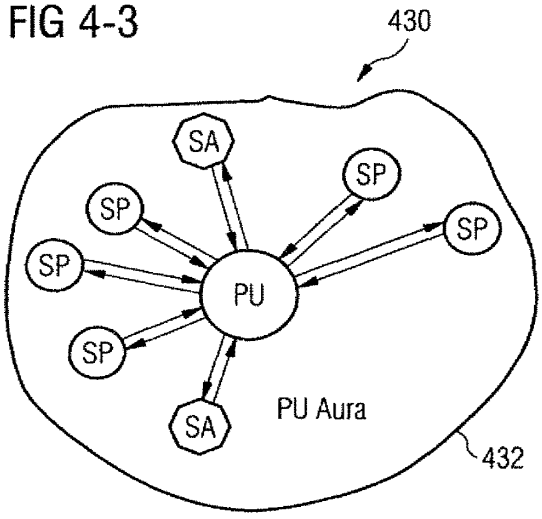
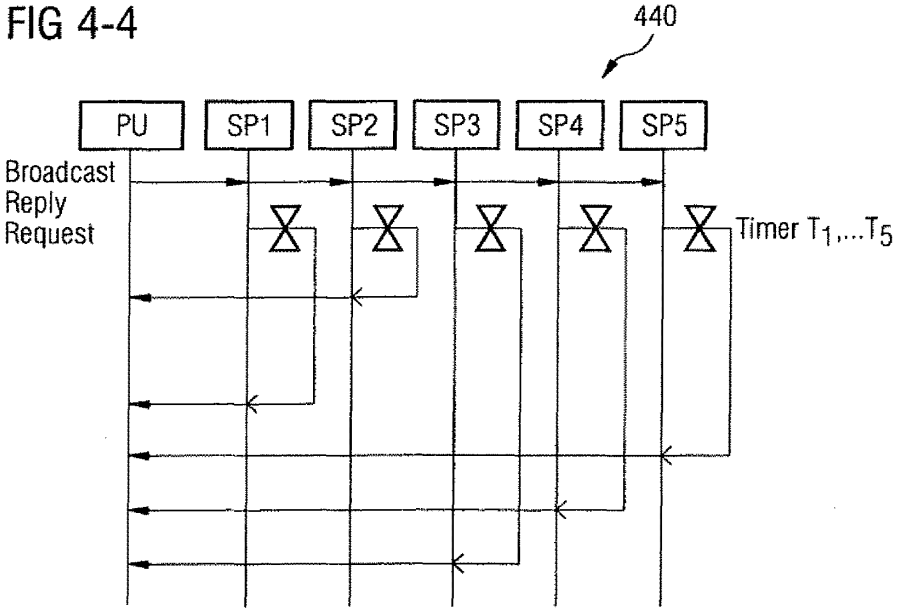


FIG 4-4



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FIG 4-5

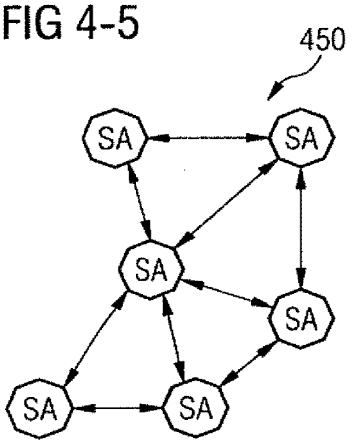

450
SA
SA
SA
SA
SA
SA

FIG 4-6

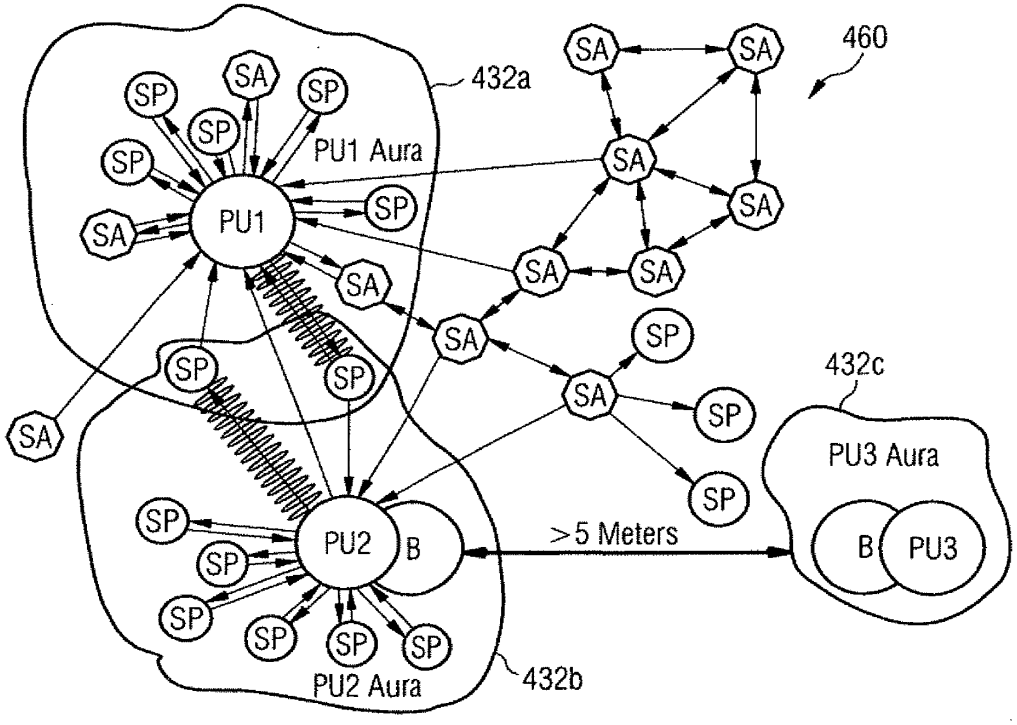

460
432a
PU1 Aura
PU1
SP
SA
PU2
B
>5 Meters
PU2 Aura
432b
432c
PU3 Aura
B
PU3

FIG 4-7

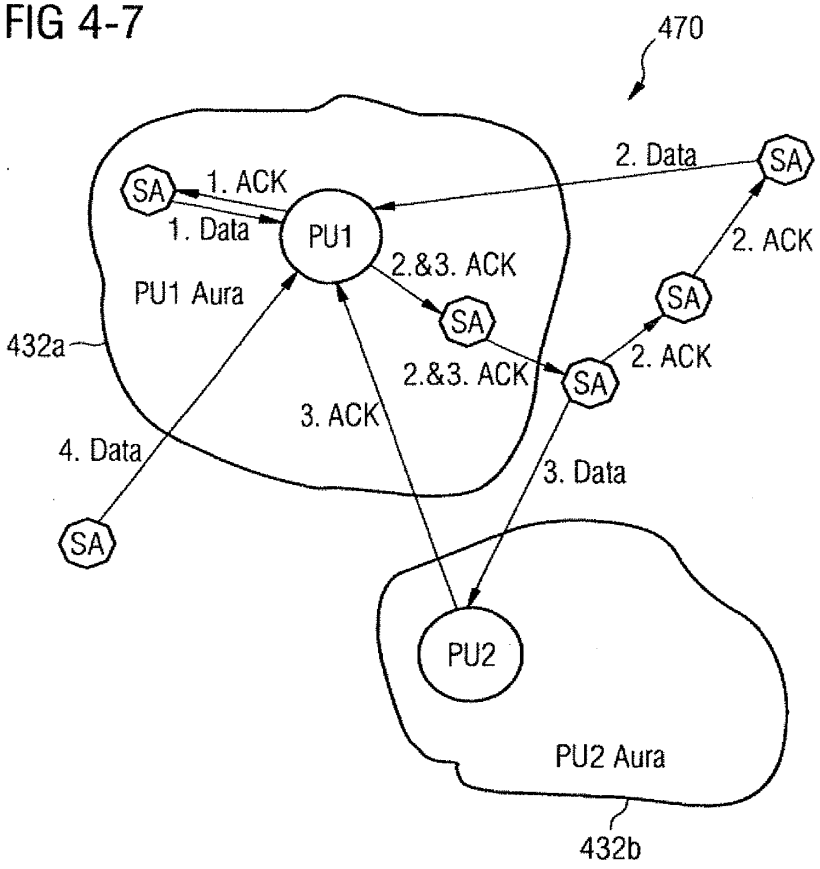
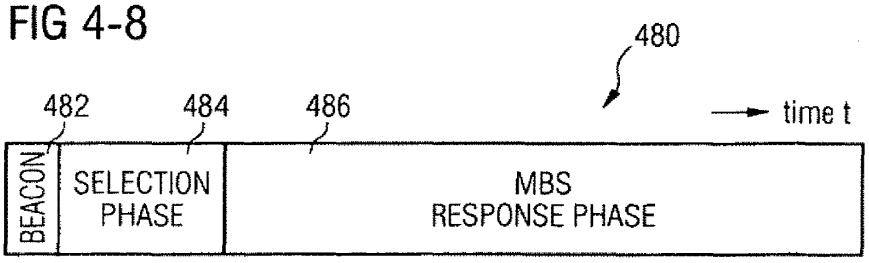


FIG 4-8



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FIG 4-9

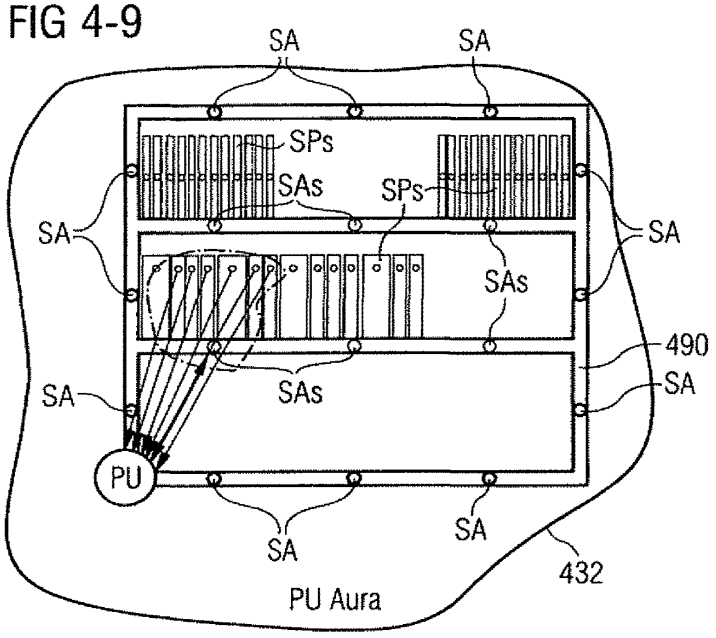
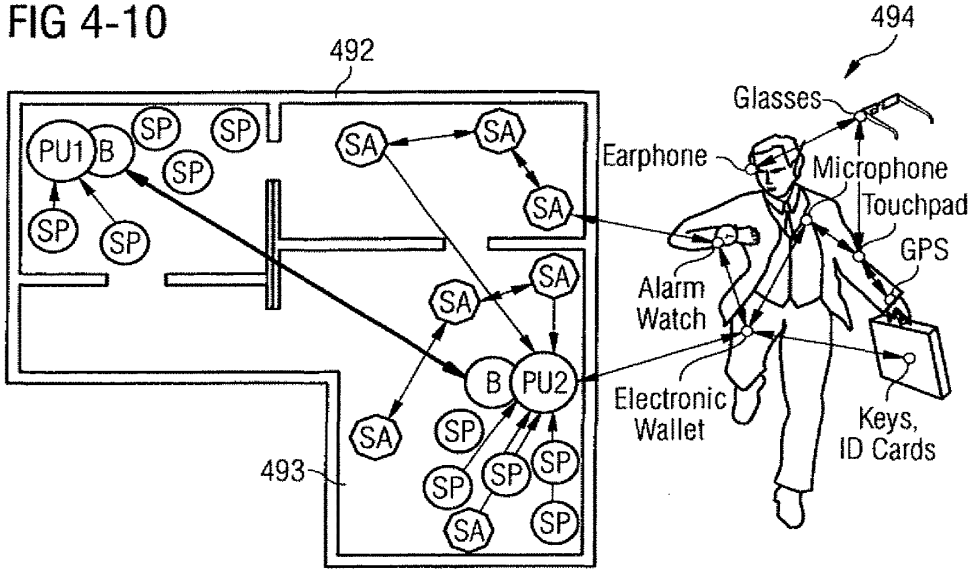


FIG 4-10



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FIG 5-1

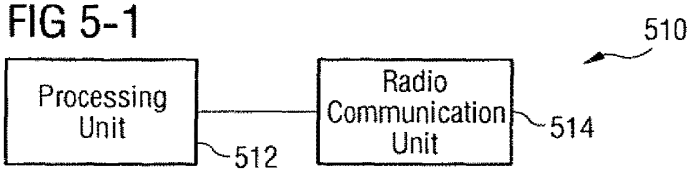


FIG 5-2

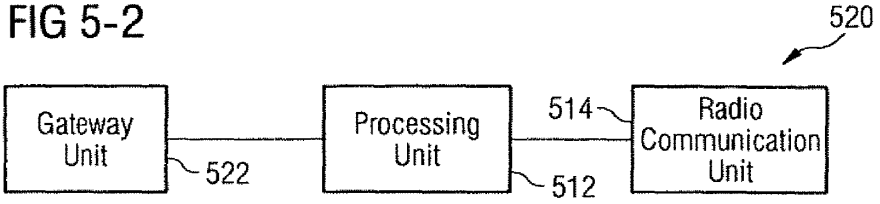
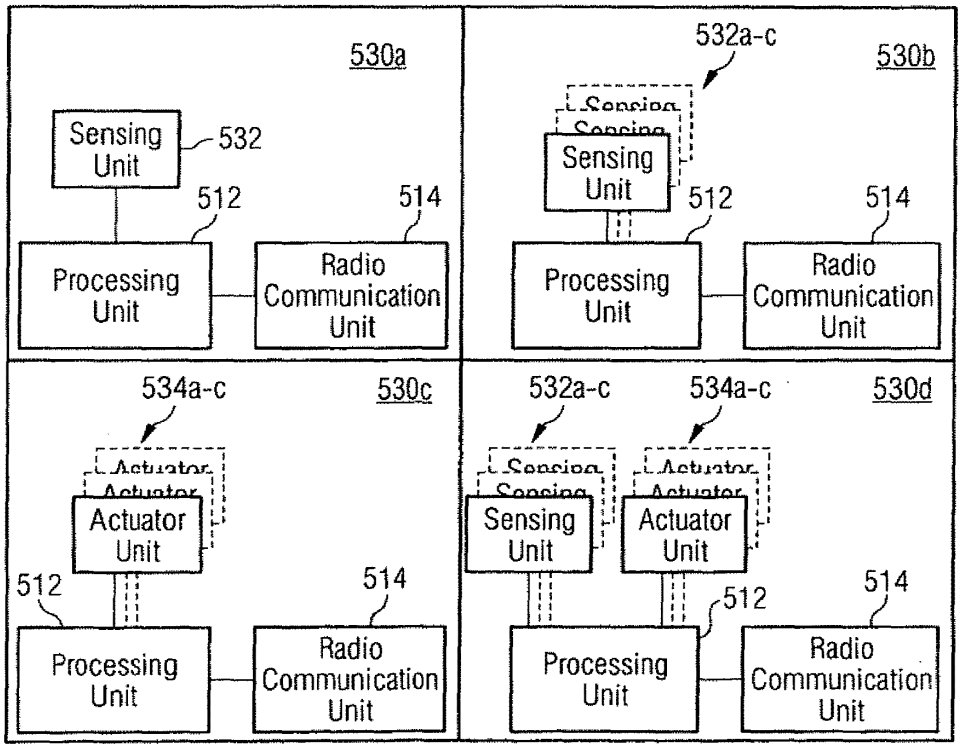


FIG 5-3



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FIG 5-4

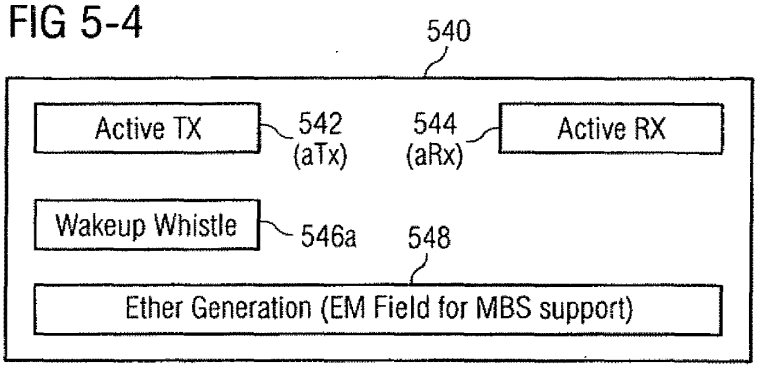


FIG 5-5

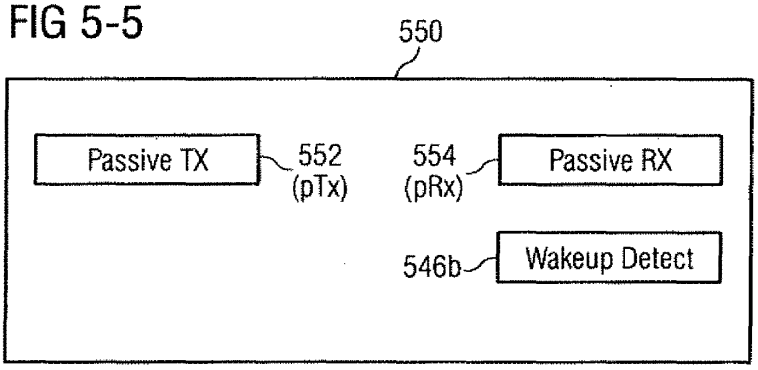
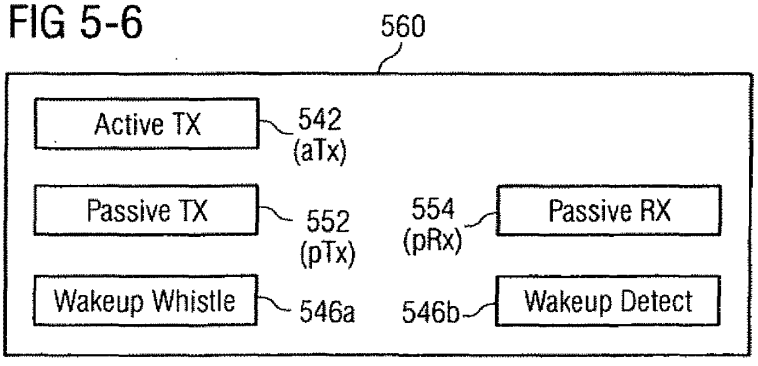


FIG 5-6



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FIG 5-7


570
Wake-Up
ID
Data
Time

FIG 5-8

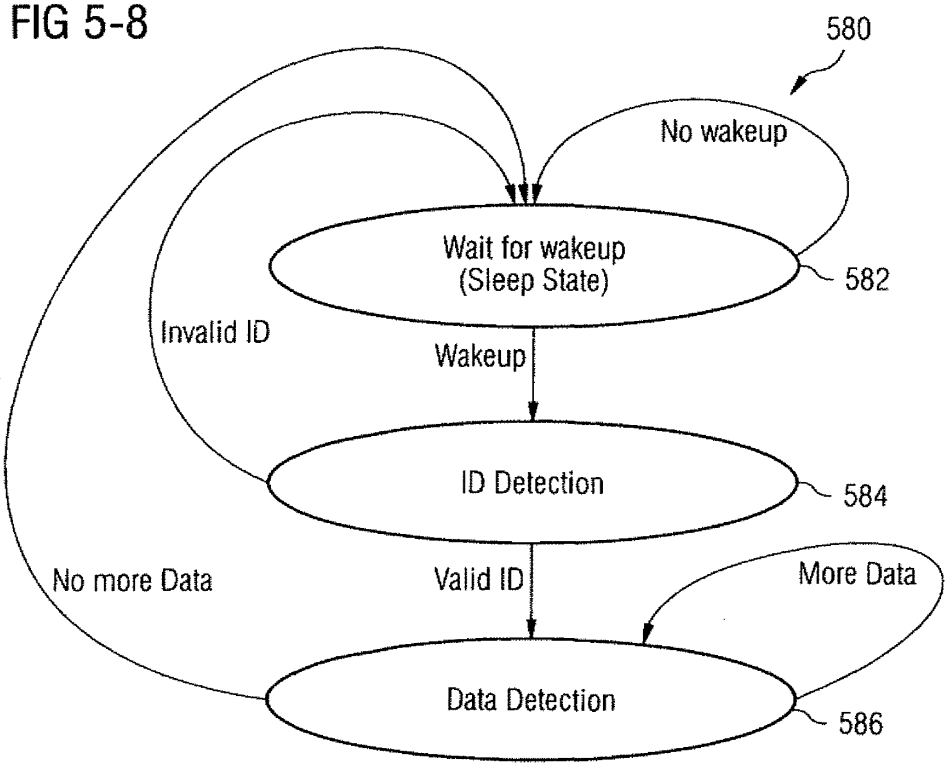

580
No wakeup
Wait for wakeup
(Sleep State)
582
Invalid ID
Wakeup
ID Detection
584
No more Data
Valid ID
More Data
Data Detection
586

FIG 6-1

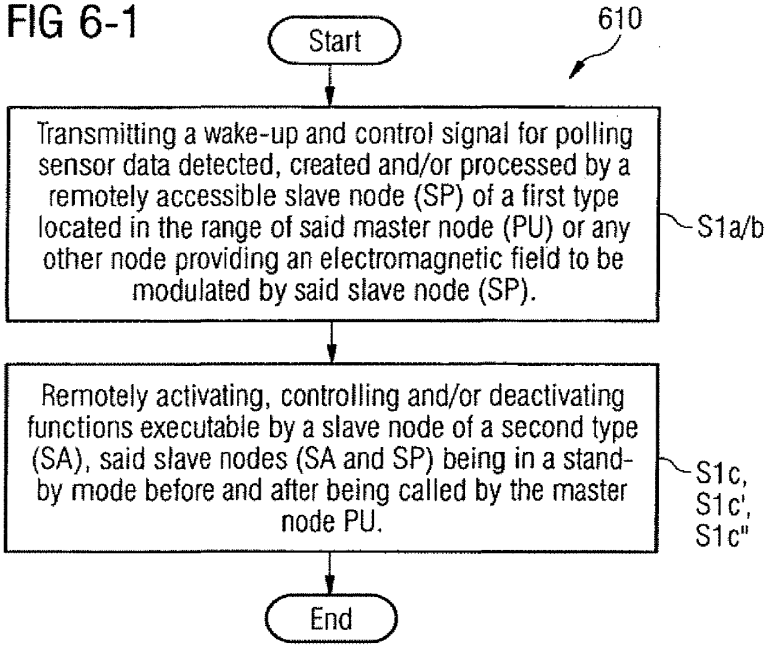
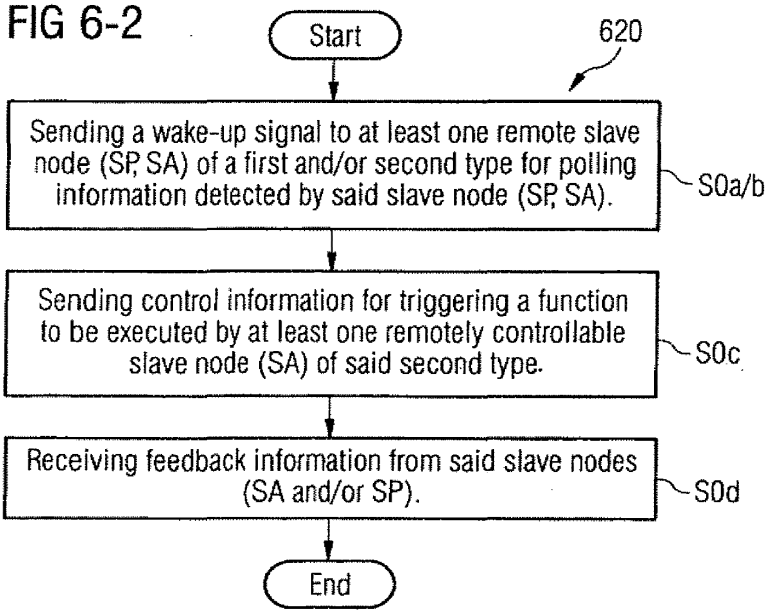


FIG 6-2



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FIG 6-3

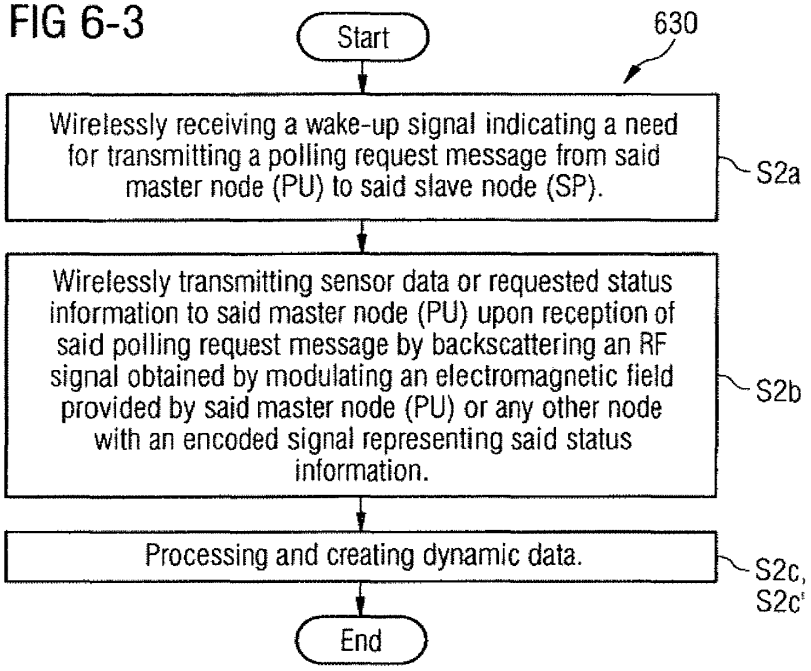
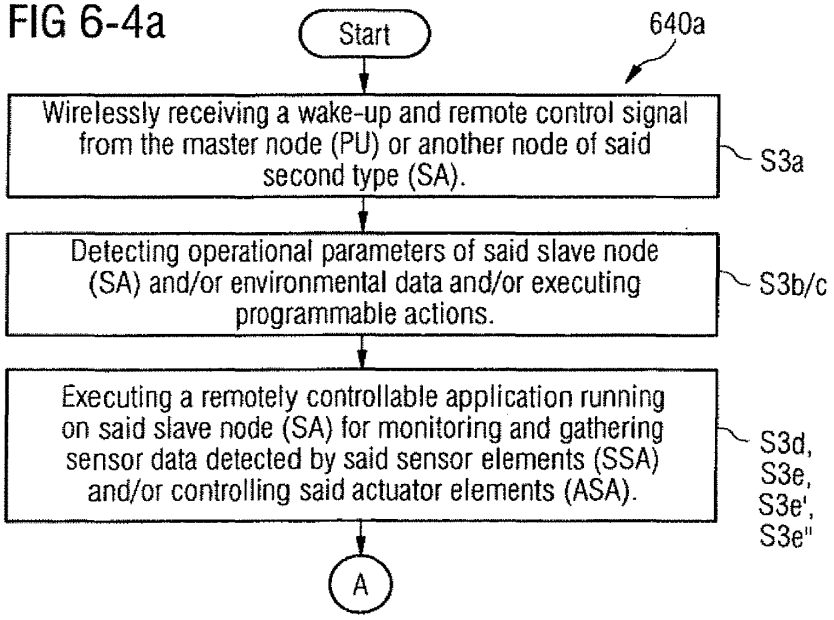
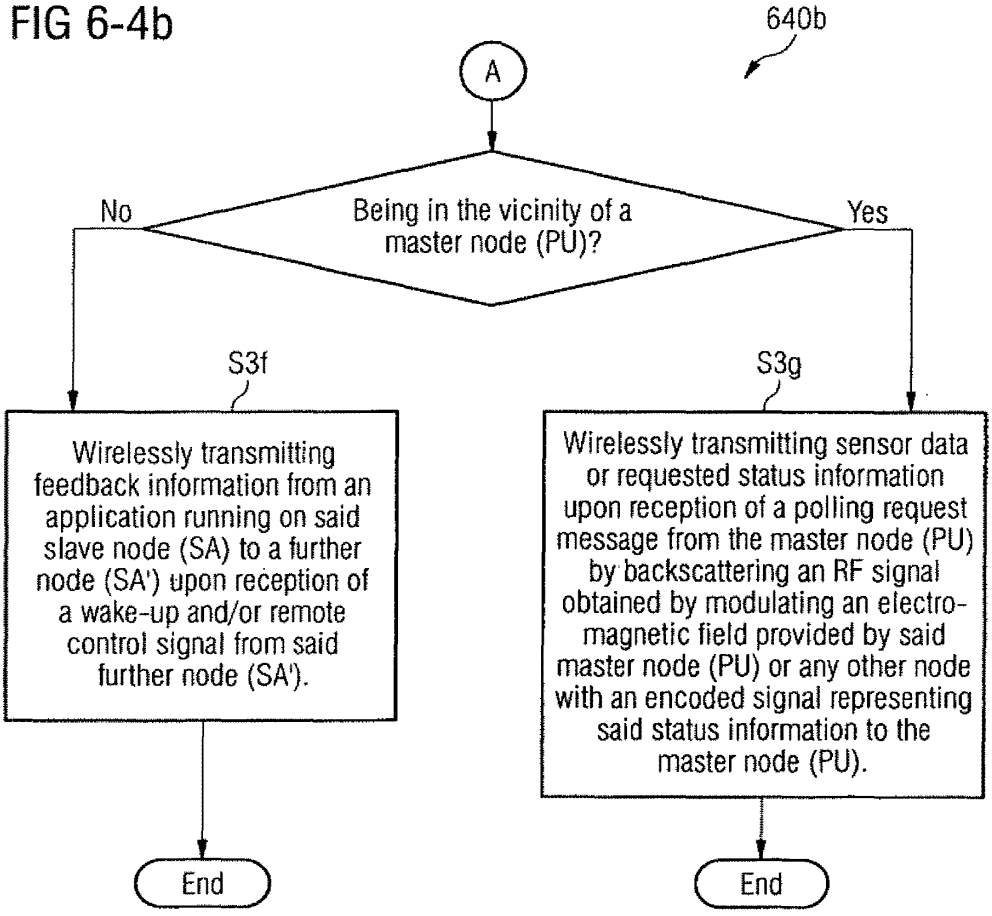


FIG 6-4a



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FIG 6-4b



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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 02 9448

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 4 685 149 A (DICKERSON BOBBY V ET AL) 4 August 1987 (1987-08-04) * abstract * * column 1, line 15 - column 3, line 43 * * column 4, line 64 - column 5, line 21 * * column 6, line 1 - line 53 * * column 7, line 16 - line 22 * * column 10, line 56 - column 11, line 43 * * column 30, line 55 - line 62 *	1-3,6,9, 11,13	H04L12/56
Y		4,5,7,10	
A		12	

X	US 2002/004370 A1 (LUTKE WOLFRAM ET AL) 10 January 2002 (2002-01-10) * paragraph '0001! - paragraph '0029! * * paragraph '0042! - paragraph '0043! * * paragraph '0056! - paragraph '0057! * * paragraph '0060! *	1-3,6,9, 13	
Y		4,5,7,10	
A		11,12	TECHNICAL FIELDS SEARCHED (Int.Cl.7)

X	US 2003/104848 A1 (BRIDEGLALL RAJ) 5 June 2003 (2003-06-05) * the whole document *	1-3,5,7, 9,10,13	H04L G08C
Y		12	
A		4,6,11	

Y	US 2003/058886 A1 (STANFORTH PETER J ET AL) 27 March 2003 (2003-03-27) * paragraph '0003! * * paragraph '0009! - paragraph '0011! *	4	
A		1,3,9	

	-/--		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	31 August 2004	Vaskimo, K

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

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EUROPEAN SEARCH REPORT

Application Number
EP 03 02 9448

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	US 2002/075940 A1 (HAARTSEN JACOBUS CORNELIS) 20 June 2002 (2002-06-20) * paragraph '0008! * * paragraph '0010! - paragraph '0011! *	4	
A		1,3,9	
Y	EP 1 220 499 A (TOKYO SHIBAURA ELECTRIC CO) 3 July 2002 (2002-07-03) * paragraph '0012! *	4	
A		1,3,9	
Y	US 5 252 979 A (NYSEN PAUL A) 12 October 1993 (1993-10-12) * column 1, line 5 - column 3, line 19 * * column 5, line 1 - line 14 * * column 6, line 20 - column 7, line 15 * * column 8, line 6 - line 17 *	5,7,10	
A		1,9,12	
Y	EP 1 246 094 A (ERICSSON TELEFON AB L M) 2 October 2002 (2002-10-02) * paragraph '0001! - paragraph '0050! * * paragraph '0060! * * claims 1,7,10,12 *	5,7,10	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A		1,9,12	
Y	WO 01/39103 A (TAGMASTER AB ; GUNNARSSON STAFFAN (SE)) 31 May 2001 (2001-05-31) * page 1, line 6 - page 2, line 32 * * page 4, line 21 - page 6, line 7 * * figure 2 *	5,7,10	
A		1,9,12	
Y	US 2003/099212 A1 (ADAMOU MARIA ET AL) 29 May 2003 (2003-05-29) * paragraph '0001! - paragraph '0013! * * paragraph '0025! - paragraph '0031! *	12	
A		1,9	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	31 August 2004	Vaskimo, K

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L : document cited for other reasons

& : member of the same patent family, corresponding document

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 02 9448

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	WO 03/077480 A (VAN VALKENBURG SANDER ; NOKIA CORP (FI)) 18 September 2003 (2003-09-18) * page 1, line 4 - page 8, line 12 * * page 9, line 12 - page 11, line 13 * * figures 2-4 *	12	
A		1,9	
Y	WO 03/025774 A (INET BLUE CORP) 27 March 2003 (2003-03-27) * page 1, line 4 - page 4, line 7 * * page 7, line 20 - page 8, line 28 *	12	
A		1,9	
A	US 2002/127970 A1 (MARTINEZ RENE D) 12 September 2002 (2002-09-12) * paragraph '0001! - paragraph '0011! * * paragraph '0016! - paragraph '0017! *	1,2,5,7, 9,10,12	
A	US 6 122 329 A (CHIEU TRIEU C ET AL) 19 September 2000 (2000-09-19) * column 1, line 16 - column 2, line 67 * * column 3, line 21 - line 63 * * claims 1,16 *	1,2,5,7, 9,10,12	TECHNICAL FIELDS SEARCHED (Int.Cl.7)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	31 August 2004	Vaskimo, K

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European Patent Office

Application Number
EP 03 02 9448

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☒ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

1-7,9-13

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

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European Patent Office

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 03 02 9448

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-4,6,9,11,13

A remote polling and control system, where a control means polls data from remote nodes, where said remotes are in stand-by mode before and after being polled, and where CSMA/CA is used.

1.1. claim: 9 and 11

A remote polling and control system, where a control means polls data from remote nodes, where said remotes are in stand-by mode before and after being polled, and where a valid identification code of the control means needs to be detected in the header of a received poll.

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2. claims: 1,2,5,7,9,10

A remote polling and control system, where a control means polls data from remote nodes, where said remotes are in stand-by mode before and after being polled, and where backscatter transmission is utilized

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3. claims: 1,2,8

A remote polling and control system, where a control means polls data from remote nodes, where said remotes are in stand-by mode before and after being polled, and where said control means is connected through a bridge to another control means.

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4. claims: 9,12

A remote polling and control system, where a control means polls data from remote nodes, where said remotes are in stand-by mode before and after being polled, and where the communication between said control means and said remotes are relayed through a further node.

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 03 02 9448

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

KOREAN PATENT ABSTRACTS

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(51)Int. Cl **G06F 19/00**

(71)Applicant: **PAK, CHAN IL**

(72)Inventor: **PAK, CHAN IL**

(54) **SYSTEM AND METHOD FOR MONITORING/CONTROLLING SENSORS AND EQUIPMENT OVER INTERNET**

(57) Abstract:

A system and method for monitoring/controlling sensors and equipment are provided to automatically reflect a homepage of a web server by exchanging input and output information with the sensors and equipment. CONSTITUTION: Client terminals(200,210,220,230) access the internet, monitor/control a sensor and equipment. Each client terminal(200,210,220,230) includes a web browser. The internet(240) is connected with the client terminals(200,210,220,230). An interface system(250) includes a web server therein. The interface system(250) dynamically monitors and controls input/output digital port using a web server. The interface system(250) includes a connector for accessing the internet(240). An information collecting terminal(260) collects and transmits data to the web server of the interface system(250). The information collecting terminal(260) includes a sensor and an actuator.

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(19) 대한민국특허청(KR)
(12) 등록특허공보(B1)

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		(11) 등록번호	10-0372788
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(21) 출원번호	10-2000-0016911	(65) 공개번호	특2001-0094543
(22) 출원일자	2000년03월31일	(43) 공개일자	2001년11월01일
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(77) 심사청구	심사관: 정준모

(54) 출원명 인터넷을 통해 각종 센서와 장비를 감시/통제할 수 있는시스템 및 그 방법

요약

본 발명은 인터넷을 통해 각종 센서와 장비를 감시/통제할 수 있는 시스템에 있어서, 인터넷망에 연결하여 센서와 장비를 감시/통제하는 웹브라우저를 내장한 클라이언트 단말기; 상기 클라이언트 단말기에 연결된 인터넷망; 자체에 웹서버를 내장하고 이 웹서버를 이용하여 디지털 입출력포트를 동적으로 웹에 의하여 감시/통제하며 상기 인터넷망에 접속하기 위한 접속부를 구비한 인터페이스 시스템; 및 센서 및 액추에이터가 장착되고 자료를 수집하여 상기 인터페이스 시스템의 웹서버로 송신하는 정보수집 단말기로 이루어진 인터넷을 통해 각종 센서와 장비를 감시/통제하는 시스템을 게시한다.

대표도

도1

색인어

인터넷, 감시/통제 시스템

명세서

도면의 간단한 설명

도 1은 본 발명의 바람직한 실시예에 관한 시스템을 도시하는 도면,

도 2는 특히 도 1중 인터넷에서 각종 센서와 장비를 감시/통제할 수 있는 인터페이스 시스템의 하드웨어적 구성을 도시한 도면,

도 3은 본 발명에 관한 인터페이스 시스템에서의 내부 시스템 구성의 블록도,

도 4은 본 발명에 관한 시스템을 이용하여 각종 장비 및 액추에이터에 대한 통제를 원격으로 제어하는 동작을 나타내는 일예를 보여주는 흐름도,

도 5는 본 발명의 일실시예에 따른 기업체 전산시스템에서 인터넷망를 통한 장비의 원격 감시/통제 방법을 도시하는 흐름도,

도 6은 본 발명의 일실시예에 따른 인터넷망에서 XML 형식을 이용한 시스템과의 자료교환 및 시스템 연계방법을 설명하는 흐름도,

도 7은 본 발명에 관한 시스템에서 웹 브라우저를 통해 가정 기기들을 감시/통제하는 실시예를 도시하는 도면,

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 인터넷 통신 환경하에서 각종 센서 및 액추에이터(동작기, actuator) 및 범용 장비를 감시하고 통제할 수 있도록 하기 위한 시스템 및 그 방법에 관한 것으로서, 특히 시스템내에 웹서버를 내장하고, 웹브라우저로 이를 제어할 수 있는 방법 그리고 기존의 응용프로그램과 연계하는 방법 및 시스템에 관한 것이다.

일반적으로 각종 센서 및 액추에이터, 범용장비를 감시하고 통제하는 분야는 공장자동화, 빌딩자동화, 원격설비관리, 무인관리 등 수많은 다양한 분야에서 응용되고 있으며, 종래에 이들은 전용 네트웍으로 연결되거나 혹은 RS232(RS485)에 준한 직렬(serial) 통신에 의해 감시,

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통제되고 또한 공장자동화 전용 프로그램에 의해 전산 관리되어 왔다. 근래에 인터넷 통신이 발달되고 있다고는 하나, 이 인터넷 통신은 주로 영업, 마케팅등 관리분야, 상거래 분야, 콘텐츠 영업분야 등에서 활용되어 각광을 받아왔다. 즉 물류, 방범, 방재, 자동화등 실생활과 직접적으로 연관된 분야는 상대적으로 소외되어 전사적 관리시스템에서조차 활용되고 있지 못하다.

이와 같은 문제점을 해결하고, 기구축된 저렴한 인터넷망을 적극 활용하는 방안으로 각종 현장에서 발생하는 실시간 자료를 표준화된 인터넷 환경에 보다 손쉽게 사용할 수 있도록 하기 위하여 인터넷의 웹서버기능을 이용하여 현장자료를 가상의 인터넷공간에서 활용할 수 있게 할 수 있으나 그 구현에 몇 가지 문제점이 있다.

우선, 인터넷 가상공간에서 정보를 교환하는 수단인 HTML 문서형식은 하이퍼텍스트 및 이미지의 전송 및 연결 위주인 정적인 문서형식으로 구성되어 있어, 실시간 자료를 표현할 수 있는 동적인 기능이 부족하여 인터넷 웹 환경하에서 동작하는 웹브라우저로 원격에서 감시 및 통제를 실시간으로 할 수 없는 제한적인 요인을 갖고 있다. 이를 해결하기 위하여, 현재의 HTML 표준 문서형식은 정보교환을 위해 CGI (Common Gateway Interface) 기능을 활용하여 원거리에서 통신장비의 설정값을 설정하는 수준의 정적이고 단순한 양방향 통신만을 지원하고 있는 것이다. 또한 이를 극복하기 위하여 Java를 이용하는 경우에는 내장(Embeded) 장비내에 자바 가상기계(Java virtual machine)가 내장되어 있어야 하며, 또한 특정 운영체제에 있는 기능을 활용하여 동적으로(Dynamic) 구성하는 방법은 내장 장비안에 특정 운영체제를 지원하여야 하는 범용시스템의 기능을 필요로 할 뿐 아니라, 표준화에서도 문제가 되어 인터넷 가상공간에 존재하는 다양한 브라우저 환경에서 사용할 수가 없는 것이다.

인터넷 기술의 급속한 발전이 콘텐츠, 경영관리 및 상거래 위주로 우선 적용발전되어, 현장 자료의 수집에 대한 부분이 상대적으로 소외되고 있으며, 기업체의 관리프로그램인 인터넷 환경의 전사적 관리시스템 등에서 이들 자료의 수집, 저장 및 분석을 위한 연계방법이 절대적으로 필요할 것이다. 이와 같이 인터넷 환경하에서 현장자료를 수집하기 위하여서는 앞에서 언급한 웹서버의 홈페이지 기능만으로는 복잡한 기업체 관리시스템에서 사용하기에는 기능이 제한적일 수 밖에 없기 때문에, 분산처리 구조에 기반한 중간계층(Middle Layer)에 의한 실시간 자료의 입출력을 통제하는 기능도 필요하다.

즉, 장비를 활용하여 사람이 관여된 자료와 관여되지 않은 자료를 인터넷 상에서 웹브라우저로 활용할 수 있고, 또한 기업체의 인터넷 연결 웹 베이스 프로그램에서 이들 자료를 데이타베이스에 저장할 수도 있고 이를 분석할 수 있는 기능에 대한 방법은 아직 정립이 된 적이 없다. 여기에 더불어 각종 센서 디바이스, 액추에이터 디바이스, 범용장비 등과 직렬 케이블을 이용한 자료 전송, 무선을 이용한 자료 전송, 적외선을 이용한 자료 전송, 전력선을 이용한 자료들의 자료 전송 방법을 활용하여 장비까지 전송한 후 이를 표준화된 인터넷의 웹환경에서 거리와 시간의 제한을 극복하고 활용할 수 있게 하는 방법은 절대적으로 필요하다고 하겠으며 장비와 인터넷의 연결에 있어서도 기존의 전용 케이블을 활용한 연결과 더불어 근거리 연결에 있어서 무선에 의한 연결, 전력선을 이용한 연결, 적외선을 이용한 연결도 필요하다.

각종 센서의 감시 및 통제분야에 동한히 됨으로써, 이의 운영에 대한 방법이 절대적으로 필요할 것이며, 이를 인터넷의 웹서버기능을 이용하여 웹서버가 HTML 파일 서버로만 동작되기 보다는 더불어 각종 센서 및 감시장치의 자료 서버 및 통제 서버로서 활용될 수 있도록 하는 기술이 무엇보다도 절대적이라고 하겠다.

발명이 이루고자 하는 기술적 과제

따라서 본 발명은 상기와 같은 요망에 따라 안출된 것으로서, 인터넷의 기 구축된 네트웍망을 적극 활용하고, 보급 확산에 따른 저렴한 관련장비를 적극 활용하기 위하여 장비에 인터넷 웹서버기능을 제공하고 이를 이용하여 다양한 입력장치(디지털 입력, 아나로그 입력, RS232c-RS485에 준하는 직력 입출력, 무선 단말기 입출력(BlueTooth), 적외선 입출력(적외선 리모콘, irda))등을 감시/통제하며 또한 다양한 장비 및 근거리의 센서 기기와 입출력에 의한 정보교환을 함으로써 자동적으로 웹서버의 홈페이지에 반영할 수 있는 시스템과 이를 이용하여 다양한 장비 및 근거리의 센서 기기들을 제어할 수 있는 시스템을 제공하는데 본 발명의 목적이 있다.

또한, 본 발명의 목적은 무선 입출력 및 적외선 입출력 장치에 시리얼 포트 및 각종 센서를 추가적으로 부착함으로써 개발장비와 입출력 기기간에 케이블을 삭제할 수 있으며, 또한 무선입출력 및 적외선 입출력 장치에 고유의 식별자(ID)를 부여함으로서, 기기 상호간의 간섭을 배제하고 정확히 통제를 가능하도록 하는 데 있다.

또한 본 발명의 목적은 다양한 전송매체로부터 수집된 각종 자료를 자동적으로 장비에 있는 웹서버의 홈페이지에 반영하여 웹브라우저로 간단히 상황을 감시할 수 있으며 또한 장비의 홈페이지에 있는 Java Applet을 이용하여 웹브라우저에서 실시간으로 다이나믹하게 감시 및 통제가 가능하도록 하는 것이다.

또한 본 발명의 목적은 웹서버 기능과 별도로 원거리에서 인터넷망을 이용하여 정보를 수집할 수 있도록 장비에서 자료를 인터넷에 입출력 서비스할 수 있는 미들웨어 혹은 중간계층(middle layer)을 삽입하여 이를 이용하여 응용 프로그램에서 네트웍의 전문적인 지식 없이 간편히 장비의 정보를 수집하고 저장하며 분석할 수 있는 다양한 환경의 개발 라이브러리를 제공하는 시스템을 제공함에 있다.

발명의 구성 및 작용

이하, 본 발명의 바람직한 실시예를 상세히 기술하기로 한다.

본 발명은 인터넷을 통해 각종 센서와 장비를 감시/통제할 수 있는 시스템에 있어서, 인터넷망에 연결하여 센서와 장비를 감시/통제하며 웹브라우저를 내장한 클라이언트 단말기; 상기 클라이언트 단말기에 연결된 인터넷망; 자체에 웹서버를 내장하고 이 웹서버를 이용하여 디지털 입출력포트를 동적으로 웹에 의하여 감시/통제하며 상기 인터넷망에 접속하기 위한 접속부를 구비하며, 센서 및 액추에이터가 장착되거나 시리얼포트가 내장된 무선단말기와 통신하여 자료를 수집하고 제어하는 무선송수신장치가 구비되고, 센서 및 액추에이터가 장착되거나 시리얼포트가 내장된 적외선 단말기와 통신하여 자료를 수집하고 제어하는 적외선 포트가 구비되며, 센서 및 액추에이터가 장착되거나 시리얼포트가 내장된 전력선 단말기와 통신하여 센서, 액추에이터 및 시리얼포트를 동작시키고 이를 상기 웹서버와 연계시키는 전력선 포트가 구비되며, 자료를 수집하고 제어하는 디지털 입출력포트가 구비되며, 사용자가 원격으로 센서, 액추에이터 및 장비를 분산처리하는 것이

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가능하고 웹페이지를 구성하여 저장과 변경이 가능하도록 Java 언어를 사용하여 실시간으로 상황을 감시할 수 있는 마들웨어의 정보서버 및 FTP서버를 내장하고 있는 인터페이스 시스템; 및 센서 및 액추에이터가 장착되고 자료를 수집하여 상기 인터페이스 시스템의 웹서버로 송신하는 정보수집 단말기로 이루어진 것을 특징으로 하는 인터넷을 통해 각종 센서와 장비를 감시/통제하는 시스템이 제공된다.

도 1은 본 발명의 바람직한 실시예에 관한 시스템을 도시하는 도면이며, 도 2는 특히 도 1중 인터넷에서 각종 센서와 장비를 감시/통제할 수 있는 인터페이스 시스템의 하드웨워적 구성을 나타낸 것이다.

도 1에서 알 수 있는 바와 같이, 본 발명은 웹브라우저를 내장한 클라이언트 단말기(200, 210, 220, 230)가 인터넷망(240)에 연결되어 실질적으로 센서와 장비를 감시/통제한다. 그리고 인터페이스 시스템(250)이 자체에 웹서버를 내장하고 이 웹서버를 이용하여 디지털 입출력포트를 동적으로 웹에 의하여 감시/통제하게 된다. 물론 이 인터페이스 시스템(250)은 상기 인터넷망(240)에 접속하기 위한 접속부를 구비한다. 그리고 각종 PLC 등과 같이 센서 및 액추에이터가 장착되고 자료를 수집하여 상기 인터페이스 시스템의 웹서버로 송신하는 정보수집 단말기(260)가 구성된다.

도 2에서 알 수 있는 상기 인터페이스 시스템(250)은 랜 혹은 다양한 모뎀(ADSL, cable 모뎀) 혹은 직렬 포트(PPP)를 이용하여 인터넷망에 연결되는 인터넷 접속부(1)가 구비된다. 또한 도면에서 알 수 있듯이 이 인터페이스 시스템에는 디지털, 아날로그 입력포트(2, 2'), 디지털, 아날로그 출력포트(3, 3'), 무선 포트(4), 적외선 포트(5), 전력선 포트(6), 직렬 포트(7)등이 있으며 이하 이들의 역할에 대해 서술하기로 한다.

디지탈 입력 포트(2)는 각종 디지탈 센서를 연결하여 자료의 수집 및 감시작업을 수행하고 현재의 상태를 시스템으로 전달하는 역할을 한다.

디지탈 출력 포트(2')는 각종 액추에이터를 연결하여 시스템의 명령에 따라 동작을 수행하는 역할을 한다.

아날로그 입력 포트(3)는 아날로그 신호를 발생하여 관련된 액추에이터를 조종하는 역할을 한다.

직렬 포트(7), 즉 시리얼(Serial) 포트는 주로 장비와 연결하여 상호 명령을 주고 받음으로서 장비의 상태를 시스템에 알려주고, 장비를 통제하는 데 사용된다. 주로 RS232 혹은 RS485등에 준한 다양한 직렬 통신을 활용하여 기존의 장비와 연계하는 데 사용된다.

무선 포트(4)는 직접 케이블을 통하여 유선으로 연결할 수 없을 때 사용하는 포트로서 시스템에 있는 무선 포트와 각종 센서 및 액추에이터가 달린 무선단말기 간에 무선으로 통신함으로서 자료를 교환한다. 이 경우 각각의 무선 단말기는 고유한 식별 ID를 갖고 있어서 이를 통해 무선단말기 상호간의 간섭을 배제하고 시스템이 무선단말기를 통제하는 데 혼선이 없도록 한다. 예를 들면 블루투쓰(Bluetooth)를 이용하여 무선으로 상호연결하는 경우를 들 수 있겠다.

적외선 포트(5)에 의한 연결은 적외선을 이용해 각종 센서가 달린 적외선 단말기와 통신함으로서 센서와 액추에이터를 통제하는 것으로서 이 단말기도 고유한 식별 ID를 갖고 있다. 또한 적외선 포트(5)를 리모콘용으로 설계하여 이용할 수도 있는데 이는 리모콘을 이용하여 근거리에서 장비를 통제하고, 리모콘을 활용하여 웹서버에 신호를 보냄으로서 자동적으로 홈페이지를 변경할 수도 있고 또한 기업체의 전사적 관리시스템에 특정 이벤트를 통보할 수도 있다. 이 경우 각각 리모콘에도 고유의 식별 ID를 부여함으로서 리모콘에 의한 메시지의 발생을 추적하거나 사용자의 접근 레벨등 다양한 정보를 가상의 인터넷 공간에서 활용할 수 있다.

전력선 포트(6)에 의한 연결은 가존에 포설된 전력선을 활용하여 전력선 단말기와 통신함으로서 전력선 단말기에 부착된 각종 센서 및 액추에이터를 동작시키는 것으로서 전력선 단말기도 고유의 ID를 갖고 있다.

따라서, 본 시스템에 있어서 상기 인터페이스 시스템(250)은 무선송수신장치를 구비하고 있으며 센서 및 액추에이터가 장착된 무선단말기 또는 각종 시리얼 포트를 내장한 무선단말기와 통신을 하며 이를 통해 자료를 수집하고 제어할 수 있게된다.

본 발명에 있어서는 또한 상기 인터페이스 시스템(250)이 적외선포트(5)를 내장하고 있으며 근거리에 위치한 센서 및 액추에이터를 장착한 적외선 단말기 혹은 시리얼포트(7)가 장착된 적외선 단말기와 통신하고 이를 통해 자료를 수집하고 제어할 수 있다.

또한, 상기 인터페이스 시스템(250)은 전력선 포트(6)를 통하여 전력선 단말기와 통신함으로서 전력선 단말기에 부착된 각종 센서, 액추에이터 및 시리얼포트를 동작시키고 이를 상기 인터페이스 시스템(250)의 웹서버와 연계시키도록 한다.

본 시스템에 있어서 정보수집단말기(260)로 사용되는 무선송수신 단말기,적외선 송수신 단말기, 전력선 송수신 단말기에는 각자 고유의 식별자(ID)가 부여되어 있다.

또한, 본 발명에서 상기 인터페이스 시스템(250)에 전원소켓부(8)를 구비하도록 하여 이를 원격에서 웹브라우저나 인터넷 프로그램으로 on-off하도록 하는 것이 바람직할 것이다.

도 2에서 미설명부호 9는 프로세서 메모리 넷트웍 저장장치이고, 10은 리모콘수광부로서 리모콘 단말기와 통신하며, 11은 리모콘 발광부로서 가전기기등과 통신하는 것을 보여주고 있다. 12는 전원을 나타낸다.

도 3은 본 발명에 관한 인터페이스 시스템(250)에서의 내부 시스템 구성의 블록도이다. 본 인터페이스 시스템(250)에는 자체에 웹서버(20)를 내장하고 이 웹서버(20)를 이용하여 디지털 입출력포트를 동적으로 웹에 의하여 감시/통제한다. 그리고, 본 발명에서는 기업체에서 활용되고 있는 기업체 전산시스템에서 각종 센서, 액추에이터 및 다양한 현장 생산 장비 혹은 물류 장비등을 집중적으로 통제하기 위하여 분산처리를 가능하게 하는 중간 계층(Middle layer)의 정보서버(30)를 상기 시스템상에 위치시킬 수 있다. 이를 통해 기업체 전산 시스템에서 정보를 수집, 저장, 분석할 수 있도록 함으로서 본격적인 전사적 관리시스템을 구축할 수 있다.

본 인터페이스 시스템(250)에는 그 외에도 홈페이지 공간(60)을 둘 수 있다.

또한 상기 인터페이스 시스템(250)은 FTP(File Transfer Protocol) 서버와 정보서버(Middle layer)를 내장하고 있어 사용자가 원격으로 상기 시스템의 웹페이지의 저장과 변경이 가능하므로 항상 상황에 맞는 웹페이지를 구성할 수 있으며, Java 언어를 지원하므로 실시간으로 상황을 감시할 수 있다.

본 발명에서는 또한, 상기 인터페이스 시스템과 무선통신단말기 혹은 적외선 통신 단말기간 혹은 통신 단말기 상호간의 통신거리를 늘리고 장애물을 극복하기 위하여 시스템과 적외선, 무선 통신 단말기 혹은 적외선, 무선 단말기 상호간에 자료를 적외선 혹은 유선/무선을

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통해 수신하고 재생발생 시키는 기능을 내장한 적외선 정보 리피터를 포함시키는 것이 바람직하다.

다음은 실질적으로 본 발명을 인터넷상에서 구현하기 위한 구체적인 방법을 설명하기로 한다.

본 발명은 먼저, 인터넷을 통해 각종 센서와 장비를 감시/통제하는 방법에 있어서, 각종 센서등을 이용하여 자료를 수집하는 단계와; 상기 수집된 자료를 자체에 웹서버를 내장하고 이 웹서버를 이용하여 디지털 입출력포트를 동적으로 웹에 의하여 감시/통제하기 위한 인터페이스 시스템에 전송하는 단계와; 상기 인터페이스 시스템을 인터넷망에 연결시키는 단계와; 웹브라우저를 내장한 클라이언트 단말기를 통하여 상기 인터넷망에 연결하여 센서와 장비를 감시/통제하는 단계;로 이루어지되, 인터넷을 통해 각종 센서와 장비를 감시/통제하는 방법에 있어서,

(a) 각종 센서등을 이용하여 자료를 수집하는 단계와;

(b) 상기 수집된 자료를 자체에 웹서버를 내장하고 이 웹서버를 이용하여 디지털 및 아날로그 입출력포트를 동적으로 웹에 의하여 감시/통제하기 위한 인터페이스 시스템에 전송하는 단계와;

(c) 상기 인터페이스 시스템을 인터넷망에서 연결시키는 단계와;

(d) 웹브라우저를 내장한 클라이언트 단말기를 통하여 상기 인터넷망에 연결하여 센서와 장비를 감시/통제하는 단계;로 이루어지되,

상기 인터페이스 시스템에 적외선포트와 각각 고유 식별자(ID)를 보유하도록하여 이를 인터페이스 시스템의 웹서버를 통제하는 통제레벨의 구분 혹은 접근범위를 지정하도록 구비된 리모콘을 이용하여 상기 인터페이스 시스템과 통신함으로서 근거리에서 감시/통제하고, 상기 리모콘으로 상기 인터페이스 시스템의 웹서버에 신호를 전송하여 자동적으로 홈페이지를 발생시키고, 발생된 홈페이지를 이용하여 동적으로 통제하며, 상기 인터페이스 시스템에 XML프로세서를 내장하여 자료를 분석하고, 분석된 자료를 인터넷 환경에 상호 맞출수 있도록 기존 시스템 자료형식과 XML형식을 실시간 양방향으로 변환시킬 수 있는 것을 특징으로 하는 인터넷을 통해 각종 센서와 장비를 감시/통제하는 방법을 제공한다.

본 발명에서는 상기 인터페이스 시스템에 적외선포트를 구비하도록 하여 리모콘을 이용하여 상기 인터페이스 시스템과 통신함으로서 근거리에서 감시/통제하고, 상기 리모콘을 이용하여 상기 인터페이스 시스템의 웹서버에 신호를 전송하여 자동적으로 홈페이지를 발생시킬 수 있도록 할 수 있다. 또한 상기 적외선 포트는 리모콘을 이용하여 상기 인터페이스 시스템과 통신함으로서 기업체의 전사적 관리 시스템등 기업전산환경에 특정이벤트를 발생함으로서 통보할 수 있게 된다.

상기 리모콘에는 각각 고유 식별자(ID)를 보유하도록 하여 이를 인터페이스 시스템의 웹서버를 통제하는 통제레벨의 구분 혹은 접근범위를 지정하도록 하는 것이 바람직할 것이다. 또한 상기 클라이언트 단말기는 상호간에 간섭을 배제하고 인터페이스 시스템와의 통신에 의한 감시 통제가 정확히 이루어지도록 하기 위하여 각각 고유의 식별자(ID)를 부여하여 감시/통제할 수 있도록 한다.

본 발명은 상기 인터페이스 시스템에 내장된 웹서버에서 사용하는 저장된 홈페이지를 이용하여 동적으로 통제할 수 있을 것이다.

본 발명에서는 또한, 각종 센서등을 이용하여 수집된 자료는 XML파일형식으로 전송하여 표준화된 기업체 관리시스템의 데이터베이스, PDA(Personal Digital Assistance) 및 휴대폰의 WAP과도 연동될 수 있도록 한다. 따라서 상기 인터페이스 시스템에 XML 프로세서를 내장하여 기업체 관리 시스템의 프로그램에 의한 자료를 분석하여 이를 다른 형식으로 변경시킬 수 있도록 하는 것을 포함할 수 있을 것이다.

도 4는 상기의 시스템을 이용하여 각종 장비 및 액추에이터에 대한 통제를 원격으로 제어하는 동작을 나타내는 일예를 보여주는 흐름도이다. 본 발명에서는 상술한 바와 같이, 인터넷과 유/무선으로 연결된 다양한 장비들(PC, 셋탑박스, 디지탈 TV, PDA, 휴대폰, IMT2000 단말기등 웹 브라우저를 장착하고 인터넷과 연결될 수 있는 일체의 장비들을 총칭한다.)을 통해 웹 브라우저로 상기의 시스템을 감시할 수 있다.

또한 사용자의 조작에 의한 상기 장비들의 웹 서버로의 통제 요청(Request)에 의해 상기 시스템의 웹 서버에 전달되어 상기 시스템의 여러가지 입출력 포트를 통해 각종 기기(Equipment)들을 실질적으로 통제할 수 있고 각종 기기로부터의 여러 신호를 받아 데이터베이스에 저장할 수 있으며 상황을 웹서버를 통해 표시하게 함으로써 감시할 수 있다.

도 4에 나타난 바와 같이, 본 발명의 인터페이스 시스템(250)은 자체에 웹서버(20)를 내장하고 있으며 통신접속부(70)을 통하여 인터넷망과 연결하여 웹브라우저(70)로 상기의 시스템을 제어 감시한다. 또한, 본 인터페이스 시스템(250)에는 홈페이지 저장공간(60)을 구비하도록 한다.

즉, 웹브라우저가 내장된 각종 클라이언트 단말기를 통하여 인터페이스 시스템과 웹연결을 하여 인터페이스 시스템에서 홈페이지를 전송받는다.(HTML, Java-Applet) 이후 Java-Applet 과 상호 미들웨어 통신을 수행하여 실시간 감시/통제가 가능하도록 한다.

도 5는 본 발명의 일실시예에 따른 기업체 전산시스템에서 인터넷망을 통한 장비의 원격 감시/통제 방법을 도시하는 흐름도이다.

마찬가지로, 본 발명에서의 인터페이스 시스템(250)은 통신접속부(70)를 통하여 인터넷망과 연결하여 기업체의 전산관리 시스템과 미들웨어 통신을 수행한다.

이를 구체적으로 살펴보면, 서비스 사업자가 본 인터페이스 시스템(250)에 일련의 인증절차를 거쳐 접속을 한 후 센서등의 정보를 요구하면, 상기 시스템(250)에서는 센서정보등을 제공하고 이와 같이 제공된 정보는 데이터 베이스에 저장한 후 액추에이터 가동요구를 수행한다. 이후 상기 시스템(250)에서 액추에이터 가동이 명령이 수행되게 된다.

도 6은 본 발명의 일실시예에 따른 인터넷망에서 XML 형식을 이용한 시스템과의 자료교환 및 시스템 연계방법을 설명하는 흐름도이다.

본 실시예에서는 시스템(250)내에 XML 프로세서(100)과 XML 작성기가 내장된다. 이는 상술한 바와 같이, 각종 센서등을 이용하여 수집된 자료는 XML파일형식으로 전송하여 표준화된 기업체 관리시스템의 데이터베이스, PDA(Personal Digital Assistance) 및 휴대폰의 WAP과도 연동될 수 있도록 하는 것에 특징이 있으며, 또한, 상기 시스템(250)에 XML 프로세서를 내장하여 기업체 관리 시스템의 프로그램에 의한 자료를 분석하여 이를 인터넷 환경에 맞출 수 있도록 변환시킬 수 있는 데 큰 특징을 갖고 있다.

도 7은 웹 브라우저를 통해 가정 기기들을 감시/통제하는 실시예를 보여준다. 상기 도면의 좌, 우 하단부의 Java Applet으로 구성된 버튼을 조작함에 따라 각 기기들을 통제(예를 들면 거실 조명 켜기, 가스 차단하기 등)할 수 있고 그 결과를 실시간으로 감시할 수 있다.

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발명의 효과

상술한 바와 같이, 본 발명에 의하면, 기존의 독립적으로 동작되고 있는 생산기기 및 자동화 관련기기를 인터넷 환경에서 자연스럽게 연결되도록 함으로서 응용분야를 확대할 뿐만 아니라 기 구축된 인터넷 망을 활용함으로써 기업활동에 최대한의 효과를 얻을 수 있을 것이다.

즉, 본 발명은 인터넷 웹 서버, 유/무선 인터페이스를 내장하고 있어 이를 이용하여 외부의 웹브라우저를 장착한 클라이언트로부터 손쉽게 제어를 통해 다양한 장비들을 감시/통제할 수 있으며 또한 다양한 장비들과 입출력에 의한 정보교환을 하고 그 내용을 자동적으로 내장된 웹서버의 홈페이지에 반영할 수 있으며, 또한 본 발명에 의하면 생산, 물류관리, 물류배송, 방범/방재, 자동화등의 기능 및 생산활동과 관련된 분야들을 기 구축된 인터넷 망을 활용하여 감시/통제할 수 있으므로 손쉬운 기업활동을 영위할 수 있게 하여 적은 비용으로도 최대한의 효과를 얻게 할 수 있다.

(57) 청구의 범위

청구항 1.

인터넷을 통해 각종 센서와 장비를 감시/통제할 수 있는 시스템에 있어서, 인터넷망에 연결하여 센서와 장비를 감시/통제하는 웹브라우저를 내장한 클라이언트 단말기;

상기 클라이언트 단말기에 연결된 인터넷망;

자체에 웹서버를 내장하고 이 웹서버를 이용하여 디지털 입출력포트를 동적으로 웹에 의하여 감시/통제하며 상기 인터넷망에 접속하기 위한 접속부를 구비하며, 센서 및 액추에이터가 장착되거나 시리얼포트가 내장된 무선단말기와 통신하여 자료를 수집하고 제어하는 무선송수신장치가 구비되고, 센서 및 액추에이터가 장착되거나 시리얼포트가 내장된 적외선 단말기와 통신하여 자료를 수집하고 제어하는 적외선 포트가 구비되며, 센서 및 액추에이터가 장착되거나 시리얼포트가 내장된 전력선 단말기와 통신하여 센서, 액추에이터 및 시리얼포트를 동작시키고 이를 상기 웹서버와 연계시키는 전력선 포트가 구비되며, 자료를 수집하고 제어하는 디지털 입출력포트가 구비되며, 사용자가 원격으로 센서, 액추에이터 및 장비를 분산처리하는 것이 가능하고 웹페이지를 구성하여 저장과 변경이 가능하도록 Java 언어를 사용하여 실시간으로 상황을 감시할 수 있는 미들웨어의 정보서버 및 FTP서버를 내장하고 있는 인터페이스 시스템; 및

센서 및 액추에이터가 장착되고 자료를 수집하여 상기 인터페이스 시스템의 웹서버로 송신하는 정보수집 단말기로 이루어진 것을 특징으로 하는 인터넷을 통해 각종 센서와 장비를 감시/통제하는 시스템.

청구항 2.

삭제

청구항 3.

삭제

청구항 4.

삭제

청구항 5.

삭제

청구항 6.

삭제

청구항 7.

삭제

청구항 8.

삭제

청구항 9.

제1항에 있어서, 상기 정보수집단말기는 무선송수신 단말기, 적외선송수신 단말기, 전력선송수신 단말기중의 어느 하나로 이루어진 것을 특징으로 하는 인터넷을 통해 각종 센서와 장비를 감시/통제하는 시스템.

청구항 10.

제 9항에 있어서, 상기 정보수집단말기는 시스템과 상호간, 혹은 단말기간 상호간의 자료를 무선을 통해 수신하고 재생발신하는 기능을 내장한 무선통신 정보 리피터를 더욱 포함하는 것을 특징으로 하는 인터넷을 통해 각종 센서와 장비를 감시/통제하는 시스템.

청구항 11.

제9항에 있어서, 상기 정보수집단말기에는 각자 고유의 식별자(ID)가 부여되어 있는 것을 특징으로 하는 인터넷을 통해 각종 센서와 장비를 감시/통제하는 시스템.

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청구항 12.

제1항에 있어서, 상기 인터페이스 시스템에 전원소켓부를 구비하도록 하여 이를 원격에서 웹브라우저나 인터넷 프로그램으로 on-off하는 것을 특징으로 하는 인터넷을 통해 각종 센서와 장비를 감시/통제하는 시스템.

청구항 13.

삭제

청구항 14.

삭제

청구항 15.

제 1항에 있어서, 상기 인터페이스 시스템과 무선통신단말기 간의 통신거리를 늘리기 위해 시스템과 무선통신 단말기간 혹은 무선통신 단말기 상호간의 자료를 무선을 통해 수신하고 재생 발신하는 기능을 내장한 무선통신 정보 리피터를 더욱 포함하는 것을 특징으로 하는 인터넷을 통해 각종 센서와 장비를 감시/통제하는 시스템.

청구항 16.

제 1항에 있어서, 상기 인터페이스 시스템과 적외선 통신 단말기간의 통신 거리를 늘리고, 장애물을 극복하기 위하여 시스템과 적외선 통신 단말기 혹은 적외선 단말기 상호간에 자료를 적외선 혹은 유선/무선을 통해 수신하고 재생발생 시키는 기능을 내장한 적외선 정보 리피터를 더욱 포함하는 것을 특징으로 하는 인터넷을 통해 각종 센서와 장비를 감시/통제하는 시스템.

청구항 17.

인터넷을 통해 각종 센서와 장비를 감시/통제하는 방법에 있어서,

(a) 각종 센서등을 이용하여 자료를 수집하는 단계와;

(b) 상기 수집된 자료를 자체에 웹서버를 내장하고 이 웹서버를 이용하여 디지털 및 아날로그 입출력포트를 동적으로 웹에 의하여 감시 통제하기 위한 인터페이스 시스템에 전송하는 단계와;

(c) 상기 인터페이스 시스템을 인터넷망에 연결시키는 단계와;

(d) 웹브라우저를 내장한 클라이언트 단말기를 통하여 상기 인터넷망에 연결하여 센서와 장비를 감시/통제하는 단계로 이루어지되,

상기 인터페이스 시스템에 적외선포트와 각각 고유 식별자(ID)를 보유하도록 하여 이를 인터페이스 시스템의 웹서버를 통제하는 통제레벨의 구분 혹은 접근범위를 지정하도록 구비된 리모콘을 이용하여 상기 인터페이스 시스템과 통신함으로서 근거리에서 감시/통제하고, 상기 리모콘으로 상기 인터페이스 시스템의 웹서버에 신호를 전송하여 자동적으로 홈페이지를 발생시키고, 발생된 홈페이지를 이용하여 동적으로 통제하며, 상기 인터페이스 시스템에 XML프로세서를 내장하여 자료를 분석하고, 분석된 자료를 인터넷 환경에 상호 맞출수 있도록 기존 시스템 자료형식과 XML형식을 실시간 양방향으로 변환시킬 수 있는 것을 특징으로 하는 인터넷을 통해 각종 센서와 장비를 감시/통제하는 방법.

청구항 18.

삭제

청구항 19.

삭제

청구항 20.

삭제

청구항 21.

삭제

청구항 22.

삭제

청구항 23.

삭제

청구항 24.

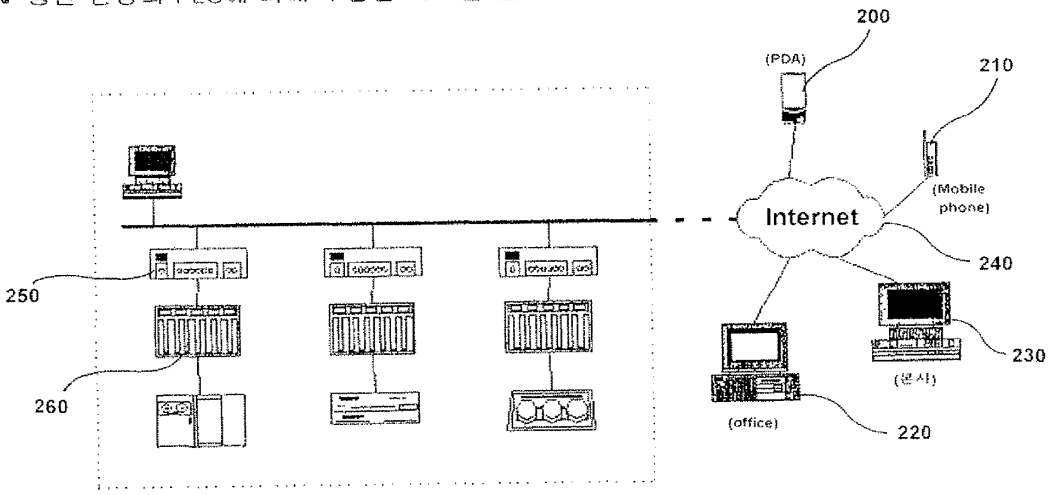
삭제

도면

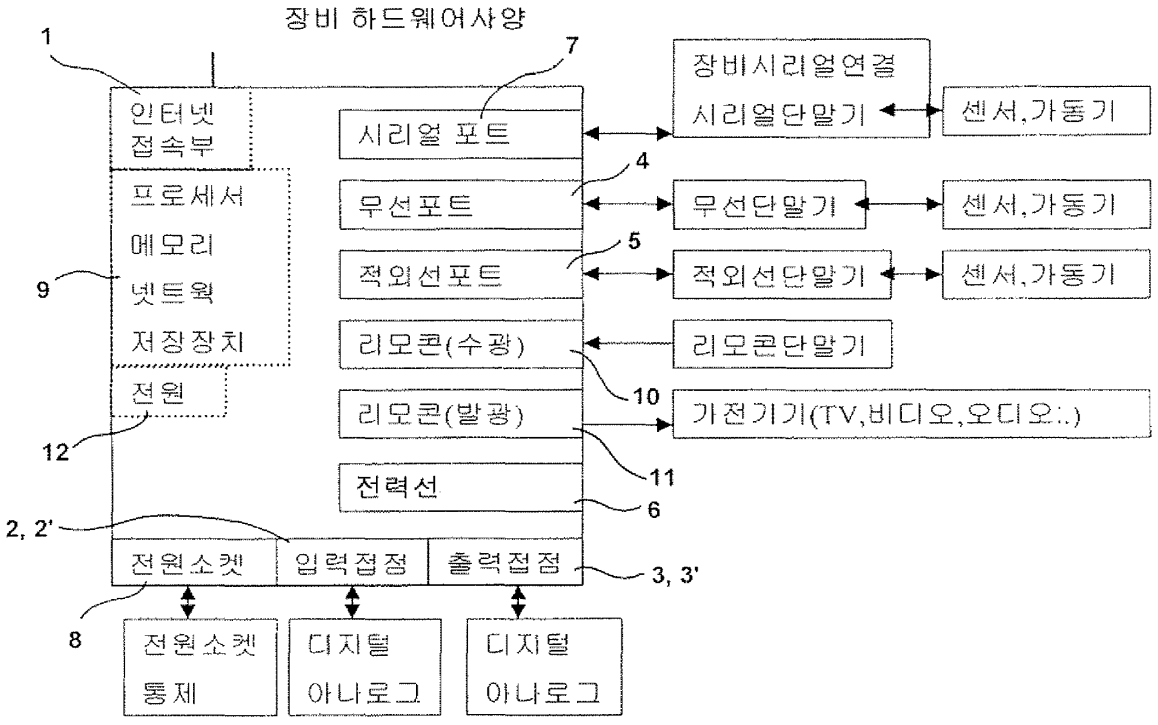
도면 1

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• 생산 현장의 PLC에 의해 수집된 자료를 인터넷을 통해 감시/통제 가능

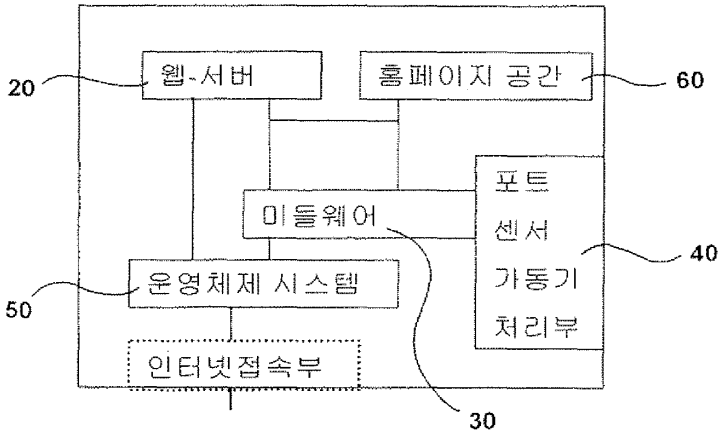


도면 2



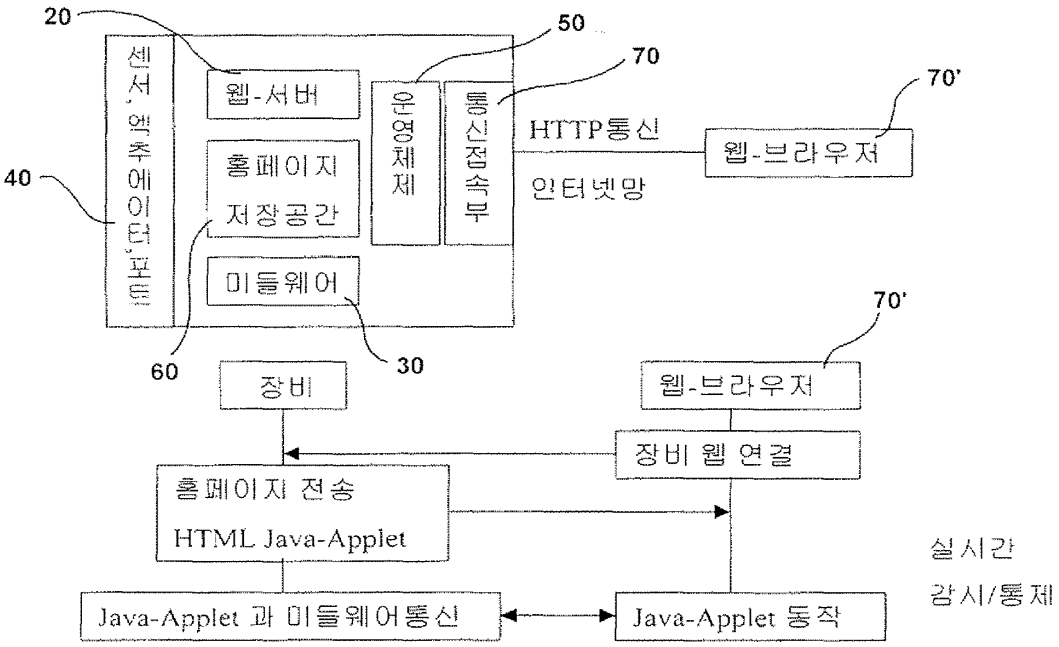
도면 3

장비 소프트웨어 사양



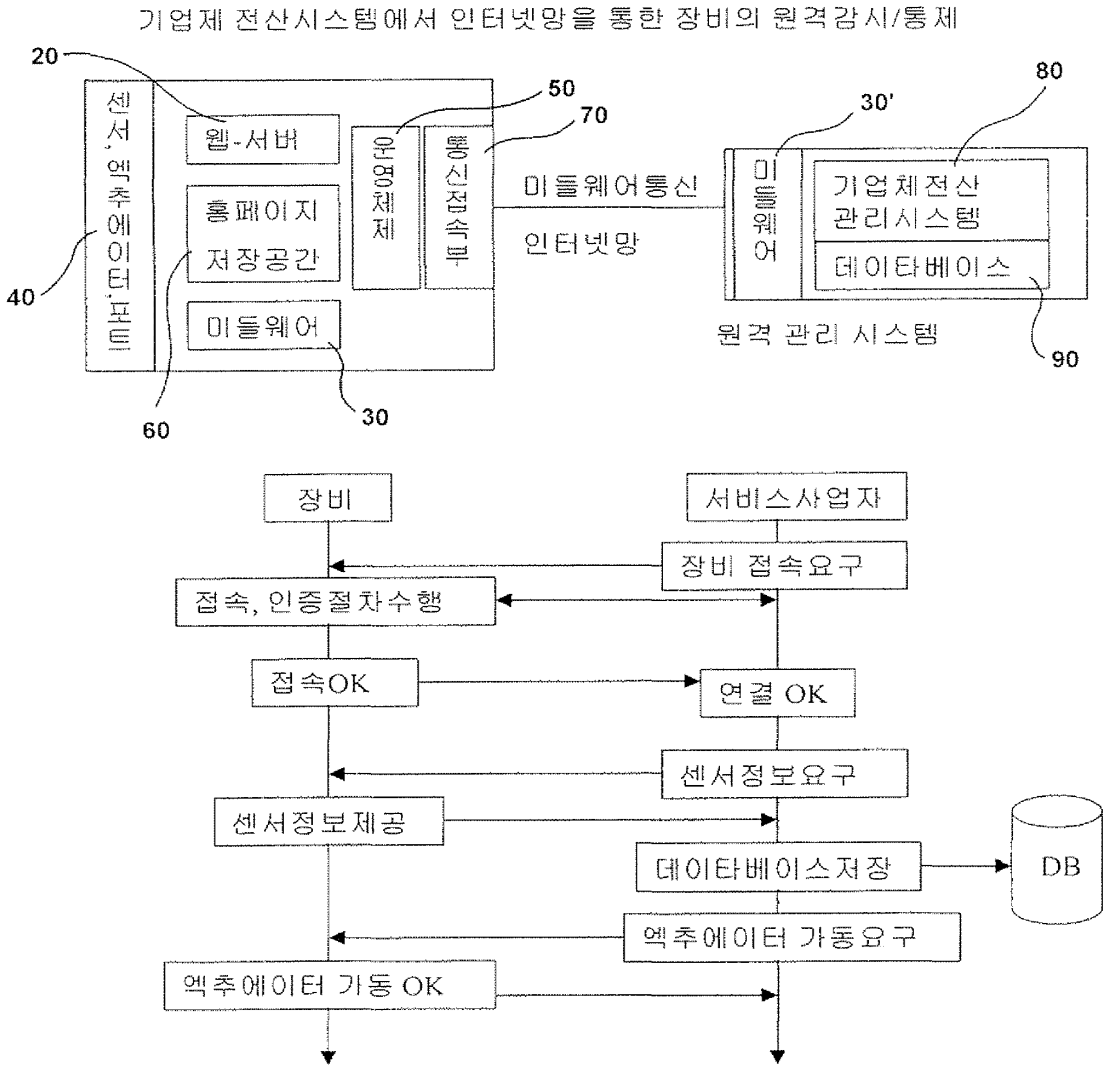
도면 4

웹-브라우저 에 의한 감시/제어

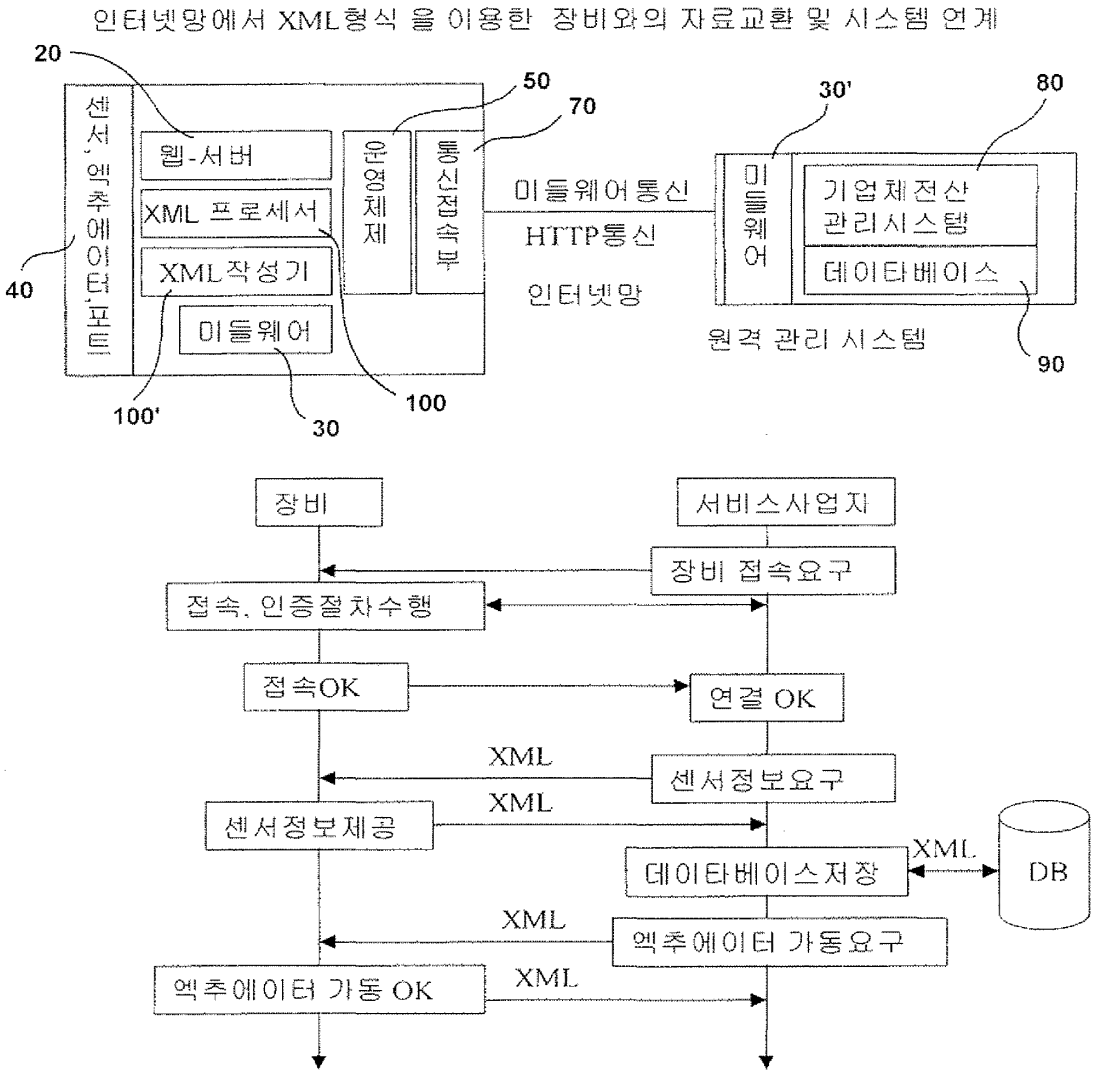


도면 5

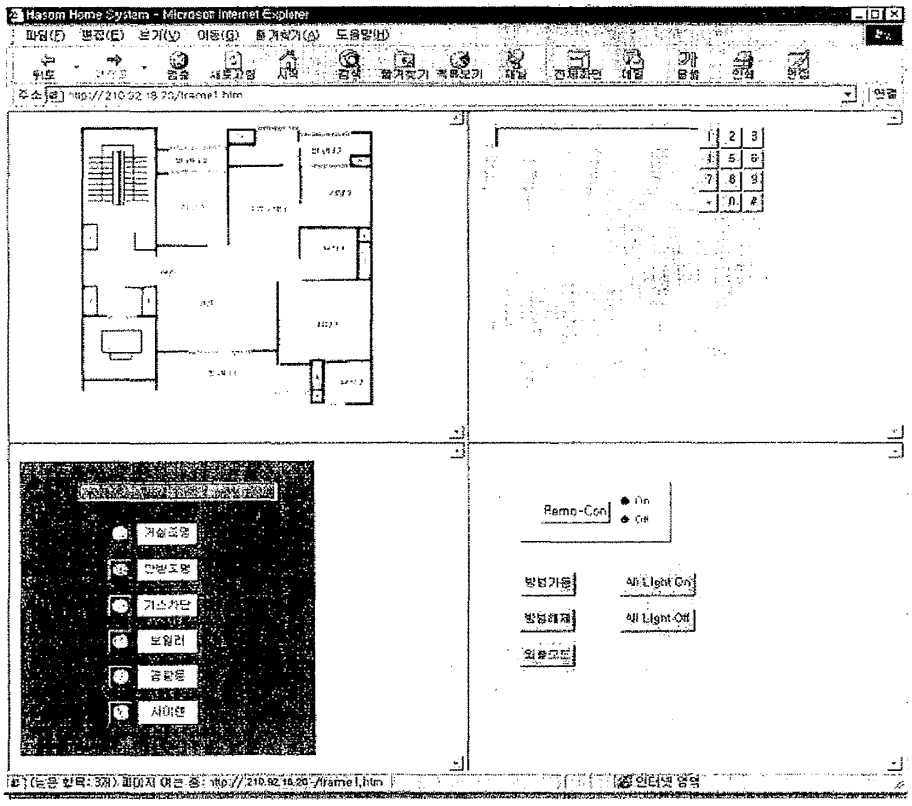
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기업체 전산시스템에서 인터넷망을 통한 장비의 원격감시/통제
20
50
70
80
30'
센서,엑추에이터,포트
웹-서버
운영체제
통신접속부
미들웨어통신
미들웨어
기업체전산 관리시스템
홈페이지 저장공간
인터넷망
데이타베이스
40
미들웨어
원격 관리 시스템
90
60
30
장비
서비스사업자
장비 접속요구
접속, 인증절차수행
접속OK
연결 OK
센서정보요구
센서정보제공
데이타베이스저장
DB
엑추에이터 가동요구
엑추에이터 가동 OK

도면 6


인터넷망에서 XML형식 을 이용한 장비와의 자료교환 및 시스템 연계
20
50
70
30'
80
센서, 엑추에이터,포트
웹-서버
XML 프로세서
XML작성기
미들웨어
운영체제
통신접속부
미들웨어통신
HTTP통신
인터넷망
미들웨어
기업체전산 관리시스템
데이타베이스
원격 관리 시스템
40
100'
30
100
90
장비
서비스사업자
장비 접속요구
접속, 인증절차수행
접속OK
연결 OK
XML
센서정보요구
XML
센서정보제공
XML
데이타베이스저장
DB
XML
엑추에이터 가동요구
엑추에이터 가동 OK
XML

도면 7


Nasom Home System - Microsoft Internet Explorer
파일(F) 편집(E) 보기(V) 이동(G) 즐겨찾기(A) 도움말(H)
Remo-Con
On
Off
All Light On
All Light Off
거실조명
안방조명
가스차단
보일러
침실등
사이렌

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(71)Applicant: SAMSUNG ELECTRONICS CO., LTD.
(72)Inventor: CHO, YONG JIN

(54) DEVICE AND METHOD FOR OFFERING CAS ADAPTIVE TO DYNAMICALLY CHANGED SITUATION

(57) Abstract:

PURPOSE: A device and a method for offering a CAS(Context-Aware Service) adaptive to a dynamically changed situation are provided to construct a system adaptive to the dynamically changed situation by loosely connecting a client object and a server object via context, enable many client objects to share the server object by using the context, and enable many server objects to share the client object by sharing knowledge offered from the client object. CONSTITUTION: A CAS managing module(520) manages information for the CAS and the context defined by the CAS. A sensor managing module(510) manages the information for a sensor and requests observation for the knowledge to the sensor. A context managing module(530) notifies the CAS managing module of the CAS defining the context in case that the observed knowledge satisfies the context offered by the CAS managing module. In the case that notification is received the context managing module, the CAS managing module requests the corresponding CAS to provide a service.

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(74) 대리인 김동진
정상빈

심사청구 : 있음

(54) 상황인지 서비스를 제공하는 장치 및 방법

요약

상황인지 서비스를 제공하는 장치 및 방법(Apparutus and method for providing context-aware service)를 제공한다.

본 발명의 실시예에 따른 상황인지 서비스 제공 장치는, 상황인지 서비스 객체(Context-Aware Service object; 이하 CAS라 함)에 관한 정보 및 CAS에 의해 정의된 컨텍스트를 등록, 관리, 및 제거하는 CAS 관리 모듈; 컨텍스트를 검사하기 위한 상황정보를 관측하는 센서에 관한 정보를 등록, 관리 및 제거하며, 센서에 상황정보의 관측을 요청하는 센서 관리 모듈; 및 관측된 상황정보를 관리하며, 상황정보가 CAS 관리 모듈에 의해 제공된 컨텍스트를 만족시키는 경우, CAS 관리 모듈에 컨텍스트를 정의한 CAS를 알리는 컨텍스트 관리 모듈을 포함한다. 이 때, CAS 관리 모듈은 컨텍스트 관리 모듈로부터 CAS의 알림을 받은 경우 해당하는 CAS 객체에 서비스를 제공하도록 요청한다.

대표도

도 5

색인어

상황인지 서비스(Context-Aware Service), 컨텍스트(Context), 상황정보(Knowledge)

명세서

도면의 간단한 설명

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도 1은 종래의 객체지향 미들웨어의 개념을 보여주는 도면이다.

도 2는 본 발명의 실시예에 따른 상황인지 서비스(Context-Aware Service)의 개요를 보여주는 도면이다.

도 3은 본 발명의 실시예에 따른 상황인지 서비스 프레임워크(Context-Aware Service Framework)의 개요를 보여주는 도면이다.

도 4는 본 발명의 실시예에 따른 상황인지 서비스 프레임워크(Context-Aware Service Framework)의 동작 순서를 보여주는 도면이다.

도 5는 본 발명의 실시예에 따른 상황인지 서비스(Context-Aware Service) 제공 장치의 구성을 보여주는 도면이다.

도 6은 도 4에 도시된 상황인지 서비스 프레임워크(Context-Aware Service Framework)에 의한 서비스 제공 방법의 순서를 보다 상세하게 보여주는 흐름도이다.

도 7은 상황인지 서비스 프레임워크(Context-Aware Service Framework)에 의한 센서의 관리 방법을 보여주는 흐름도이다.

도 8은 본 발명의 실시예에 따른 센서(Sensor)의 동작 순서를 보여주는 흐름도이다.

도 9는 본 발명의 실시예에 따른 센서(Sensor)의 상태 변화를 보여주는 도면이다.

도 10은 상황인지 서비스 프레임워크(Context-Aware Service Framework)에 의한 상황인지 서비스 객체(Context-Aware Service object; 이하 CAS라 함)의 관리 방법을 보여주는 흐름도이다.

도 11은 본 발명의 실시예에 따른 CAS의 상태 변화를 보여주는 도면이다.

도 12는 상황인지 서비스 프레임워크(Context-Aware Service Framework)를 구현한 소스 코드의 일 실시예를 보여주는 도면이다.

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 상황인지 서비스(Context-Aware Service)를 제공하는 장치 및 방법에 관한 것으로서, 더욱 상세하게는 상황정보(Knowledge)에 따라 서비스의 내용이 결정되는 상황인지 서비스 프레임워크(Context-Aware Service Framework)를 제공함으로써, 동적으로 변화하는 상황에 보다 적응적인 서비스를 제공할 수 있는 상황인지 서비스 제공 장치 및 방법에 관한 것이다.

응용 소프트웨어를 지원하는 미들웨어의 주류는 객체지향 미들웨어로서, 종래의 객체지향 미들웨어에서는 클라이언트 객체가 서비스를 사용하기 위한 인터페이스를 서버 객체로부터 획득하고 이를 사용하여 서버 객체를 사용한다.

도 1은 종래의 대표적인 객체지향 미들웨어인 CORBA(Common Object Request Broker Architecture)의 개념을 보여주는 도면이다.

CORBA는 네트워크에서 분산 프로그램 객체를 생성, 배포, 관리하기 위한 구조와 규격이며, 네트워크상의 서로 다른 장소에 있고 여러 벤더(Vendor)들에 의해 개발된 프로그램들이 인터페이스 브로커를 통해 통신하도록 해준다. CORBA를 비롯한 일반적인 객체지향 미들웨어는 클라이언트 객체(110)의 서버 객체(120)로의 요청을 중계하는 객체 요청 중계자(Object Request Broker; 이하 ORB라 함)(130)를 포함하고 있다. ORB(130)는 객체들간의 클라이언트-서버 관계를 맺어주는 중계자로서, ORB를 사용하면 클라이언트는 서버 객체에 있는 메쏘드(Method)를 그것이 같은 컴퓨터에 있든, 네트워크 상에 있든 상관없이 투명하게 호출할 수 있다. ORB는 클라이언트의 서버에 대한 호출을 가로채어 요구를 처리할 객

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체를 찾고, 매개변수를 전달하고, 메쏘드를 호출하고, 그 처리결과를 돌려주는 일 등을 담당한다. 클라이언트는 서버 객체의 인터페이스를 제외하고는 서버 객체의 위치나 사용된 프로그램 언어나 운영체계, 그 밖의 시스템과 관련된 어느 것도 알 필요가 없다.

이처럼 종래의 객체지향 미들웨어에서 서버 객체는 자신이 서비스하는 서비스의 인터페이스 함수를 제공한다. 클라이언트 객체는 서버 객체의 인터페이스를 획득하고 인터페이스를 직접 호출함으로써 서버 객체가 서비스를 제공하도록 한다. 따라서 클라이언트 객체와 서버 객체는 강인한 연결 구조를 가지게 되는데, 이는 상황에 따라 동적으로 변경되는 동작 환경에 적합하지 못하다. 이에 동적으로 변화하는 상황에 따라 변형된 서비스를 제공할 수 있는 미들웨어가 필요하게 되었다.

발명이 이루고자 하는 기술적 과제

본 발명은 클라이언트 객체와 서버 객체를 컨텍스트(Context)를 매개로 느슨하게 연결함으로써 동적으로 변화하는 상황에 적응적인 시스템을 구축할 수 있는 방법을 제공하는데 그 목적이 있다.

본 발명의 또 다른 목적은 컨텍스트를 사용하여 여러 클라이언트 객체가 서버 객체를 공유하는 방법을 제공하는 것이다.

본 발명의 또 다른 목적은 클라이언트 객체가 제공하는 상황정보(Knowledge)를 공유함으로써 여러 서버 객체가 클라이언트 객체를 공유하는 방법을 제공하는 것이다.

마지막으로 본 발명의 또 다른 목적은 클라이언트 객체와 서버 객체의 통일된 인터페이스를 제공하는 것이다.

본 발명의 목적들은 이상에서 언급한 목적들로 제한되지 않으며, 언급되지 않은 또 다른 목적들은 아래의 기재로부터 당업자에게 명확하게 이해되어질 수 있을 것이다.

발명의 구성 및 작용

상기 목적을 달성하기 위하여, 본 발명의 실시예에 따른 상황인지 서비스 제공 장치는, 상황인지 서비스 객체(Context-Aware Service object; 이하 CAS라 함)에 관한 정보 및 CAS에 의해 정의된 컨텍스트를 등록, 관리, 및 제거하는 CAS 관리 모듈; 컨텍스트를 검사하기 위한 상황정보를 관측하는 센서에 관한 정보를 등록, 관리 및 제거하며, 센서에 상황정보의 관측을 요청하는 센서 관리 모듈; 및 관측된 상황정보를 관리하며, 상황정보가 CAS 관리 모듈에 의해 제공된 컨텍스트를 만족시키는 경우, CAS 관리 모듈에 컨텍스트를 정의한 CAS를 알리는 컨텍스트 관리 모듈을 포함한다.

한편, 본 발명의 실시예에 따른 상황인지 서비스 제공 방법은, CAS에 관한 정보 및 CAS에 의해 정의된 컨텍스트를 등록하는 단계; 센서에 관한 정보를 등록하는 단계; 센서에 관한 정보에 따라 센서에 의해 관측된 상황정보(Knowledge)를 센서로부터 제공받는 단계; 상황정보가 컨텍스트를 만족시키는 경우, 컨텍스트를 정의한 CAS를 알리는 단계; 및 CAS에 서비스를 요청하는 단계를 포함한다.

상기 목적을 달성하기 위하여, 본 발명의 실시예에 따른 상황인지 서비스 제공 방법은, 센서로부터 등록 요청을 받는 단계; 등록 요청에 따라 센서에 관한 정보를 등록하는 단계; 센서가 관측할 상황정보가 필요한 경우, 센서에 상황정보의 관측을 요청하는 단계; 센서로부터 제거 요청을 받는 단계; 및 제거 요청에 따라 센서에 관한 정보를 제거하는 단계를 포함한다.

한편, 본 발명의 실시예에 따른 상황인지 서비스 제공 방법은, CAS로부터 등록 요청을 받는 단계;

등록 요청에 따라 CAS에 관한 정보 및 CAS에 의해 제공된 컨텍스트를 등록하는 단계; 컨텍스트를 결정하기 위해 필요한 센서가 등록되어 있는 경우, 센서에 의해 제공된 상황정보가 컨텍스트를 만족시키는지 검사하는 단계; CAS로부터 제거 요청을 받는 단계; 및 제거 요청에 따라 CAS에 관한 정보 및 컨텍스트를 제거하는 단계를 포함한다.

기타 실시예들의 구체적인 사항들은 상세한 설명 및 도면들에 포함되어 있다.

본 발명의 이점 및 특징, 그리고 그것들을 달성하는 방법은 첨부되는 도면과 함께 상세하게 후술되어 있는 실시예들을 참조하면 명확해질 것이다. 그러나 본 발명은 이하에서 개시되는 실시예들에 한정되는 것이 아니라 서로 다른 다양한 형태로 구현될 수 있으며, 단지 본 실시예들은 본 발명의 개시가 완전하도록 하고, 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자에게 발명의 범주를 완전하게 알려주기 위해 제공되는 것이며, 본 발명은 청구항의 범주에 의해 정의될 뿐이다. 명세서 전체에 걸쳐 동일 참조 부호는 동일 구성 요소를 지칭한다

이하, 첨부된 도면을 참조하여 본 발명의 바람직한 실시예를 상세히 설명하기로 한다.

설명에 앞서 본 명세서에서 사용하는 용어의 의미를 간략히 설명한다. 그렇지만 용어의 설명은 본 명세서의 이해를 돕기 위한 것으로서 명시적으로 본 발명을 한정하는 사항으로 기재하지 않은 경우에 본 발명의 기술적 사상을 한정하는 의미로 사용하는 것이 아님을 주의해야 한다.

- 컨텍스트(Context)

상황인지 서비스 객체에 의해 정의된 서비스 행위를 결정하는 정보를 의미한다. 여기서 서비스 행위를 결정하는 정보에는 서비스의 제공 시점, 서비스의 제공 여부, 서비스의 제공 대상, 서비스의 제공 위치 등이 포함된다. 컨텍스트는 서비스 행위의 어떤 특성을 결정하는가에 따라 서비스의 제공 시점을 결정하는 컨텍스트(When-Context), 서비스의 제공 여부를 결정하는 컨텍스트(Why-Context), 서비스의 내용을 결정하는 컨텍스트(How-Context)로 구분될 수 있다. 상황인지 서비스는 When-Context가 만족되는 시점에 Why-Context가 만족되는 경우에 How-Context에 해당하는 서비스를 제공한다. 컨텍스트는 도 2에서 후술하는 바와 같이 클라이언트 객체가 제공하는 상황정보(Knowledge)에 의해 검사되며, 상황인지 서비스 프레임워크가 결정한다.

- 상황정보(Knowledge)

엔티티(Entity)의 상황(Situation)을 특징지을 수 있는 모든 정보를 의미한다. 엔티티는 사용자와 응용 프로그램간의 상호작용과 관련되었다고 생각되는 사람, 장소, 또는 사물을 말하며, 사용자와 응용 프로그램 자체도 포함한다. 상황정보는 온도, 습도 등과 같이 물리적인 센서가 관측한 값에서부터, 전자우편의 도달 여부, 인터넷 정보 등과 같은 일반 정보까지 확장될 수 있다. 따라서, 모든 서비스 소프트웨어는 상황인지 서비스라고 말할 수 있다.

- 상황인지 서비스(Context-Aware Service)

서비스 객체가 정의하는 컨텍스트가 바뀜에 따라 서비스 여부와 서비스의 내용이 결정되는 서비스를 의미한다. 클라이언트에 의해 제공되는 상황정보를 근거로 판단할 때, When-Context가 만족되는 시점에 Why-Context도 만족되면 How-Contxt를 근거로 서비스를 제공하게 된다. 따라서 동작 환경이나 사용자의 취향에 따라 서비스가 요구하는 상황정보와 컨텍스트가 바뀔 수 있다. 예를 들면, "25도 이상이면 에어컨을 동작시킨다"라는 상황인지 서비스가 있을 때, "25도 이상이다"라는 컨텍스트는 사용자의 취향에 따라 "28도 이상이다" 또는 "25도 이상이고, 습도가 80% 이상이다" 등으로 다양하게 바뀔 수 있다.

도 2는 본 발명의 실시예에 따른 상황인지 서비스(Context-Aware Service)의 개요를 보여주는 도면이다.

상황인지 서비스는 동작 상황을 인식하는 인식 단계(210), 인식된 상황정보를 이용하여 서비스 행위를 결정하는 결정 단계(220) 및 결정된 서비스를 실행하는 서비스 단계(230)로 구성된다. 인식 단계(210)에서는 1 이상의 센서(센서1, 센서2, 센서3)가 클라이언트 객체(240)로서 상황정보를 관측하여 결정 단계(220)로 제공하고, 결정 단계(220)에서는 상황정보로 컨텍스트의 만족여부를 결정한다. 서비스 단계(230)에서는 컨텍스트의 내용에 따라 1 이상의 상황인지 서비스 객체(Context-Aware Service object; 이하 CAS라 함)(CAS1, CAS2)가 서버 객체(260)로서 서비스를 제공하게 된다. 인식 단계(210)는 다수의 CAS에 의해 공유될 수 있고, 결정 단계(220)는 상황인지 서비스 프레임워크(Context-Aware Service Framework)(250)에 의해 일반적인 형태로 지원될 수 있다.

상황인지 서비스 프레임워크(250)는 상황인지 서비스의 결정 단계(220)를 지원하며, 인식 단계(210)를 공유할 수 있도록 하는 미들웨어이다. 즉, When-Context가 만족되는 시점에 Why-Context도 만족되는 CAS로 하여금 서비스 행위를 제공할 수 있도록 알리고 CAS에 How-Context를 제공하는 상황인지 서비스를 위한 미들웨어이다. 상황인지 서비스 프레임워크에서 인식 단계는 센서(240)로, 서비스 단계는 CAS(260)로 모델링 될 수 있다.

도 3은 본 발명의 실시예에 따른 상황인지 서비스 프레임워크(Context-Aware Service Framework)의 개요를 보여주는 도면이다.

상황인지 서비스 프레임워크(330)는 센서(310)로부터 상황정보(331)를 제공받아 컨텍스트(332)를 결정함으로써 CAS(320)가 서비스를 제공하도록 요청한다. 따라서 센서는 객체지향 미들웨어의 클라이언트 객체이며, CAS는 서버 객체이다. 일반 객체지향 미들웨어와 달리 상황인지 서비스 프레임워크에서는 서버 객체(CAS)가 제공하는 컨텍스트를 결정함

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으로써 서버 객체(CAS)를 사용한다. 즉, 클라이언트 객체(센서)와 서버 객체(CAS)는 클라이언트 객체가 제공하는 상황정보(331)와 서버 객체가 요청한 컨텍스트(332)에 의해서 연결된다. 상황정보를 근거로 컨텍스트가 결정될 때, 클라이언트 객체(310)는 서버 객체(320)를 사용하는 것이다.

컨텍스트는 단순히 하나의 센서가 제공하는 상황정보에 의해 결정된다기 보다는 다수의 센서들이 제공하는 상황정보와 동작 환경에 관한 지식(동작 환경에 관한 정보, 일반상식, 사용자의 성향 등)에 의해서 결정된다. 즉, 상황인지 서비스 프레임워크(330)에서 센서와 CAS는 센서가 제공하는 상황정보와 CAS가 요구하는 컨텍스트 사이의 결정에 따르는 느슨한 연결 구조를 가진다.

도 4는 본 발명의 실시예에 따른 상황인지 서비스 프레임워크(Context-Aware Service Framework)의 동작 순서를 보여주는 도면이다.

상황인지 서비스 프레임워크에서 상황인지 서비스 어플리케이션은 CAS와 센서의 복합체를 의미한다. 상황인지 서비스 어플리케이션은 다수의 센서를 포함할 수도 있고, 센서를 포함하지 않을 수도 있다. 마찬가지로, 상황인지 서비스 어플리케이션은 다수의 CAS를 포함할 수도 있고, CAS를 포함하지 않을 수도 있다.

상황인지 서비스 프레임워크의 동작 순서는 다음과 같다.

상황인지 서비스 어플리케이션은 상황인지 서비스 프레임워크에 CAS를 등록(S410)한다. 이때, CAS의 컨텍스트를 등록한다. 상황인지 서비스 어플리케이션은 상황인지 서비스 프레임워크에 센서를 등록(S420)한다. 이때, 센서는 자신이 관측하는 상황정보가 무엇인지 등록한다. CAS와 센서가 등록되면 상황인지 서비스 프레임워크는 센서를 동작시켜 관측된 상황정보를 획득(S430)하고, 관측된 상황정보를 근거로 컨텍스트를 검사(S440)한다. 컨텍스트가 결정되는 CAS에 대해서 서비스를 요청(S450)하게 된다. 도4에 도시된 동작 순서와 같이 CAS와 센서는 상황인지 서비스 프레임워크에 의해 제어되며, 컨텍스트에 의하여 CAS와 센서가 연결된다.

도 5는 본 발명의 실시예에 따른 상황인지 서비스(Context-Aware Service) 제공 장치의 구성을 보여주는 도면이다.

본 발명의 실시예에 따른 상황인지 서비스 제공 장치(500)는 크게 센서 관리 모듈(510), CAS 관리 모듈(520), 컨텍스트 관리 모듈(530)로 구성된다.

본 실시예에서 사용되는 "모듈"이라는 용어는 소프트웨어 또는 FPGA또는 ASIC과 같은 하드웨어 구성요소를 의미하며, 모듈은 어떤 역할들을 수행한다. 그렇지만 모듈은 소프트웨어 또는 하드웨어에 한정되는 의미는 아니다. 모듈은 어드레싱할 수 있는 저장 매체에 있도록 구성될 수도 있고 하나 또는 그 이상의 프로세서들을 재생시키도록 구성될 수도 있다. 따라서, 일 예로서 모듈은 소프트웨어 구성요소들, 객체지향 소프트웨어 구성요소들, 클래스 구성요소들 및 태스크 구성요소들과 같은 구성요소들과, 프로세스들, 함수들, 속성들, 프로시저들, 서브루틴들, 프로그램 코드의 세그먼트들, 드라버들, 펌웨어, 마이크로코드, 회로, 데이터, DB, 데이터 구조들, 테이블들, 어레이들, 및 변수들을 포함한다. 구성요소들과 모듈들 안에서 제공되는 기능은 더 작은 수의 구성요소들 및 모듈들로 결합되거나 추가적인 구성요소들과 모듈들로 더 분리될 수 있다. 뿐만 아니라, 구성요소들 및 모듈들은 디바이스 또는 보안 멀티미디어카드 내의 하나 또는 그 이상의 CPU들을 재생시키도록 구현될 수도 있다.

센서 관리 모듈(510)은 센서에 관한 정보를 관리한다. 센서에 관한 정보는 센서의 식별자, 센서의 상태정보, 센서의 통신방법, 또는 센서가 관측할 상황정보에 관한 정보 등을 포함한다. 센서의 상태는 상황정보를 관측하는 사용 상태와 상황인지 서비스 프레임워크로부터 관측 요청을 기다리는 미사용 상태로 나뉘어질 수 있다. 센서의 상태에 관한 상세한 설명은 도 9에서 후술하도록 한다. 센서가 관측할 상황정보(Knowledge)에 관한 정보는 온도, 습도 등 센서가 관측할 정보가 무엇인지를 나타낸다. 센서에 관한 정보는 센서 레포지토리(Repository)(511)라는 저장소에 저장될 수 있다.

센서 관리 모듈(510)은 새로운 센서가 추가되는 경우 센서에 관한 정보를 센서 레포지토리에 등록하고, 등록된 센서가 제거되면 그 센서에 관한 정보를 센서 레포지토리에서 삭제한다. 또한, 센서가 관측할 상황정보를 변경하거나, 센서의 이름을 설정 또는 변경하거나, 센서에 관한 정보를 제공하거나, 특정 조건에 해당하는 센서를 검색하는 역할을 수행한다.

CAS 관리 모듈(520)은 CAS에 관한 정보 및 CAS에 의해 정의된 컨텍스트를 관리한다. 또한, 컨텍스트를 컨텍스트 관리 모듈(530)에 제공한다. CAS에 관한 정보란 CAS의 식별자, CAS의 상태정보 또는 CAS의 통신방법에 관한 정보 등을 포함

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한다. CAS의 상태는 대기 상태, 활성 상태, 서비스 상태로 나뉘어질 수 있다. CAS의 상태에 관한 상세한 설명은 도 11에서 후술하도록 한다. CAS에 관한 정보는 CAS 레포지토리(521)라는 저장소에 저장될 수 있다. 컨텍스트는 컨텍스트 레포지토리(522)라는 저장소에 저장될 수 있다.

CAS 관리 모듈(520) 새로운 CAS가 추가되는 경우 그 CAS에 대한 정보 및 컨텍스트를 등록하고, 등록된 CAS가 제거되는 경우 그에 해당하는 컨텍스트 및 CAS에 대한 정보를 삭제한다. 또한, 컨텍스트를 변경하거나, CAS의 이름을 설정 또는 변경하거나, CAS에 관한 정보를 제공하거나, 특정 조건에 해당하는 CAS를 검색하는 역할을 한다.

컨텍스트 관리 모듈(530)은 센서 관리 모듈(510)에 의해 등록된 센서에 관한 정보에 따라 센서에 의해 관측된 상황정보를 관리하며, 상황정보가 CAS 관리 모듈(520)에 의해 제공된 컨텍스트를 만족시키는 경우, CAS 관리 모듈(520)에 해당 CAS를 알린다.

컨텍스트 관리 모듈(530)은 상황정보 레포지토리(531), 추론 엔진(Inference Engine)(532), 질의 프로세서(Query Processor)(533), 트리거 관리자(Trigger Manager)(534)를 포함한다. 상황정보 레포지토리(531)는 센서에 의해 관측된 상황정보를 저장하는 저장소이다.

컨텍스트 관리 모듈(530)은 센서로부터 상황정보를 제공받으면 이를 상황정보 레포지토리(531)에 저장한다. 상황정보 레포지토리(531)에는 센서가 제공하는 상황정보 뿐만 아니라 동작 환경에 관한 지식도 포함된다. 따라서 동작 환경이 변화하는 경우, 상황정보 레포지토리(531)에 동작 환경에 관한 적절한 정보를 제공함으로써 변화한 동작 환경에 적응할 수 있다.

추론 엔진(532)은 상황정보 레포지토리에 저장되어 있는 상황정보가 CAS 관리 모듈에 의해 제공된 컨텍스트를 만족시키는지 검사한다. 추론 엔진은 기존에 공개되어 있는 추론 엔진을 사용할 수 있다. 추론 엔진(532)이 컨텍스트를 검사하는 과정에서 필요한 상황정보는 질의 프로세서(533)가 상황정보 레포지토리에 질의(Query)를 던짐으로써 얻을 수 있다. 추론 엔진의 검사 결과 When-Context가 만족되는 시점에 Why-Context도 만족되면 트리거 관리자(534)가 CAS 관리 모듈(520)에 해당 CAS를 알린다.

도 6은 도 4에 도시된 상황인지 서비스 프레임워크(Context-Aware Service Framework)에 의한 서비스 제공 방법의 순서를 보다 상세하게 보여주는 흐름도이다.

CAS 관리 모듈(520)이 CAS에 관한 정보 및 CAS에 의해 정의된 컨텍스트를 등록(S610)하고, 센서 관리 모듈(510)이 센서에 관한 정보를 등록(S620)한다. 컨텍스트 관리 모듈(530)이 센서에 의해 관측된 상황정보를 제공받아 상황정보 레포지토리(531)에 저장(S630)한 후, 상황정보가 컨텍스트를 만족시키는지 판단(S640)한다. 상황정보가 컨텍스트를 만족시키면, 컨텍스트 관리 모듈(530)은 CAS 관리 모듈(520)에 해당 CAS 객체를 알리고(S650), CAS 관리 모듈(520)은 해당 CAS 객체에 서비스를 요청(S660)한다. 반대의 경우 서비스 제공 과정을 종료한다.

CAS를 등록하는 단계(S610)에서는, CAS 객체가 상황인지 서비스 프레임워크에 CAS의 등록을 요청하면, CAS 관리 모듈(520)이 CAS에 관한 정보를 CAS 레포지토리(521)에 등록한다. CAS 객체가 컨텍스트를 제공하면 CAS 관리 모듈(520)이 컨텍스트를 컨텍스트 레포지토리(522)에 저장한다.

센서를 등록하는 단계(S620)에서는, 센서 객체가 상황인지 서비스 프레임워크에 센서의 등록을 요청하면, 센서 관리 모듈(510)이 센서에 관한 정보를 센서 레포지토리(511)에 등록한다.

CAS와 센서가 모두 등록되고 나면, 컨텍스트 관리 모듈(530)이 센서 객체에 의해 관측된 상황정보를 제공받고, 이를 상황정보 레포지토리(531)에 저장(S630)한다. 컨텍스트 관리 모듈(530) 내의 추론 엔진이 상황정보가 컨텍스트를 만족시키는지 여부를 판단(S640)하는데, 판단과정에서 필요한 상황정보는 질의 프로세서(533)를 통하여 상황정보 레포지토리(531)로부터 획득한다. 상황정보가 컨텍스트를 만족시킨다고 판단되는 경우, 컨텍스트 관리 모듈(530) 내의 트리거 관리자(534)가 CAS 관리 모듈(520)에 컨텍스트가 만족된 CAS 객체를 알려준다(S650). 그러면 CAS 관리 모듈(520)은 해당 CAS 객체에 서비스를 요청(S660)한다.

동작 환경이 변화하는 경우, 상황정보 레포지토리에 동작 환경에 적절한 정보(Knowledge)를 제공함으로써 변화한 동작 환경에 적응할 수 있다. 또는 상황정보를 가공하는 CAS를 사용하여 동적인 동작 환경을 만들 수도 있다. 예를 들면,,

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CAS1이 컨텍스트1에 의해 서비스가 결정되고 서비스 결과로 상황정보를 제공한다고 가정하자. CAS1이 제공하는 상황정보가 CAS2가 요구하는 Context2를 결정하면 CAS2가 서비스를 제공한다. 따라서, 사용자가 바뀌는 등 동작 환경이 바뀔 때, CAS1을 변경함으로써 동작 환경에 적응적인 시스템이 될 수 있다.

도 7은 상황인지 서비스 프레임워크(Context-Aware Service Framework)에 의한 센서의 관리 방법을 보여주는 흐름도이다.

상황인지 서비스 프레임워크가 센서로부터 등록 요청을 받으면(S710), 센서 관리 모듈(510)은 센서에 관한 정보를 센서 레포지토리(511)에 등록(S720)한다. 컨텍스트를 결정하기위하여 상황정보가 필요한지 살펴보아(S730), 상황정보가 필요한 경우 센서 관리 모듈(510)이 센서에 상황정보의 관측을 요청(S740)한다. 센서로부터 제거 요청을 받으면(S750), 센서 관리 모듈(510)은 센서 레포지토리(511)에서 센서에 관한 정보를 삭제함으로써 해당 센서를 제거(S760)한다. 상황정보가 필요하지 않은 경우, 센서로부터 제거 요청이 없는 한 상황정보의 관측이 필요할 때까지 센서를 계속 미사용 상태로 대기시킨다.

도 8은 본 발명의 실시예에 따른 센서(Sensor)의 동작 순서를 보여주는 흐름도이다.

센서가 종료 상태인지 살펴보아(S710) 종료 상태가 아니면 관측하는 상황정보가 변경되었는지 살펴본다(S720). 관측하는 상황정보가 변경되었으면 상황정보를 관측(S730)하고, 상황정보가 변경되지 않았으면 센서가 종료 상태가 될 때까지 계속 관측한다. 센서는 관측을 종료할 때까지 계속 관측한다. 이때, 관측하는 상황정보가 변경되었는가를 검사하는 단계(S720)와 상황정보를 관측하는 단계(S730)를 구분함으로써 관측의 효율성을 높일 수 있다.

도 9는 본 발명의 실시예에 따른 센서(Sensor)의 상태 변화를 보여주는 도면이다.

센서는 동작을 시작(910)하면 관측을 하기 전의 대기 상태에 해당하는 미사용 상태(920)가 된다. 센서가 상황정보의 관측을 시작하면 사용 상태(930)로 되고, 센서가 상황정보의 관측을 종료하면 사용 상태(930)에서 미사용 상태(920)로 변한다. 센서가 동작을 시작하면서 바로 상황정보를 관측하는 경우 시작 상태(910)에서 미사용 상태(920)를 거치지 않고 바로 사용 상태(930)로 전환될 수 있다. 센서가 동작을 중지하면 종료 상태(940)가 된다.

도 10은 상황인지 서비스 프레임워크(Context-Aware Service Framework)에 의한 상황인지 서비스 객체(Context-Aware Service object; 이하 CAS라 함)의 관리 방법을 보여주는 흐름도이다.

상황인지 서비스 프레임워크가 CAS로부터 등록 요청을 받으면(S1010), CAS 관리 모듈(520)은 CAS에 관한 정보 및 컨텍스트를 CAS 레포지토리(521) 및 컨텍스트 레포지토리(522)에 각각 등록(S1020)한다. 컨텍스트를 결정하기 위하여 필요한 상황정보를 관측할 수 있는 센서가 모두 등록되었는지 살펴보아(S1030), 필요한 센서가 모두 등록되어 있는 경우 컨텍스트 관리 모듈(530)이 상황정보가 컨텍스트를 만족시키는지 검사(S1040)한다. CAS로부터 제거 요청을 받으면(S1050), CAS 관리 모듈(520)은 컨텍스트 레포지토리(522)에서 해당 컨텍스트를 삭제하고 CAS 레포지토리(521)에서 CAS에 관한 정보를 삭제함으로써 해당 CAS를 제거(S1060)한다. 필요한 센서가 모두 등록되어 있지 않은 경우, CAS로부터 제거 요청이 없는 한 필요한 센서를 모두 확보할 때까지 CAS를 계속 대기시킨다.

도 11은 본 발명의 실시예에 따른 CAS 객체의 상태 변화를 보여주는 도면이다.

CAS 객체가 동작을 시작(1110)하면 대기 상태(1120) 또는 활성 상태(1130)가 된다. 대기 상태(1120)는 CAS 객체가 동작을 시작하였으나 컨텍스트를 검사하기에 충분한 센서가 확보되지 않은 경우의 상태를 의미한다. 컨텍스트를 검사하기 위해 필요한 모든 센서가 등록이 되면 CAS 객체는 활성 상태(1130)가 된다. 반면, 활성 상태(1130)에 있다가도 컨텍스트를 검사하기 위해 필요한 센서가 제거되면 대기 상태(1120)가 된다.

CAS 객체는 컨텍스트가 만족되어 서비스를 시작하면 활성 상태에서 서비스 상태(1140)로 전환된다. 서비스가 종료되면 다시 활성 상태(1130)로 변한다. CAS 객체가 동작을 중지하면 대기 상태(1120) 또는 활성 상태(1130)에서 종료 상태(1150)가 된다.

도 12는 상황인지 서비스 응용프로그램을 정의한 소스 코드의 일 실시예를 보여주는 도면이다.

도 12는 2개의 CAS(SamCAS1, SamCAS2)와 1개의 센서(SamSensor1)으로 구성된 SamAirCon이라는 상황인지 서비스 응용프로그램을 정의하고 있다. SamCAS1의 When-Context는 Warm으로 명시되어 있으며, 이는 상황정보 Warm이

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False에서 True로 변경될 때, SamCAS1의 서비스, 즉 에어컨의 작동(Cooling)이 개시된다는 것을 의미한다. SamCAS2는 온도(Temperature)가 25도 이상으로 올라가는 순간에 상황정보 Warm이 False이면, 상황정보 Warm을 True로 바꾼다는 것을 의미한다.

센서 SamSensor1은 온도(Temperature)를 상황정보로서 관측하여 제공하고, SamCAS2가 온도 상황정보가 25도 보다 높은 시점에 Warm 상황정보가 False이면 Warm 상황정보를 False로 바꾼다. SamCAS1은 SamCAS2에 의해 Warm 상황정보가 True가 되는 시점에 에어컨이 작동하고 있지 않으면 에어컨을 동작시키게 된다.

이상 첨부된 도면을 참조하여 본 발명의 실시예를 설명하였지만, 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자는 본 발명이 그 기술적 사상이나 필수적인 특징을 변경하지 않고서 다른 구체적인 형태로 실시될 수 있다는 것을 이해할 수 있을 것이다. 그러므로 이상에서 기술한 실시예들은 모든 면에서 예시적인 것이며 한정적이 아닌 것으로 이해해야만 한다.

발명의 효과

상기한 바와 같은 본 발명의 정보 제공 방법 및 장치에 따르면 다음과 같은 효과가 하나 혹은 그 이상 있다.

첫째, 클라이언트 객체와 서버 객체를 컨텍스트를 매개로 느슨하게 연결함으로써 동적으로 변화하는 상황에 적응적인 시스템을 구축할 수 있다는 장점이 있다.

둘째, 컨텍스트를 사용하여 여러 클라이언트 객체가 서버 객체를 공유할 수 있다는 장점도 있다.

셋째, 클라이언트 객체가 제공하는 상황정보를 공유함으로써 여러 서버 객체가 클라이언트 객체를 공유할 수 있다는 장점도 있다.

넷째, 클라이언트 객체와 서버 객체의 통일된 인터페이스를 제공할 수 있다는 장점도 있다.

(57) 청구의 범위

청구항 1.

CAS에 관한 정보 및 상기 CAS에 의해 정의된 컨텍스트를 관리하는 CAS 관리 모듈;

센서에 관한 정보를 관리하고, 상기 센서에 상황정보의 관측을 요청하는 센서 관리 모듈; 및

상기 관측된 상황정보가 상기 CAS 관리 모듈에 의해 제공된 컨텍스트를 만족시키는 경우, 상기 CAS 관리 모듈에 상기 컨텍스트를 정의한 CAS를 알리는 컨텍스트 관리 모듈을 포함하며,

상기 CAS 관리 모듈은 상기 컨텍스트 관리 모듈로부터 상기 CAS의 알림을 받은 경우 해당하는 CAS에 서비스를 제공하도록 요청하는 상황인지 서비스 제공 장치

청구항 2.

제 1항에 있어서,

상기 컨텍스트 관리 모듈은

상기 상황정보를 저장하는 상황정보 레포지토리;

상기 상황정보 레포지토리에 질의를 수행하는 질의 프로세서;

상기 상황정보가 상기 컨텍스트를 만족시키는지 결정하는 추론엔진; 및

상기 추론엔진의 결정에 따라 상기 CAS 관리 모듈에 해당 CAS를 알리는 트리거 프로세서를 포함하는 상황인지 서비스 제공 장치

청구항 3.

제 1항에 있어서,

상기 CAS에 관한 정보는

상기 CAS의 식별자, 상기 CAS의 상태정보 또는 상기 CAS의 통신방법에 관한 정보 중 적어도 하나를 포함하는 상황인지 서비스 제공 장치

청구항 4.

제 1항에 있어서,

상기 CAS에 관한 정보는

CAS 레포지토리에 저장되는 상황인지 서비스 제공 장치

청구항 5.

제 1항에 있어서,

상기 센서에 관한 정보는

상기 센서의 식별자, 상기 센서의 상태정보, 상기 센서의 통신방법, 또는 상기 센서가 관측할 상황정보에 관한 정보 중 적어도 하나를 포함하는 상황인지 서비스 제공 장치

청구항 6.

제 1항에 있어서,

상기 센서에 관한 정보는

센서 레포지토리에 저장되는 상황인지 서비스 제공 장치

청구항 7.

제 1항에 있어서,

상기 컨텍스트는

컨텍스트 레포지토리에 저장되는 상황인지 서비스 제공 장치

청구항 8.

CAS에 관한 정보 및 상기 CAS에 의해 정의된 컨텍스트를 등록하는 단계;

센서에 관한 정보를 등록하는 단계;

상기 센서에 관한 정보에 따라 상기 센서에 의해 관측된 상황정보(Knowledge)를 상기 센서로부터 제공받는 단계;

상기 상황정보가 상기 컨텍스트를 만족시키는 경우, 상기 컨텍스트를 정의한 상기 CAS를 알리는 단계; 및

상기 CAS에 서비스를 요청하는 단계를 포함하는 상황인지 서비스(Context-Aware Service) 제공 방법

청구항 9.

제 8항에 있어서,

상기 CAS에 관한 정보는

상기 CAS의 식별자, 상기 CAS의 상태정보 또는 상기 CAS의 통신방법에 관한 정보 중 적어도 하나를 포함하는 상황인지 서비스 제공 방법

청구항 10.

제 8항에 있어서,

상기 센서에 관한 정보는

상기 센서의 식별자, 상기 센서의 상태정보, 상기 센서의 통신방법, 또는 상기 센서가 관측할 상황정보에 관한 정보 중 적어도 하나를 포함하는 상황인지 서비스 제공 방법

청구항 11.

센서로부터 등록 요청을 받는 단계;

상기 등록 요청에 따라 센서에 관한 정보를 등록하는 단계;

상기 센서가 관측할 상황정보가 필요한 경우, 상기 센서에 상기 상황정보의 관측을 요청하는 단계;

상기 센서로부터 제거 요청을 받는 단계; 및

상기 제거 요청에 따라 상기 센서에 관한 정보를 제거하는 단계를 포함하는 상황인지 서비스 제공 방법

청구항 12.

제 11항에 있어서,

상기 센서에 관한 정보는

상기 센서의 식별자, 상기 센서의 상태정보, 상기 센서의 통신방법, 또는 상기 센서가 관측할 상황정보에 관한 정보 중 적어도 하나를 포함하는 상황인지 서비스 제공 방법

청구항 13.

CAS로부터 등록 요청을 받는 단계;

상기 등록 요청에 따라 상기 CAS에 관한 정보 및 상기 CAS에 의해 제공된 컨텍스트를 등록하는 단계;

상기 컨텍스트를 결정하기 위해 필요한 센서가 등록되어 있는 경우, 상기 센서에 의해 제공된 상황정보가 상기 컨텍스트를 만족시키는지 검사하는 단계;

상기 CAS로부터 제거 요청을 받는 단계; 및

상기 제거 요청에 따라 상기 CAS에 관한 정보 및 상기 컨텍스트를 제거하는 단계를 포함하는 상황인지 서비스 제공 방법

청구항 14.

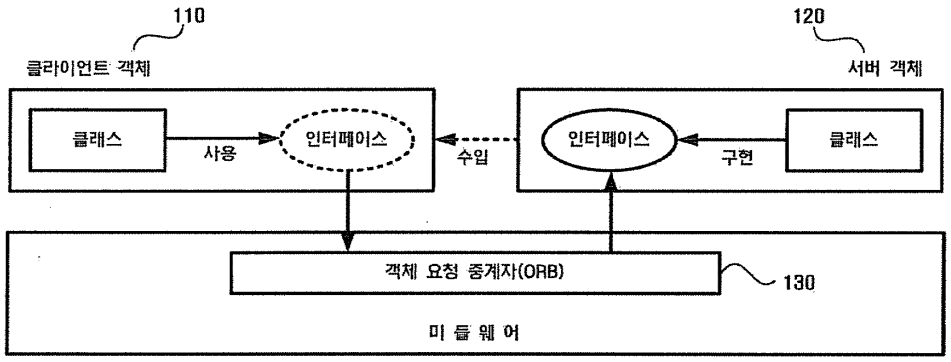
제 13항에 있어서,

상기 CAS에 관한 정보는

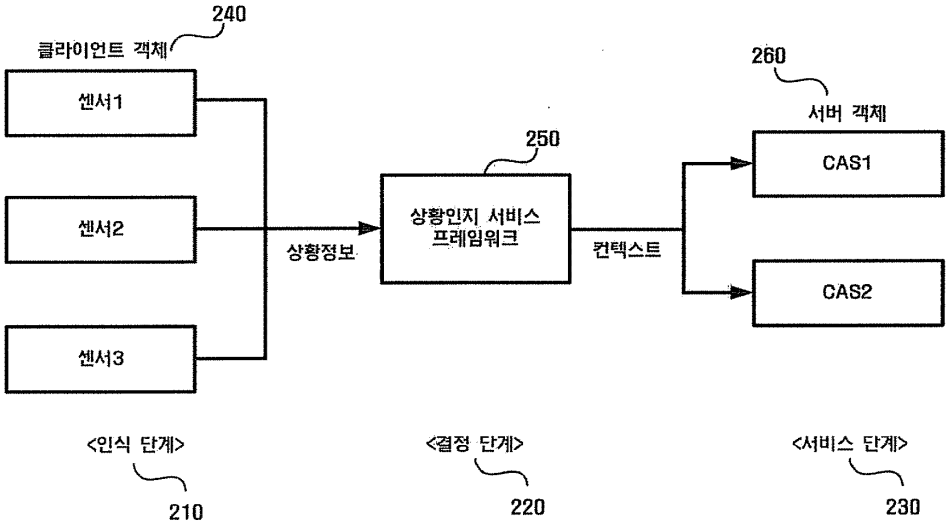
상기 CAS의 식별자, 상기 CAS의 상태정보 또는 상기 CAS의 통신방법에 관한 정보 중 적어도 하나를 포함하는 상황인지 서비스 제공 방법

도면

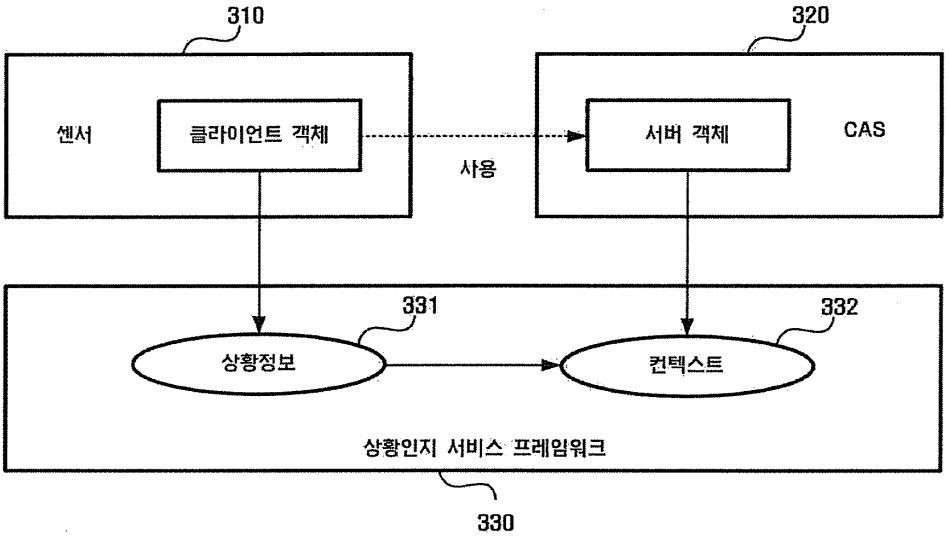
도면1



도면2

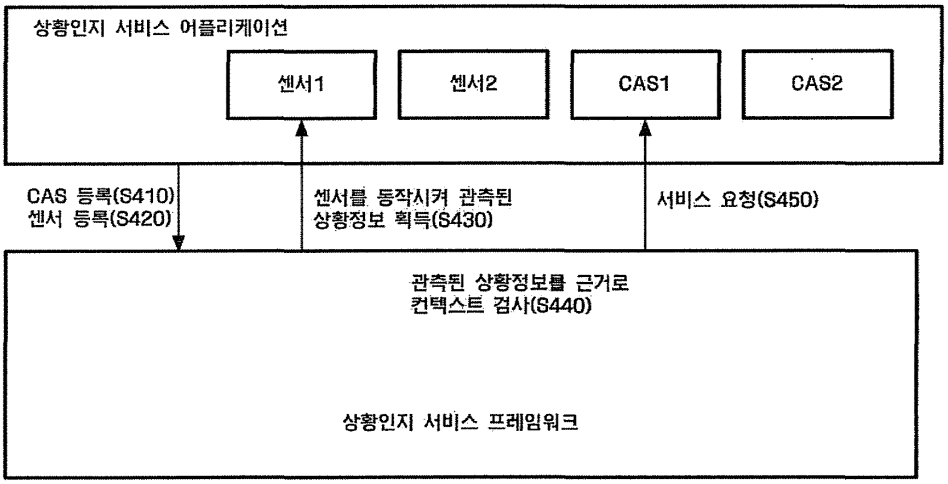


도면3

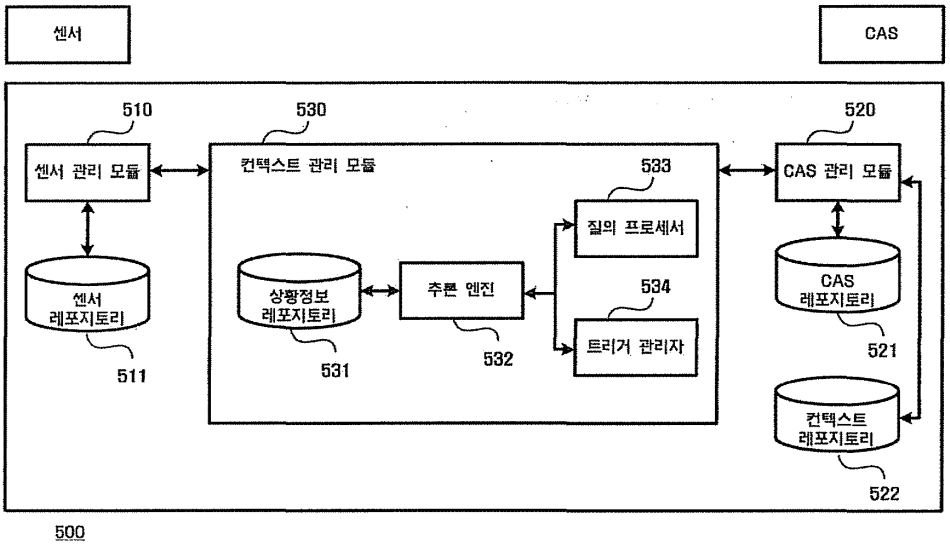


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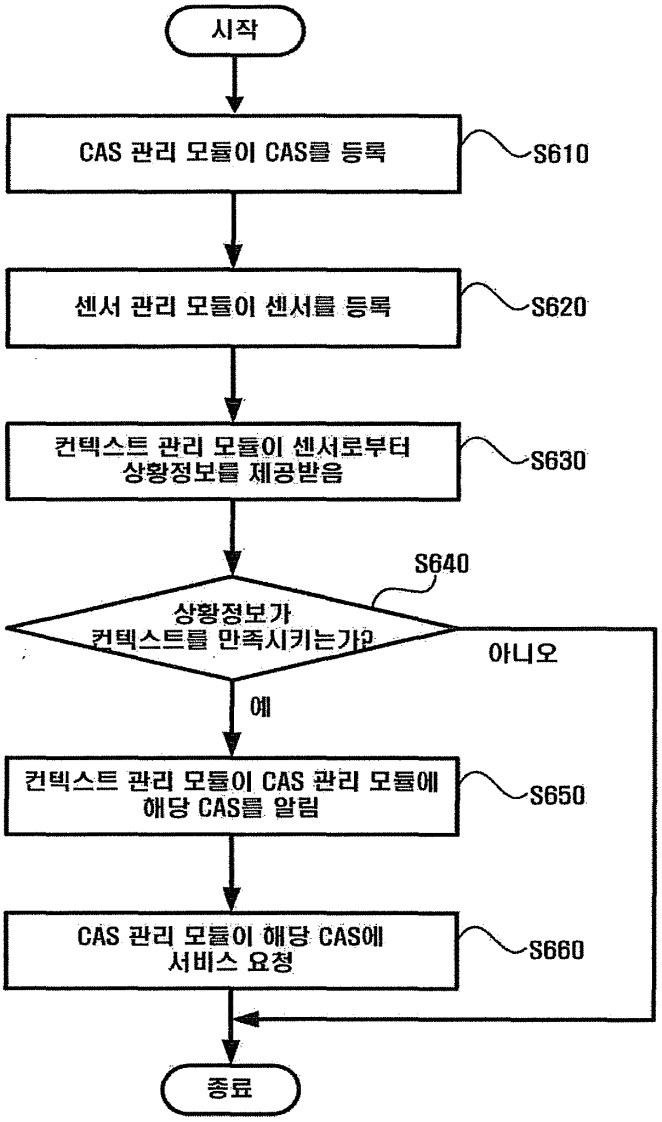
도면4


상황인지 서비스 어플리케이션
센서1
센서2
CAS1
CAS2
CAS 등록(S410)
센서 등록(S420)
센서를 동작시켜 관측된
상황정보 획득(S430)
서비스 요청(S450)
관측된 상황정보를 근거로
컨텍스트 검사(S440)
상황인지 서비스 프레임워크

도면5

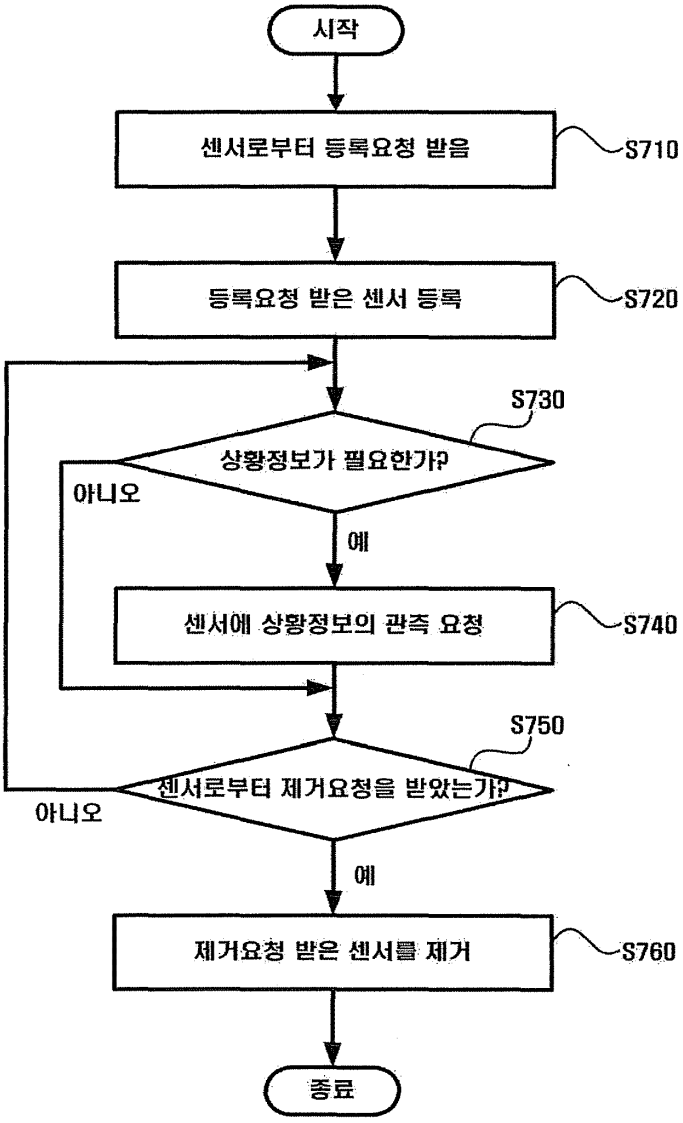

센서
CAS
510
530
520
센서 관리 모듈
컨텍스트 관리 모듈
533
CAS 관리 모듈
질의 프로세서
센서
레포지토리
511
상황정보
레포지토리
531
추론 엔진
532
534
트리거 관리자
CAS
레포지토리
521
컨텍스트
레포지토리
522
500

도면6

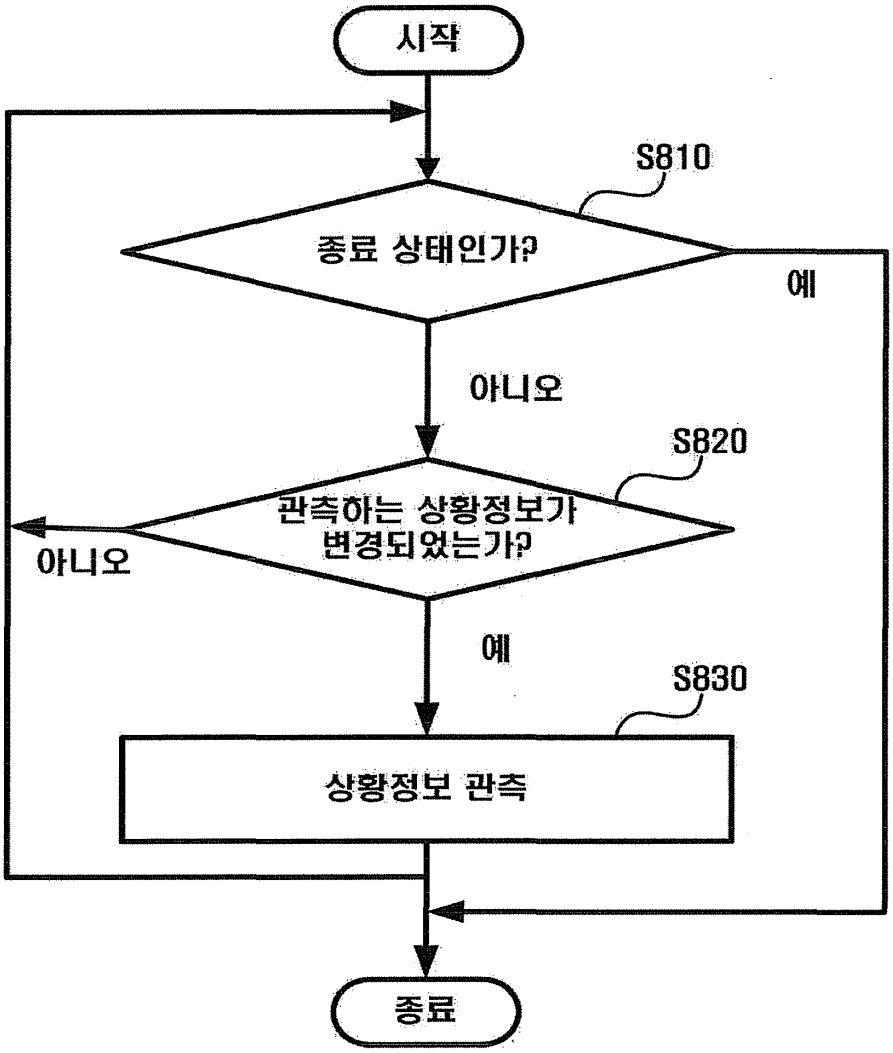


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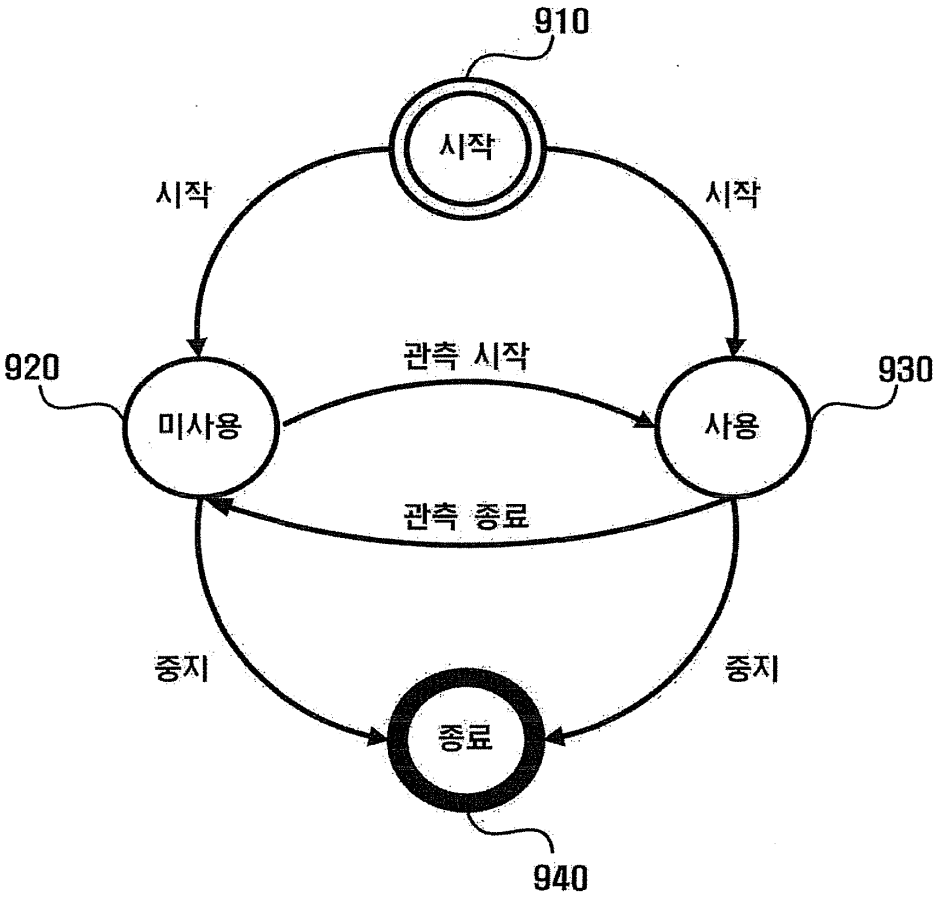
도면7


시작
센서로부터 등록요청 받음
S710
등록요청 받은 센서 등록
S720
S730
상황정보가 필요한가?
아니오
예
센서에 상황정보의 관측 요청
S740
S750
센서로부터 제거요청을 받았는가?
아니오
예
제거요청 받은 센서를 제거
S760
종료

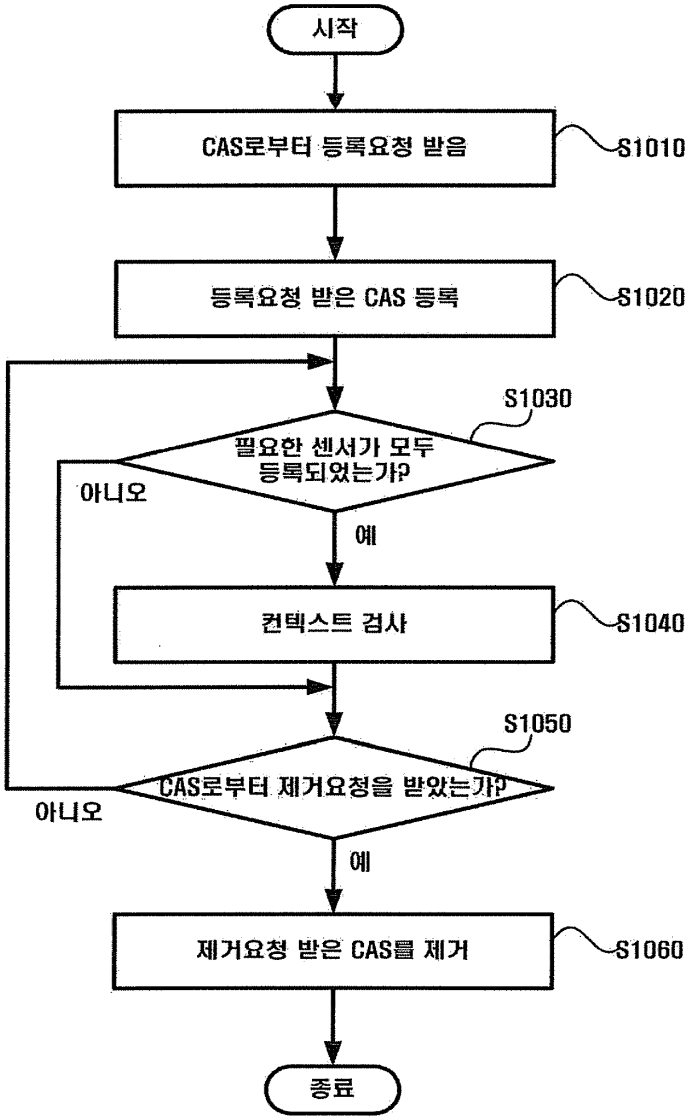
도면8


시작
S810
종료 상태인가?
예
아니오
S820
관측하는 상황정보가
변경되었는가?
아니오
예
S830
상황정보 관측
종료

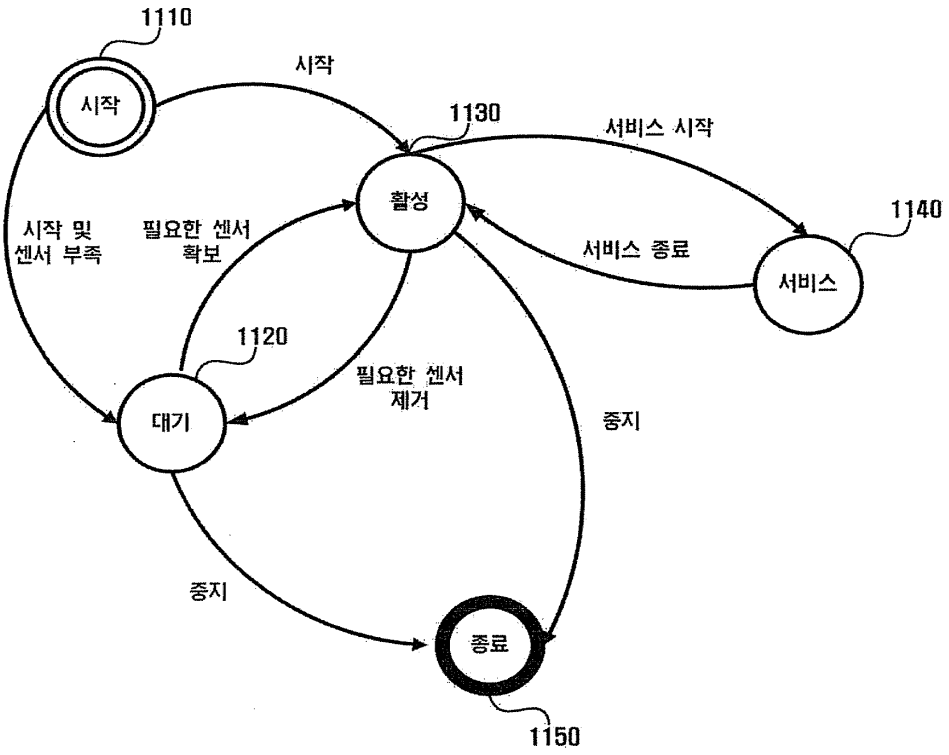
도면9



도면10


시작
CAS로부터 등록요청 받음
S1010
등록요청 받은 CAS 등록
S1020
S1030
필요한 센서가 모두 등록되었는가?
아니오
예
컨텍스트 검사
S1040
S1050
CAS로부터 제거요청을 받았는가?
아니오
예
제거요청 받은 CAS를 제거
S1060
종료

도면11



도면12

```
[Application]
Name=SamAirCon

[CAS]
Name=SamCAS1
When-Context=Warm
Why-Context=not Cooling
Action=Cooling

[CAS]
Name=SamCAS2
When-Context=Temperature > 25
Why-Context=not Warm
Action=Warm

[Sensor]
Name=SamSensor1
Observation=Temperature
```

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME
First Named Inventor/Applicant Name:	Se-Won OH
Filer:	Randall J. Beckers/Chisty Hussain
Attorney Docket Number:	2044.1022

Filed as Small Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Basic National Stage Fee	2631	1	165	165
Natl Stage Search Fee - Report provided	2642	1	215	215
Natl Stage Exam Fee - all other cases	2633	1	110	110
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**490**

Electronic Acknowledgement Receipt

EFS ID:	4877045
Application Number:	12439421
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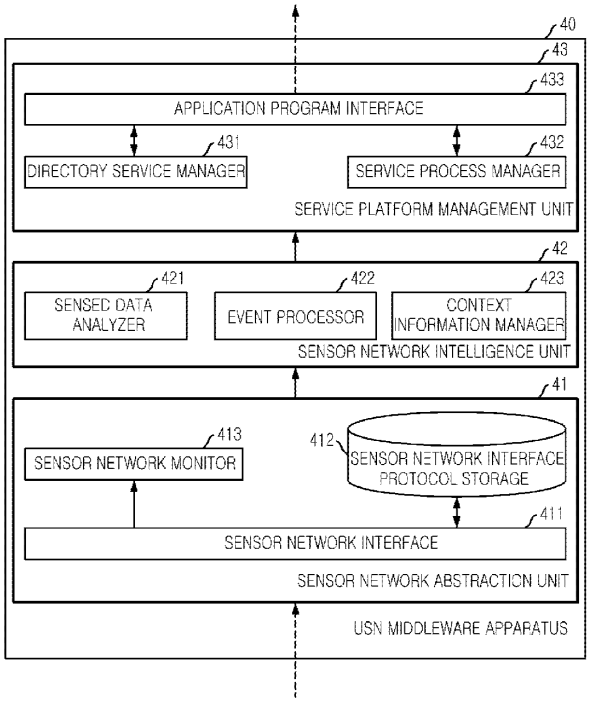
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(54) Title: USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME



(57) Abstract: Provided are a Ubiquitous Sensor Network (USN) middleware apparatus and method for generating an information service based on heterogeneous sensor networks and a system for providing the information service using the same. In the system, a sensor node constructing a sensor network senses environment information, and a sensor network data transmitter collects sensed data sensed by the sensor node in real-time and transmits the collected sensed data in a message form. A USN middleware extracts object and environment information by cleaning, classifying and integrating the message received from the sensor network data transmitter, generates conditional events and context aware information from the extracted object and environment information, and provides the information service to an application program, the application program providing a user with information related to environment where the sensor network observes.

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Description

USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

Technical Field

[1] The present invention relates to a Ubiquitous Sensor network (USN) middleware apparatus and method for generating information based on data transmitted from heterogeneous sensor networks and a system for providing the information service using the same; and, more particularly, to a USN middleware apparatus for collecting sensed data from sensor nodes of heterogeneous sensor networks, analyzing and processing sensed data, e.g., temperature, humidity, pressure, motion, and acceleration, generating events and context aware information, and providing the information to users through an application program, a method thereof, and an information service providing system employing the same.

Background Art

[2] When data sensed through sensor networks are used, an application program must directly process and integrate the sensed data in order to provide information to a user using a specific sensor network. This way requires a lot of manpower and is co st-consuming. In addition, as the number and kinds of sensor networks required for generating an information service increase, the application program must be modified and enlarged to meet a processing capability requirement with respect to a communication scheme, control protocol, functional features, and sensed data processing scheme of each sensor network. Furthermore, when the sensed data collected from the same sensor network is simultaneously used in one or more application programs, the control and communication cost of gateways and sensor networks increases, resulting in performance degradation of the sensor networks and reduction of power resources.

[3] In Ubiquitous Sensor Network (USN) environment, a plurality of sensor networks having different purposes and functions are expected to be installed or distributed in a wide area. Sensor nodes of each sensor network collect environment information in real-time while they are attached to objects, placed in a position, or in motion.

[4] In order for the application program to provide useful information service to the user, there is a need for a means that can abstract one or more heterogeneous sensor networks, generate events and context aware information by analyzing sensed data from a corresponding sensor network, and provide the generated information to the ap-

plication rapidly and conveniently. However, such a means does not exist at present.

Disclosure of Invention

Technical Problem

[5] It is, therefore, an objective of the present invention to provide a Ubiquitous Sensor Network (USN) middleware apparatus for collecting sensed data from sensor nodes of heterogeneous sensor networks, analyzing and processing sensed data, e.g., temperature, humidity, pressure, motion, and acceleration, generating events and context aware information, and providing the information to users through an application program, a method thereof, and an information service providing system employing the same.

Technical Solution

[6] In accordance with one aspect of the present invention, there is provided a system for offering an information service based on heterogeneous sensor networks, including: a sensor node constructing a sensor network to sense its ambient environment; a sensor network data transmitter for collecting sensed data sensed by the sensor nodes in real-time and transmitting the collected sensed data in a message form; and a Ubiquitous Sensor Network (USN) middleware for extracting object and environment information by cleaning, classifying and integrating the message received from the sensor network data transmitter, generating conditional events, context aware information, circumstantial analysis information, and the other relevant knowledge contents from the extracted object and environment information, and providing the information service to an application program, the application program providing a user with information related to environment where the sensor network observes or is installed.

[7] In accordance with another aspect of the present invention, there is provided a USN middleware apparatus for offering an information service based on heterogeneous sensor networks, including: a sensor network abstraction unit for extracting sensed data from a message received from a sensor network; a sensor network intelligence unit for extracting low-level information including the object properties and environment state information by performing an analysis operation to clean, classify and integrate the sensed data extracted by the sensor network abstraction unit, and generating high-level information including conditional events, context aware information, and circumstantial analysis information from the extracted low-level information; and a service platform management unit for providing the information to the application program in a form suitable for the application program.

[8] In accordance with another aspect of the present invention, there is provided a method for generating an information service based on heterogeneous sensor networks in a USN middleware apparatus, including the steps of: a) extracting sensed data and

monitoring a state management of a sensor network, based on the extracted sensed data; b) performing an analysis operation to clean, classify and integrate the extracted sensed data; c) extracting object and environment information from the analyzed sensed data, and generating context aware information and circumstantial analysis information based on the extracted object and environment information; d) generating conditional events according to a rule set by an application program; e) scheduling an operation sequence for providing an information service to the application program; and f) providing the application program with the information service obtained according to the scheduled operation sequence, the information service including conditional events, context aware information, and circumstantial analysis information.

[9] In accordance with another aspect of the present invention, the USN middleware apparatus processes and manages a large amount of sensed data collected from the heterogeneous sensor networks between the senor network and the application program, generates the real-time events and context aware information related to the environment condition by analyzing the collected sensed data, and provides the information service suitable for the application program. Therefore, a plurality of sensor networks can be utilized more easily in the USN environment.

[10] In addition, the interface with a plurality of sensor networks can be supported in the present invention. Therefore, information service about a specific position can be provided by analyzing the sensed data from a corresponding sensor network, while high-level information such as context aware information and conditional events about a wide area also can be provided by analyzing the sensed data collection obtained from the relevant multiple sensor networks.

Advantageous Effects

[11] According to the present invention, the sensor nodes automatically collect the changing environment conditions in real-time and the operation states of the sensor networks are continuously monitored, thereby increasing the effectiveness and reliability of the information service remarkably. The data sensed by one or more heterogeneous sensor networks having sensor nodes and gateways are processed into the information service of a USN middleware apparatus, and the processed information service is effectively provided to a plurality of application programs. Therefore, utilization of the information service based on the sensor networks can be improved and the application program can be easily developed and expanded.

Brief Description of the Drawings

[12] The above and other objectives and features of the present invention will become apparent from the following description of the preferred embodiments given in conjunction with the accompanying drawings, in which:

[13] Fig. 1 illustrates a system for providing an information service based on sensed data collected from heterogeneous sensor networks in accordance with an embodiment of the present invention;

[14] Fig. 2 is a block diagram of a system for providing an information service based on sensed data transmitted from heterogeneous sensor networks in accordance with an embodiment of the present invention;

[15] Fig. 3 is a block diagram of a Ubiquitous Sensor Network (USN) middleware apparatus in accordance with an embodiment of the present invention;

[16] Fig. 4 is a flowchart describing a method for providing an information service based on sensed data transmitted from heterogeneous sensor networks in accordance with an embodiment of the present invention; and

[17] Fig. 5 is a flowchart illustrating a method for operating a USN middleware apparatus in accordance with an embodiment of the present invention.

Best Mode for Carrying Out the Invention

[18] Other objectives and aspects of the present invention will become apparent from the following description of the embodiments with reference to the accompanying drawings, which is set forth hereinafter.

[19] Fig. 1 illustrates a system for providing an information service based on sensed data transmitted from heterogeneous sensor networks in accordance with an embodiment of the present invention.

[20] Referring to Fig. 1, the system for providing the information service based on the heterogeneous sensor networks in accordance with the embodiment of the present invention includes sensor nodes 10, sensor networks 20, gateways 30, a USN middleware apparatus 40, and application programs 50. The sensor nodes 10 sense environment information, and the sensor network 20 connects the sensor nodes 10 in order to wirelessly transfer data sensed at the sensor nodes 10 in real-time between the sensor nodes 10. The gateway 30 collects the data sensed by the sensor network 20 and transfers the collected data to the USN middleware apparatus 40. The USN middleware apparatus 40 stores, cleans, classifies and integrates the sensed data of the heterogeneous sensor networks 20, which are received through the gateways 30, and extracts low-level information, i.e., object properties and environment state information. Then, the USN middleware apparatus 40 provides an information service by generating high-level information, i.e., conditional events, context aware information, and circumstantial analysis information from the extracted low-level information. Using the information from the USN middleware apparatus 40 including both the low-level and high-level information, the application program provides the user with information related to the environment where the sensor network 20 observes.

[21] The sensor nodes 10 can sense at least one of ambient temperature, ambient humidity, vibration, light, pressure, and motion. The sensor nodes 10 configure the sensor network 20 through a short-range wireless communication and the sensed data of the sensor nodes 10 are collected at the gateway 30. The gateway 30 transfers the sensed data to the USN middleware apparatus 40 through Transmission Control Protocol/Internet Protocol (TCP/IP) data transmission. Using the sensed data, the USN middleware apparatus 40 can monitor the environment observed by the sensor network 20, and control the sensor network 20. In addition, the USN middleware apparatus processes the sensed data to generate events and context aware information desired by the application program 50, and provides the information to the application program.

[22] Fig. 2 is a block diagram of the system for providing the information service based on sensed data transmitted from heterogeneous sensor networks in accordance with an embodiment of the present invention.

[23] Referring to Fig. 2, the sensor node 10 includes a sensing unit for detecting a variety of information about environment such as temperature, humidity, heat, and infrared rays and generating sensed data.

[24] The sensor nodes 10 are appropriately arranged, considering function and performance of the sensing units 11 and wireless communication range. At this point, it should be noted that the sensor nodes 10 must be able to transfer data to the gateway 30 through the wireless communication. In the sensor network 20, the number and the structure of the sensor nodes 10 can be divergent according to either the given environmental properties or the specific purpose of an application.

[25] The gateway 30 includes a sensor network data transmitting unit 31 for receiving the sensed data, which are sensed in real-time by the sensing unit 11 of each sensor node 10, through the wireless communication between the sensor nodes 10 of the sensor network 20, collecting the received sensed data, and transferring the collected sensed data to the USN middleware apparatus 40 in a message form.

[26] The USN middleware apparatus 40 includes a sensor network abstraction unit 41, a sensor network intelligence unit 42, and a service platform management unit 43. The sensor network abstraction unit 41 extracts the sensed data from the message received from the gateway 30. The sensor network intelligence unit 42 extracts the object properties and the environment state information by performing an analysis operation to clean, classify and integrate the sensed data extracted by the sensor network abstraction unit 41, and generates conditional events, context aware information, and the other knowledge contents such as circumstantial analysis information. The service platform management unit 43 provides the results processed by the sensor network intelligence unit 42 to the application program 50 in a form suitable for the application program 50. The processed results include both the extracted information including the

object properties and the environment state information, and the generated information including conditional events, context aware information, and circumstantial analysis information. The service platform management unit 43 can also provide an information selection and interface function based on a plurality of heterogeneous sensor networks, which is required by the application program 50.

[27] The application program 50 includes an information service receiving unit 51 for receiving the information from the USN middleware apparatus 40.

[28] Hereinafter, operations of the sensor node 10, the sensor network 20, the gateway 30, the USN middleware apparatus 40, and the application program 50 will be described. The sensor node 10 transfers the data sensed in real-time by the sensing unit 11 to the gateway 30 through the wireless communication of the sensor network 20. The gateway 30 collects the sensed data received from the sensor network 20 and transfers the collected sensed data to the USN middleware apparatus 40 through the sensor network data transmitting unit 31. The sensor network abstraction unit 41 of the USN middleware apparatus 40 extracts the sensed data from the message received from the gateway 30. The sensor network intelligence unit 42 generates conditional events, context aware information, and other knowledge contents by performing an analysis operation to clean, classify and integrate the sensed data extracted by the sensor network abstraction unit 41. The service platform management unit 43 provides the results processed by the sensor network intelligence unit 42 to the information service receiving unit 51 of the application program 50 in a form suitable for the application program 50. The processed results include the object and environment information, conditional events and context aware information, and circumstantial analysis information.

[29] In order to provide specific information required by the application program 50, the sensor network intelligence unit 42 classifies the sensed data collected by the sensor nodes 10 of the sensor network 20 and generates conditional events, i.e., notification of a specific error and alarm of crucial state, and context aware information, i.e., detection of invasion and the best position for arousing customers' interest. In order to generate more relevant information, the sensor network intelligence unit 42 may use a predetermined rule set by the application program 50. The service platform management unit 43 transfers the information to the application program 50 in a message form suitable for the application program 50.

[30] Table 1 below shows examples of the sensed data collected by the sensor network 20, the sensed data analyzed by the USN middleware apparatus 40, and conditional events and context aware information generated by the USN middleware apparatus 40.

[31] Table 1

Classification	Analysis of sensed data and generation of information	Description
Sensed data #1 collected by sensor network for an hour	15, 15, 14, 14, 12, 11	Temperature (℃) collected every 10 minutes
Sensed data #2 collected by sensor network for an hour	80, 90	Humidity (%) collected every 30 minutes
Sensed data analyzed by USN middleware apparatus	13.5	Average temperature for latest 1 hour
Conditional Events generated by USN middleware apparatus	Provide alarm ("low temperature: 13.5") for average temperature value	Application has already set a predetermined rule: alarm is generated to application program when average temperature for latest 1 hour is below 14℃
Context aware information generated by USN middleware apparatus	Provide an imminent report about the given position ("There is high probability of problem in the heating machine; Check gas leakage or breakdown of the electricity")	USN middleware found the related rule and contents from its internal storage, as following. 1) There is high probability that problem will occur in heating facility when average temperature is below 14℃, current humidity is 80%, and it is night. 2) The latest problem occurring in the heating machine was related to the gas leakage and power supply failure.

[32] Fig. 3 is a block diagram of the USN middleware apparatus in accordance with an embodiment of the present invention.

[33] Referring to Fig. 3, the sensor network abstraction unit 41 includes a sensor network interface 411, a sensor network interface protocol storage 412, and a sensor

network monitor 413. The sensor network interface 411 extracts the sensed data by referring to a message transfer protocol, and the sensor network interface protocol storage 412 manages the message transfer protocol. The sensor network monitor 413 performs a monitoring operation for a state management of the sensor network, based on the data received from the sensor network interface 411.

[34] The sensor network intelligence unit 42 includes a sensed data analyzer 421, an event processor 422, and a context information manager 423. The sensed data manager 421 performs an analysis operation to clean, classify and integrate the sensed data processed by the sensor network abstraction unit 41. The event processor 422 generates the events, i.e., notification and alarm about a certain condition, according to the rule set by the application program 50 and manages the generated events. The context information manager 423 senses and generates the context aware information based on the analyzed sensed data information as well as the context rule in store which are related with the object and environment.

[35] In order to generate the events, i.e., notification and alarm about a certain condition, and the context aware information, the sensor network intelligence unit 42 may analyze only the sensed data from a single specific sensor network, or analyze a combination of sensed data from a plurality of heterogeneous sensor networks, or analyze the sensed data from the sensor network in association with predefined legacy data.

[36] The service platform management unit 43 includes a directory service manager 431, a service process manager 432, and an application program interface 433. The directory service manager 431 identifies and searches resources of the sensor network 20. The service process manager 432 schedules and manages an operation order of the sensed data analyzer 421, the event processor 422, the context information manager 423, and the directory service manager 431. The application program interface 433 provides the application program 50 with the results processed by the sensor network monitor 413, the sensed data analyzer 421, the event processor 422, the context information manager 423, and the directory service manager 431 in the information service form suitable for the application program 50.

[37] The service platform management unit 43 may provide the information to the application program only once, or periodically provide the information during a request period of the application program, or provide the information at a specific time point when a requirement from the application program is satisfied.

[38] Fig. 4 is a flowchart illustrating a method for providing an information service based on sensed data transmitted from heterogeneous sensor networks in accordance with an embodiment of the present invention.

[39] Referring to Fig. 4, each of the sensor nodes 10 of the sensor network 20 senses the

sensed data related to the environment in step S401. In step S402, the sensor network 20 transmits the sensed data sensed by the sensor node 10 through the gateway 30 to the USN middleware apparatus 41 in a message form.

[40] The USN middleware apparatus 40 extracts the operation state of the sensor network 20 and the sensed data from the message received from the sensor network 20 in step S403, performs an analysis operation to clean, classify and integrate the extracted sensed data in step S404, extracts the object and environment information S405, and generates the events, i.e., notification and alarm about a certain condition, and the context aware information, according to the rule set by the application program 50 in step S406.

[41] The USN middleware apparatus 40 provides the information, i.e., the events and the context aware information, to the application program 50 in a form suitable for the application program.

[42] Through these procedures, the USN middleware apparatus 40 analyzes and processes the information desired by the application program 50 from the sensed data collected by the sensor network 20 and then provides the processed information to the application program 50.

[43] Fig. 5 is a flowchart illustrating a method for operating the USN middleware apparatus in accordance with an embodiment of the present invention.

[44] Referring to Fig. 5, in step S501, the sensor network monitor 413 of the sensor network abstraction unit 41 performs a monitoring operation for a state management of the sensor network based on the sensed data extracted through the sensor network interface 411.

[45] In step S502, the sensed data analyzer 421 of the sensor network intelligence unit 42 performs an analysis operation to clean, classify and integrate the sensed data processed by the sensor network abstraction unit 41. In step S503, the context information manager 423 of the sensor network intelligence unit 42 extracts object and environment information from the sensed data analyzed by the sensed data analyzer 421, and generates the context aware information, i.e., situation recognition information, based on the extracted object and environment information as well as the as the context rule in store which are related with the object and environment. In step S504, the event processor 422 of the sensor network intelligence unit 42 generates the events, i.e., notification and alarm about a certain condition, according to the rule set by the application program 50.

[46] In step S505, the service process manager 432 of the service platform management unit 43 schedules the operation order for providing the information to the application program 50 and provides the results processed based on the scheduled sequence by the sensor network monitor 413, the sensed data analyzer 421, the event processor 422,

and the context information manager 423 through the application program interface 433 to the application program 50.

[47] The methods in accordance with the embodiments of the present invention can be realized as programs and stored in a computer-readable recording medium that can execute the programs. Examples of the computer-readable recording medium include CD-ROM, RAM, ROM, floppy disks, hard disks, magneto-optical disks and the like.

[48] The present application contains subject matter related to Korean patent application No. 2006-0084353, filed with the Korean Intellectual Property Office on September 1, 2006, the entire contents of which is incorporated herein by reference.

[49] While the present invention has been described with respect to certain preferred embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

Claims

[1] A system for providing an information service based on heterogeneous sensor networks, comprising:
a sensor node constructing a sensor network to sense environment information;
a sensor network data transmitter for collecting sensed data sensed by the sensor in real-time and transmitting the collected sensed data in a message form; and
a Ubiquitous Sensor Network (USN) middleware for extracting object and environment information by cleaning, classifying and integrating the message received from the sensor network data transmitter, generating conditional events, context aware information, and knowledge contents from the extracted object and environment information, and providing the information service to an application program, the application program providing a user with information related to environment where the sensor network is installed.

[2] The system as recited in claim 1, wherein the ubiquitous sensor network middleware comprises:
a sensor network abstraction unit for extracting the sensed data from the message received from the sensor network data transmitter;
a sensor network intelligence unit for extracting the object and environment information by analyzing the sensed data extracted by the sensor network abstraction unit, and generating the conditional events including notification and alarm about a certain condition, and the context aware information from the extracted object and environment information; and
a service platform management unit for providing the events and the context aware information to the application program in a form suitable for the application program.

[3] The system as recited in claim 2, wherein the sensor network abstraction unit comprises:
a sensor network interface for extracting the sensed data by referring to a message transfer protocol;
a sensor network interface protocol storage for managing a rule for the message transfer protocol; and
a sensor network monitor for monitoring a state of the sensor network, based on the data received from the sensor network interface.

[4] The system as recited in claim 3, wherein the sensor network intelligence unit comprises:
a sensed data analyzer for performing an analysis operation to clean, classify and integrate the sensed data processed by the sensor network abstraction unit;

an event processor for generating the conditional events including notification and alarm according to a rule set by the application program and managing the generated events; and

a context information manager for sensing and generating the context aware information, based on the sensed data analyzed by the sensed data analyzer.

[5] The system as recited in claim 4, wherein the service platform management unit comprises:

a directory service manager for identifying and searching resources of the sensor network;

a service process manager for scheduling and managing an operation sequence of the sensed data analyzer, the event processor, the context information manager, and the directory service manager in order to obtain a desired information service according to the application program; and

an application program interface for providing the application program with the results processed by the sensor network monitor, the sensed data analyzer, the event processor, the context information manager, and the directory service manager in an information service form suitable for the application program.

[6] A Ubiquitous Sensor Network (USN) middleware apparatus for generating an information service based on heterogeneous sensor networks, comprising:

a sensor network abstraction unit for extracting sensed data from a message received from a sensor network;

a sensor network intelligence unit for extracting the object and environment information by performing an analysis operation to clean, classify and integrate the sensed data extracted by the sensor network abstraction unit, and generating an event, including notification and alarm, and context aware information from the extracted object and environment information; and

a service platform management unit for providing the event and the context aware information to the application program in a form suitable for the application program.

[7] The ubiquitous sensor network middleware apparatus as recited in claim 6, wherein the sensor network abstraction unit comprises:

a sensor network interface for extracting the sensed data by referring to a message transfer protocol;

a sensor network interface protocol storage for managing a rule for the message transfer protocol; and

a sensor network monitor for monitoring a state of the sensor network, based on the data received from the sensor network interface.

[8] The ubiquitous sensor network middleware apparatus as recited in claim 7,

wherein the sensor network intelligence unit comprises:
a sensed data analyzer for performing an analysis operation to clean, classify and integrate the sensed data processed by the sensor network abstraction unit;
an event processor for generating the event including the knowledge contents according to a rule set by the application program and managing the generated event; and
a context information manager for sensing and generating the environment condition information, based on the sensed data analyzed by the sensed data analyzer.

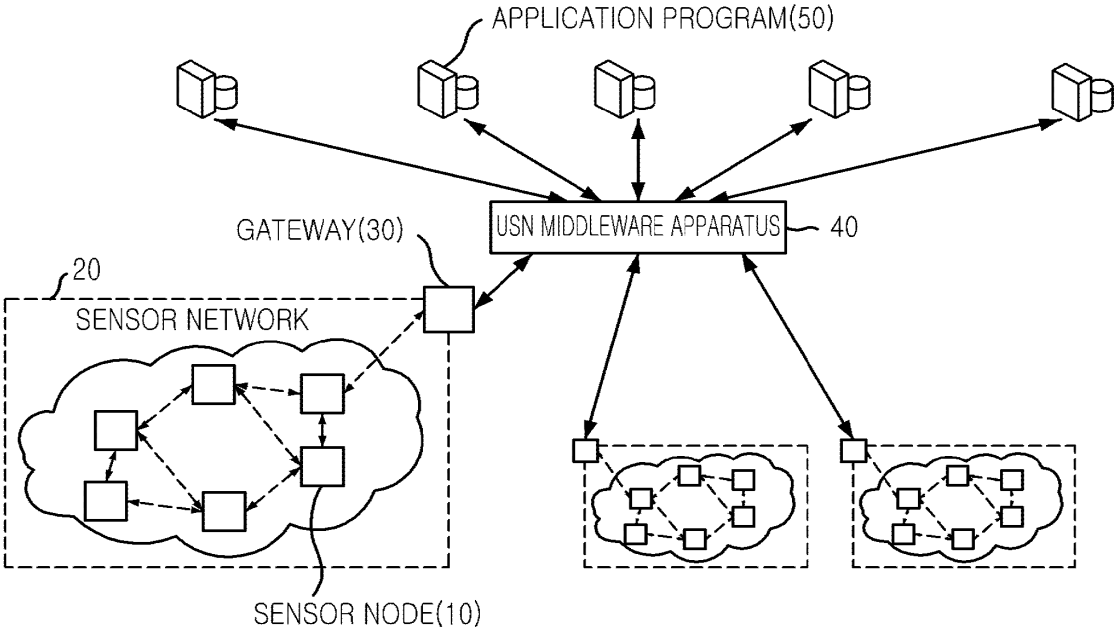
[9] The ubiquitous sensor network middleware apparatus as recited in claim 8, wherein the service platform management unit comprises:
a directory service manager for identifying and searching resources of the sensor network;
a service process manager for scheduling and managing an operation order of the sensed data analyzer, the event processor, the context information manager, and the directory service manager in order to obtain a desired information service according to the application program; and
an application program interface for providing the application program with the results processed by the sensor network monitor, the sensed data analyzer, the event processor, the context information manager, and the directory service manager in an information service form suitable for the application program.

[10] A method for generating an information service based on heterogeneous sensor networks in a ubiquitous sensor network middleware apparatus, comprising the steps of:
a) extracting sensed data and monitoring a state management of a sensor network, based on the extracted sensed data;
b) performing an analysis operation to clean, classify and integrate the extracted sensed data;
c) extracting the object and environment information from the analyzed sensed data, and generating context aware information based on the extracted object and environment information;
d) generating an event including notification event, alarm, and knowledge contents according to a rule set by an application program;
e) scheduling an operation sequence for providing an information service to the application program; and
f) providing the application program with the information service obtained according to the scheduled operation sequence, the information service including events and context aware information.

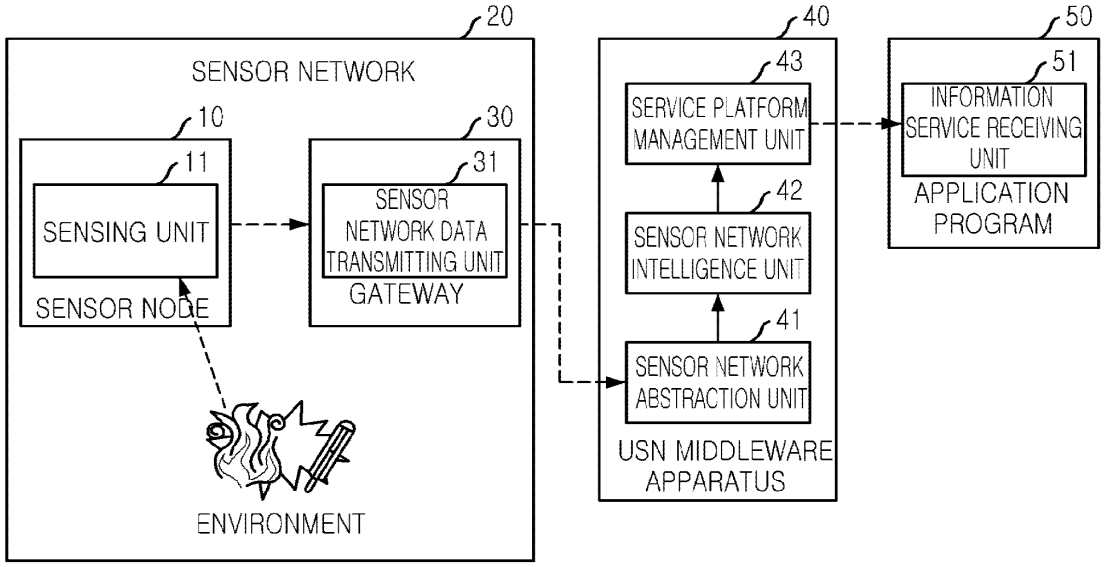
[11] The method as recited in claim 10, wherein the step b) analyzes sensed data from a specific single sensor network, or analyzes sensed data from a plurality of sensor networks, or analyzes sensed data from the sensor network in association with predefined legacy data.

[12] The method as recited in claim 10, wherein the step f) provides the information service to the application program only one time, or periodically provides the information service during a request period of the application program, or provides the information service at a specific time point when a requirement from the application program is satisfied.

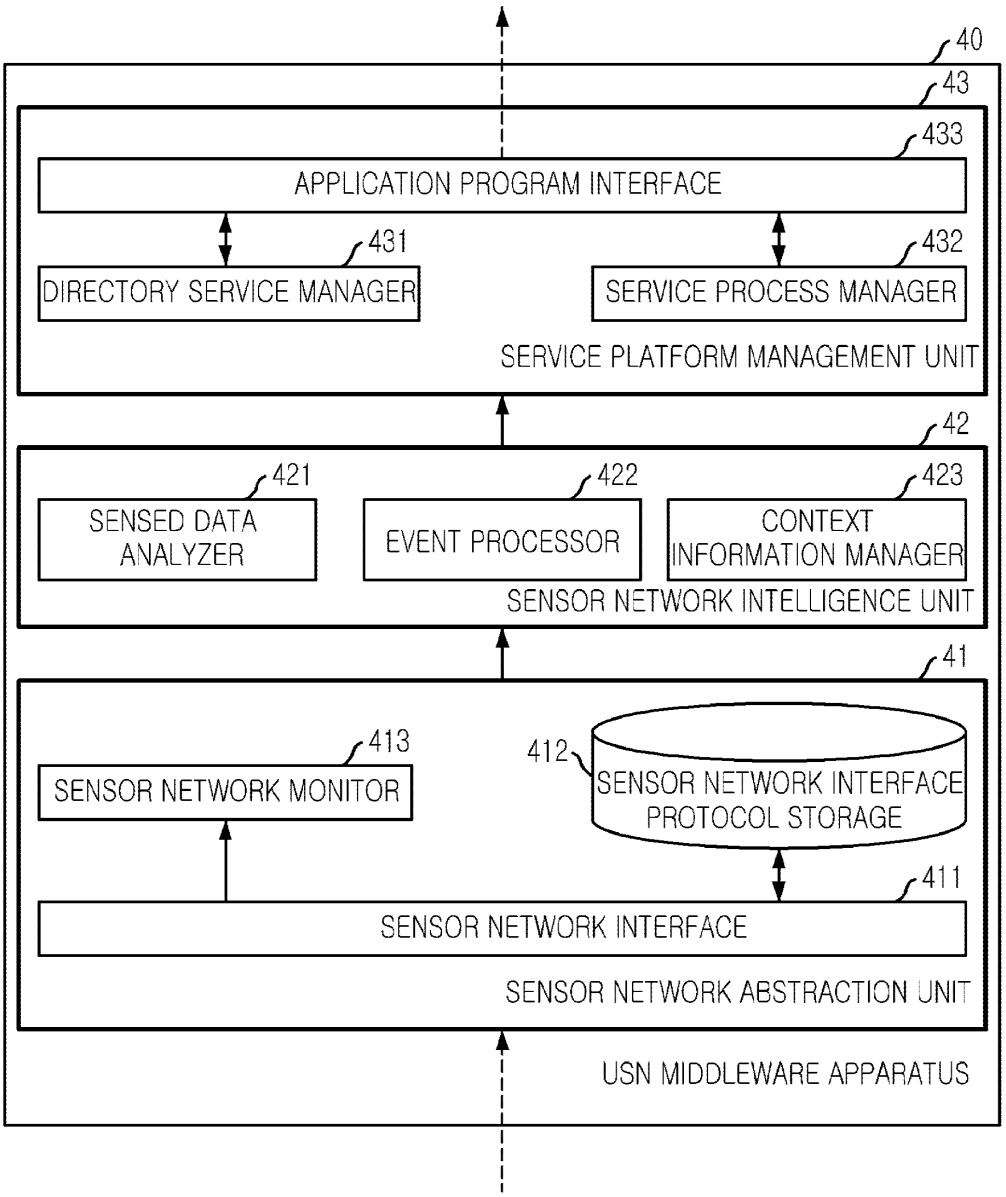
[Fig. 1]


APPLICATION PROGRAM(50)
USN MIDDLEWARE APPARATUS
40
GATEWAY(30)
20
SENSOR NETWORK
SENSOR NODE(10)

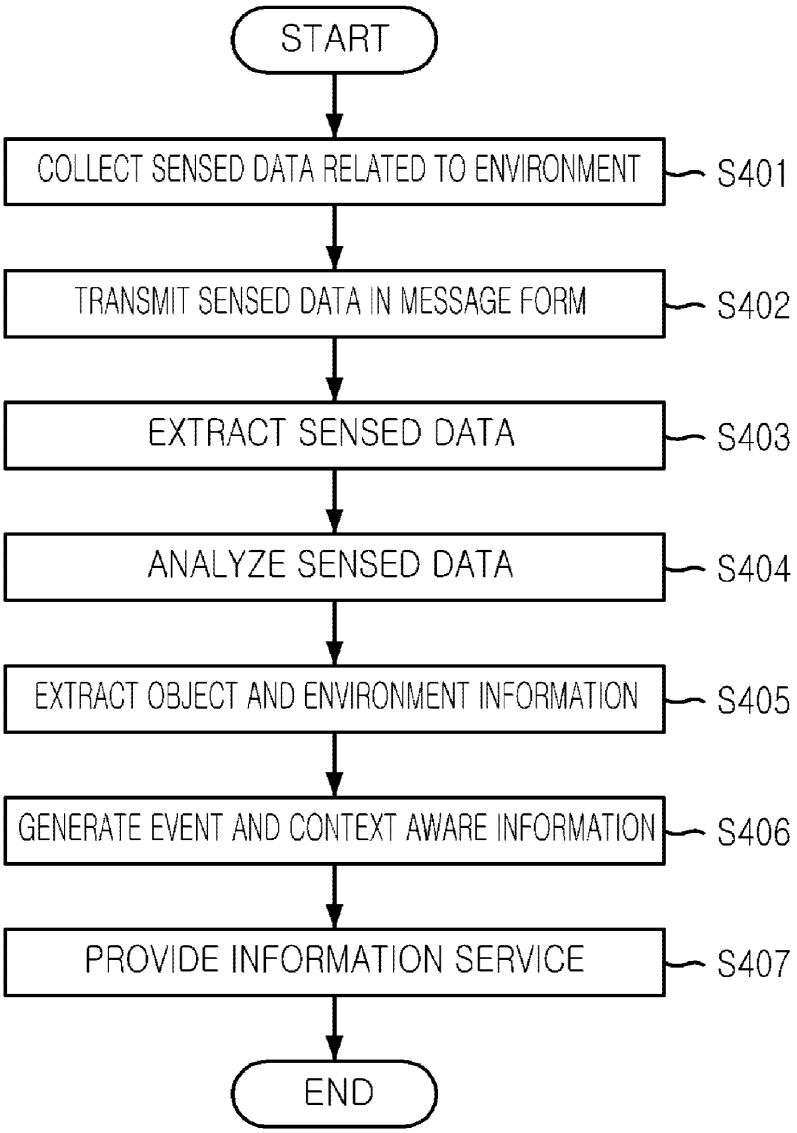
[Fig. 2]


20
SENSOR NETWORK
10
11
SENSING UNIT
SENSOR NODE
30
31
SENSOR NETWORK DATA TRANSMITTING UNIT
GATEWAY
ENVIRONMENT
40
43
SERVICE PLATFORM MANAGEMENT UNIT
42
SENSOR NETWORK INTELLIGENCE UNIT
41
SENSOR NETWORK ABSTRACTION UNIT
USN MIDDLEWARE APPARATUS
50
51
INFORMATION SERVICE RECEIVING UNIT
APPLICATION PROGRAM

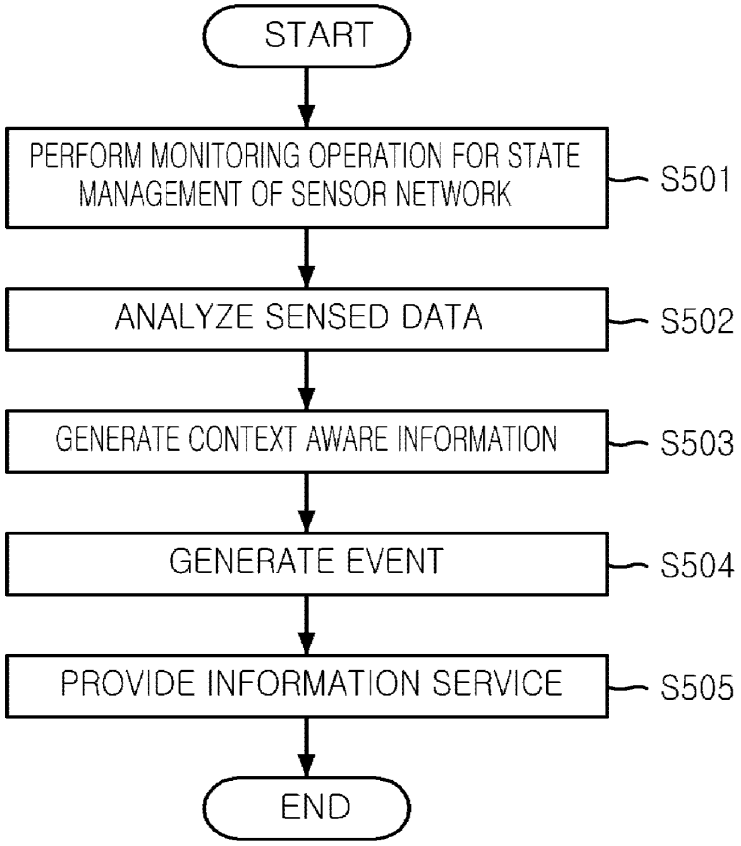
[Fig. 3]


40
43
433
APPLICATION PROGRAM INTERFACE
431
DIRECTORY SERVICE MANAGER
432
SERVICE PROCESS MANAGER
SERVICE PLATFORM MANAGEMENT UNIT
42
421
SENSED DATA ANALYZER
422
EVENT PROCESSOR
423
CONTEXT INFORMATION MANAGER
SENSOR NETWORK INTELLIGENCE UNIT
41
413
SENSOR NETWORK MONITOR
412
SENSOR NETWORK INTERFACE PROTOCOL STORAGE
411
SENSOR NETWORK INTERFACE
SENSOR NETWORK ABSTRACTION UNIT
USN MIDDLEWARE APPARATUS

[Fig. 4]


START
COLLECT SENSED DATA RELATED TO ENVIRONMENT
S401
TRANSMIT SENSED DATA IN MESSAGE FORM
S402
EXTRACT SENSED DATA
S403
ANALYZE SENSED DATA
S404
EXTRACT OBJECT AND ENVIRONMENT INFORMATION
S405
GENERATE EVENT AND CONTEXT AWARE INFORMATION
S406
PROVIDE INFORMATION SERVICE
S407
END

[Fig. 5]


START
PERFORM MONITORING OPERATION FOR STATE MANAGEMENT OF SENSOR NETWORK
S501
ANALYZE SENSED DATA
S502
GENERATE CONTEXT AWARE INFORMATION
S503
GENERATE EVENT
S504
PROVIDE INFORMATION SERVICE
S505
END

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대 한 민 국 특 허 청
KOREAN INTELLECTUAL PROPERTY OFFICE

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This is to certify that the following application annexed hereto is a true copy from the records of the Korean Intellectual Property Office

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Date of Application SEP 01, 2006

출 원 인 : 한국전자통신연구원
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2007 년 01 월 03 일

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【서지사항】

【서류명】 특허출원서

【권리구분】 특허

【수신처】 특허청장

【제출일자】 2006.09.01

【발명의 국문명칭】 이기종 센서 네트워크 기반의 정보 서비스 생성을 위한 USN 미들웨어 장치 및 그 방법과, 그를 이용한 정보 서비스 제공 시스템

【발명의 영문명칭】 USN middleware apparatus for generating information service based on heterogeneous sensor networks and its method, system for providing information service using that

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【심사청구】 청구

【취지】 특허법 제42조의 규정에 의한 출원, 특허법 제60조의 규정에 의한 출원심사를 청구합니다.

대리인 특허법인 신성 (인)

【수수료】

【기본출원료】 0 면 38,000 원

【가산출원료】 29 면 0 원

【우선권주장료】 0 건 0 원

【심사청구료】 12 항 493,000 원

【합계】 531,000 원

【감면사유】 정부출연연구기관

【감면후 수수료】 265,500 원

【기술이전】

【기술양도】 희망

【실시권허여】 희망

【기술지도】 희망

【요약서】

【요약】

1. 청구범위에 기재된 발명이 속한 기술분야

본 발명은 이기종 센서 네트워크 기반의 정보 서비스 생성을 위한 ＵＳＮ 미들웨어 장치 및 그 방법과, 그를 이용한 정보 서비스 제공 시스템에 관한 것임.

2. 발명이 해결하려고 하는 기술적 과제

본 발명은 서로 다른 목적과 기능을 가진 다수의 센서 네트워크에 대해 각각의 센서 네트워크를 구성하는 센서 노드들로부터 수집된 온도, 습도, 압력, 움직임, 가속도 등의 센싱 데이터를 가공 및 통합하여 응용 프로그램을 통해 사용자에게 정보 서비스를 제공하는, 이기종 센서 네트워크 기반의 정보 서비스 생성을 위한 USN 미들웨어 장치 및 그 방법과, 그를 이용한 정보 서비스 제공 시스템을 제공하는데 그 목적이 있음.

3. 발명의 해결방법의 요지

본 발명은, 이기종 센서 네트워크 기반의 정보 서비스 제공 시스템에 있어서, 센서 네트워크를 구성하며 주변 환경의 정보를 센싱하기 위한 센싱수단; 상기 센싱수단으로부터 실시간으로 센싱된 데이터를 취합하여 USN 미들웨어수단에 메시지로 전달하기 위한 센서 네트워크 데이터 전송수단; 및 상기 센서 네트워크 데이터 전송수단을 통해 전달받은 메시지를 정제, 분류 및 통합하여 사물 및 환경 정보를 추출하고, 상기 추출한 사물 및 환경 정보로부터 상황 인식 정보(환경 상황

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정보) 및 지식 콘텐츠를 생성하여, 상기 센서 네트워크가 설치된 환경과 관련된 정보를 사용자에게 제공하는 응용 프로그램으로 정보 서비스를 제공하기 위한 상기 USN 미들웨어 수단을 포함함.

4. 발명의 중요한 용도

본 발명은 이기종 센서 네트워크 기반의 정보 서비스 제공 시스템 등에 이용됨.

【대표도】

도 3

【색인어】

센서 네트워크, USN, 미들웨어, 정보 서비스, 센싱 데이터

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【명세서】

【발명의 명칭】

이기종 센서 네트워크 기반의 정보 서비스 생성을 위한 ＵＳＮ 미들웨어 장치 및 그 방법과, 그를 이용한 정보 서비스 제공 시스템{USN middleware apparatus for generating information service based on heterogeneous sensor networks and its method, system for providing information service using that}

【도면의 간단한 설명】

<1> 도 1 은 본 발명에 따른 이기종 센서 네트워크 기반의 정보 서비스 제공 시스템의 일실시예 전체 구성도,

<2> 도 2 는 본 발명에 따른 이기종 센서 네트워크 기반의 정보 서비스 제공 시스템의 일실시예 상세 구성도,

<3> 도 3 은 본 발명에 따른 USN 미들웨어 장치의 일실시예 상세 구성도,

<4> 도 4 는 본 발명에 따른 이기종 센서 네트워크 기반의 정보 서비스 제공 방법에 대한 일실시예 흐름도,

<5> 도 5 는 본 발명에 따른 USN 미들웨어 장치의 동작 방법에 대한 일실시예 상세 흐름도이다.

<6> * 도면의 주요 부분에 대한 부호 설명

<7> 10 : 센서 노드 11 : 센싱부

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<8> 20 : 센서 네트워크 30 : 게이트웨이

<9> 31 : 센서 네트워크 데이터 전송부 40 : USN 미들웨어 장치

<10> 41 : 센서 네트워크 추상화부 42 : 센서 네트워크 지능화부

<11> 43 : 서비스 플랫폼 관리부 50 : 응용 프로그램

<12> 51 : 정보 서비스 수신부

【발명의 상세한 설명】

【발명의 목적】

【발명이 속하는 기술분야 및 그 분야의 종래기술】

<13> 본 발명은 이기종 센서 네트워크 기반의 정보 서비스 생성을 위한 USN 미들웨어 장치 및 그 방법과, 그를 이용한 정보 서비스 제공 시스템에 관한 것으로, 보다 상세하게는 센서 네트워크를 구성하는 센서 노드들로부터 수집된 온도, 습도, 압력, 움직임, 가속도 등의 센싱 데이터를 분석 및 가공하여 응용 프로그램을 통해 사용자에게 정보 서비스를 제공하는, 이기종 센서 네트워크 기반의 정보 서비스 생성을 위한 USN 미들웨어 장치 및 그 방법과, 그를 이용한 정보 서비스 제공 시스템에 관한 것이다.

<14> 센서 네트워크를 통해 센싱된 데이터를 응용 프로그램이 활용하는 종래의 방법들은, 특정 센서 네트워크를 이용하여 사용자에게 정보 서비스를 제공하기 위하여 센싱 데이터를 응용 프로그램이 직접 가공 및 통합하는 작업을 수행하여야

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하며, 이를 위해 많은 개발 인력과 비용이 소요된다. 또한, 정보 서비스 제공에 이용되는 센서 네트워크의 수 및 종류가 증가할 때마다 추가되는 센서 네트워크의 통신 방식, 제어 프로토콜 및 센싱 데이터 처리 방식에 대하여 처리할 수 있도록 응용 프로그램을 변경해야 한다. 그리고, 동일한 센서 네트워크로부터 수집된 센싱 데이터를 하나 이상의 응용 프로그램에서 동시에 사용하려고 할 때, 게이트웨이 및 센서 네트워크의 제어 및 통신 비용이 증가하여 센서 네트워크의 성능 및 전력 자원이 저하되는 문제점이 있다.

<15> 유비쿼터스 센서 네트워크(USN : Ubiquitous Sensor Network, 이하 'USN'이라 함) 환경에서는 서로 다른 목적과 기능을 가진 다수의 센서 네트워크가 광역으로 설치되고, 각 센서 네트워크를 구성하는 센서 노드들은 사물에 부착되거나 장소에 배치 또는 이동하면서 주변 환경의 정보를 실시간으로 수집하게 된다.

<16> 따라서, 응용 프로그램은 사용자에게 유용한 정보 서비스를 제공하기 위하여, 하나 또는 그 이상의 이기종 센서 네트워크를 추상화하고 해당 센서 네트워크로부터의 센싱 데이터를 분석하여 정보 서비스를 생성한 후, 생성된 정보 서비스를 응용 프로그램에게 신속하고 편리하게 제공할 수 있는 수단을 필요로 하지만, 현재 상기와 같은 수단은 존재하지 않는다.

【발명이 이루고자 하는 기술적 과제】

<17> 본 발명은 상기 문제점을 해결하기 위하여 제안된 것으로, 서로 다른 목적과 기능을 가진 다수의 센서 네트워크에 대해 각각의 센서 네트워크를 구성하는 센서

노드들로부터 수집된 온도, 습도, 압력, 움직임, 가속도 등의 센싱 데이터를 가공 및 통합하여 응용 프로그램을 통해 사용자에게 정보 서비스를 제공하는, 이기종 센서 네트워크 기반의 정보 서비스 생성을 위한 USN 미들웨어 장치 및 그 방법과, 그를 이용한 정보 서비스 제공 시스템을 제공하는데 그 목적이 있다.

<18> 본 발명의 다른 목적 및 장점들은 하기의 설명에 의해서 이해될 수 있으며, 본 발명의 실시예에 의해 보다 분명하게 알게 될 것이다. 또한, 본 발명의 목적 및 장점들은 특허 청구 범위에 나타낸 수단 및 그 조합에 의해 실현될 수 있음을 쉽게 알 수 있을 것이다.

【발명의 구성】

<19> 상기 목적을 달성하기 위한 본 발명은, 이기종 센서 네트워크 기반의 정보 서비스 제공 시스템에 있어서, 센서 네트워크를 구성하며 주변 환경의 정보를 센싱하기 위한 센싱수단; 상기 센싱수단으로부터 실시간으로 센싱된 데이터를 취합하여 USN 미들웨어수단에 메시지로 전달하기 위한 센서 네트워크 데이터 전송수단; 및 상기 센서 네트워크 데이터 전송수단을 통해 전달받은 메시지를 정제, 분류 및 통합하여 사물 및 환경 정보를 추출하고, 상기 추출한 사물 및 환경 정보로부터 상황 인식 정보(환경 상황 정보) 및 지식 콘텐츠를 생성하여, 상기 센서 네트워크가 설치된 환경과 관련된 정보를 사용자에게 제공하는 응용 프로그램으로 정보 서비스를 제공하기 위한 상기 USN 미들웨어 수단을 포함한다.

<20> 그리고, 본 발명은, 이기종 센서 네트워크 기반의 정보 서비스 생성을 위한

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USN 미들웨어 장치에 있어서, 센서 네트워크로부터 수신된 메시지로부터 센싱 데이터를 추출하기 위한 센서 네트워크 추상화수단; 상기 센서 네트워크 추상화수단에서 추출된 센싱 데이터를 분석(정제, 분류 및 통합)하여 사물 및 환경 정보를 추출하고, 상기 추출한 사물 및 환경 정보로부터 이벤트(지식 콘텐츠) 및 환경 상황 정보를 생성하기 위한 센서 네트워크 지능화수단; 및 상기 센서 네트워크 지능화수단에서 생성된 이벤트(지식 콘텐츠) 및 환경 상황 정보를 응용 프로그램이 원하는 형태로 상기 응용 프로그램에게 제공하기 위한 서비스 플랫폼 관리수단을 포함한다.

<21> 한편, 본 발명은, USN 미들웨어 장치에서 이기종 센서 네트워크 기반의 정보서비스 생성 방법에 있어서, 센싱 데이터를 추출하여 상기 추출한 센싱 데이터를 바탕으로 센서 네트워크의 상태 관리를 위한 감시를 수행하는 단계: 상기 추출한 센싱 데이터를 분석(정제, 분류 및 통합)하는 단계: 상기 분석(정제, 분류 및 통합)한 센싱 데이터로부터 사물 및 환경 정보를 추출하고, 상기 사물 및 환경 정보를 바탕으로 환경 상황 정보를 생성하는 단계: 응용 프로그램에서 설정된 규칙에 따라 이벤트(지식 콘텐츠)를 생성하는 단계: 상기 응용 프로그램으로 정보 서비스를 제공하기 위한 작업 순서를 설계하는 단계: 및 상기 설계한 작업 순서에 따른 각각의 수행 결과(정보 서비스(이벤트 및 환경 상황 정보 등))를 상기 응용 프로그램으로 제공하는 단계를 포함한다.

<22> 본 발명은 USN 미들웨어 장치가 센서 네트워크와 응용 프로그램 사이에서 이기종 센서 네트워크로부터 수집한 대량의 센싱 데이터를 통합 처리 및 관리하고, 이로부터 실시간 환경 상황 정보를 생성하여 응용 프로그램으로 적합한 정보 서비

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스를 제공함으로써, USN 환경에 구축되는 다수의 센서 네트워크의 활용을 보다 손쉽게 지원할 수 있다.

<23> 그리고, 본 발명은 다수의 센서 네트워크와의 연동을 지원할 수 있는 구조를 제공하기 때문에, 단일 소규모 영역들에서 획득된 센싱 데이터를 복합적으로 처리하여, 특정 지점의 환경 상황 정보뿐만 아니라, 광역의 상황에서부터 이벤트(지식 콘텐츠) 처리 및 환경 상황 정보 생성을 통한 정보 서비스를 제공할 수 있다.

<24> 상술한 목적, 특징 및 장점은 첨부된 도면과 관련한 다음의 상세한 설명을 통하여 보다 분명해 질 것이며, 그에 따라 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자가 본 발명의 기술적 사상을 용이하게 실시할 수 있을 것이다. 또한, 본 발명을 설명함에 있어서 본 발명과 관련된 공지 기술에 대한 구체적인 설명이 본 발명의 요지를 불필요하게 흐릴 수 있다고 판단되는 경우에 그 상세한 설명을 생략하기로 한다. 이하, 첨부된 도면을 참조하여 본 발명에 따른 바람직한 일실시예를 상세히 설명하기로 한다.

<25> 도 1 은 본 발명에 따른 이기종 센서 네트워크 기반의 정보 서비스 제공 시스템의 일실시예 전체 구성도이다.

<26> 도 1에 도시된 바와 같이, 본 발명에 따른 이기종 센서 네트워크 기반의 정보 서비스 제공 시스템은, 주변 환경의 정보를 센싱하기 위한 센서 노드(10)와, 센서 노드(10)에서 실시간으로 센싱된 데이터를 센서 노드들 간에 무선으로 전달할 수 있도록 센서 노드들(10)을 연결하기 위한 센서 네트워크(20)와, 하나의 센서 네트워크(20)에서 센싱된 데이터를 취합하여 USN 미들웨어 장치(40)로 전달하는 게이

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트웨이(30)와, 다수의 각 게이트웨이(30)를 통해 전달된 다수의 이기종 센서 네트워크(20)의 센싱 데이터를 저장, 정제, 분류 및 통합하여 사물 및 환경 정보를 추출하고, 상기 추출한 사물 및 환경 정보로부터 상황 인식 정보(환경 상황 정보) 및 지식 콘텐츠 생성을 통하여 정보 서비스를 제공하기 위한 USN 미들웨어 장치(40)와, USN 미들웨어 장치(40)의 정보를 이용하여 센서 네트워크(20)가 설치된 환경과 관련된 정보를 사용자에게 제공하기 위한 응용 프로그램(50)을 포함한다.

<27> 본 발명에 따른 이기종 센서 네트워크 기반의 정보 서비스 제공 시스템에서는 주위 온도, 주위 습도, 진동 여부, 빛 여부, 압력, 움직임 등 하나 이상의 센싱 능력을 보유한 센서 노드(10)를 다수 설치한다. 센서 노드들(10)은 단거리 무선통신을 통해 센서 네트워크(20)를 형성하고 각 센서 노드(10)가 센싱을 통해 수집한 데이터를 게이트웨이(30)에서 취합할 수 있게 한다. 게이트웨이(30)는 USN 미들웨어 장치(40)와 TCP/IP(Transmission Control Protocol/Internet Protocol) 기반의 데이터 통신으로 센싱 데이터를 USN 미들웨어 장치(40)로 전송한다. 그러면, USN 미들웨어 장치(40)는 센싱 데이터를 이용하여 센서 네트워크(20)가 구축된 환경을 모니터링하고, 센서 네트워크(20)를 제어할 수 있다. 또한, 센싱 데이터를 가공하여 응용 프로그램(50)이 원하는 이벤트 및 환경 상황 정보를 생성하여 응용 프로그램(50)에 정보 서비스를 제공한다.

<28> 도 2 는 본 발명에 따른 이기종 센서 네트워크 기반의 정보 서비스 제공 시스템의 일실시예 상세 구성도이다.

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<29> 도 2에 도시된 바와 같이, 본 발명에 따른 센서 네트워크 기반의 정보 서비스 제공 시스템의 센서 노드(10)는 온도, 습도, 열, 적외선 등의 주위 환경에 대한 다양한 정보들을 감지하여 센싱 데이터를 생성하기 위한 센싱부(11)를 포함한다.

<30> 본 발명에서 센서 노드들(10)은 각 센싱부(11)의 기능 및 성능, 그리고 무선 통신 범위를 고려하여 적당하게 배치된다. 이때, 센서 노드 배치에 있어 고려될 사항은 모든 센서 노드들(10)이 무선통신을 통하여 게이트웨이(30)까지 데이터를 전달할 수 있어야 한다는 점이다. 여기서, 센서 네트워크(20)를 구성하는 센서 노드(10)의 개수는 주변 환경 및 적용하고자 하는 목적에 따라 변동이 가능하다.

<31> 게이트웨이(30)는 각 센서 노드(10)의 센싱부(11)가 실시간으로 센싱한 데이터를 센서 네트워크(20)를 구성하는 센서 노드(10)간 무선통신을 통해 전달받아 센싱 데이터를 취합하여 USN 미들웨어 장치(40)로 메시지로 전달하기 위한 센서 네트워크 데이터 전송부(31)를 포함한다.

<32> USN 미들웨어 장치(40)는 게이트웨이(30)로부터 수신된 메시지로부터 센싱 데이터를 추출하기 위한 센서 네트워크 추상화부(41)와, 센서 네트워크 추상화부(41)에 의해 추출된 센싱 데이터를 분석(정제, 분류 및 통합)하여 사물 및 환경 정보를 추출하고, 이로부터 이벤트(지식 콘텐츠) 및 환경 상황 정보를 생성하기 위한 센서 네트워크 지능화부(42)와, 센서 네트워크 지능화부(42)에 의해 처리된 결과(정보 서비스(이벤트(지식 콘텐츠) 및 환경 상황 정보))를 응용 프로그램(50)이 원하는 형태로 응용 프로그램(50)에게 제공하기 위한 서비스 플랫폼 관리부(43)를 포함한다. 여기서, 서비스 플랫폼 관리부(43)는 응용 프로그램(50)에서 원하는 다수

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의 이기종 센서 네트워크 기반의 정보 선택 및 연동 기능 등을 제공할 수도 있다.

<33> 응용 프로그램(50)은 USN 미들웨어 장치(40)로부터 정보 서비스를 수신하기 위한 정보 서비스 수신부(51)를 포함한다.

<34> 이하, 이기종 센서 네트워크 기반의 정보 서비스 제공 시스템을 구성하고 있는 센서 노드(10), 센서 네트워크(20), 게이트웨이(30), USN 미들웨어 장치(40) 및 응용 프로그램(50)의 각 구성요소들의 동작 과정을 개략적으로 살펴보면, 센서 노드(10)는 센싱부(11)를 통해 실시간으로 센싱한 데이터를 센서 네트워크(20)의 무선통신을 통해 게이트웨이(30)로 전달하고, 게이트웨이(30)는 센서 네트워크(20)를 통해 수신된 센싱 데이터를 취합하여 센서 네트워크 데이터 전송부(31)를 통해 USN 미들웨어 장치(40)로 전달한다. USN 미들웨어 장치(40)의 센서 네트워크 추상화부(41)는 게이트웨이(30)로부터 수신된 메시지로부터 센싱 데이터를 추출하고, 센서 네트워크 지능화부(42)는 센서 네트워크 추상화부(41)에 의해 추출된 센싱 데이터를 분석(정제, 분류 및 통합)하여 이벤트(지식 콘텐츠) 및 환경 상황 정보를 생성하고, 서비스 플랫폼 관리부(43)는 센서 네트워크 지능화부(42)에 의해 처리된 결과(정보 서비스(이벤트(지식 콘텐츠) 및 환경 상황 정보))를 응용 프로그램(50)이 원하는 형태로 응용 프로그램(50)의 정보 서비스 수신부(51)로 제공한다.

<35> 이때, 센서 네트워크 지능화부(42)는 응용 프로그램(50)에서 필요로 하는 특정 정보를 제공하기 위해 센서 네트워크(20) 내 센서 노드(10)가 수집한 센싱 데이터를 분류하여 응용 프로그램(50)에서 설정한 규칙에 따라 이벤트(지식 콘텐츠) 및 환경 상황 정보(상황 인식 정보)를 생성하며, 서비스 플랫폼 관리부(43)는 정보 서

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비스를 응용 프로그램이 원하는 메시지 형태로 응용 프로그램(50)에 전달한다.

<36> 하기의 [표 1]은 상기 센서 네트워크(20)에서 수집된 센싱 데이터, USN 미들웨어 장치(40)에 의해 분석된 센싱 데이터, USN 미들웨어 장치(40)에 의해 생성된 이벤트, 환경 상황 정보의 일예를 나타낸다.

【표 1】

<37>

구분	센싱 데이터 분석 및 정보 서비스 생성	설명
센서 네트워크에서 수집된 센싱 데이터	15, 15, 14, 14, 12, 11	10분 간격으로 수집된 온도(도)
센서 네트워크에서 수집된 센싱 데이터	80, 90	30분 간격으로 수집된 습도(%)
USN 미들웨어 장치에서 분석된 센싱 데이터	13.5	최근 1시간 동안의 평균 온도
USN 미들웨어 장치에서 생성된 이벤트	평균 온도 수치에 대한 알람 제공	최근 1시간 동안의 평균 온도가 14도 이하이면 응용 프로그램에게 알람 발생
USN 미들웨어 장치에 의해 생성된 환경 상황 정보	'난방 시스템에 문제 발생 가능성 높음'	평균 온도가 14도 이하이고, 현재 습도가 80%이며, 야간이라면 난방 시스템에 문제 발생 가능성 높음

<38> 도 3 은 본 발명에 따른 USN 미들웨어 장치의 일실시예 상세 구성도이다.

<39> 도 3에 도시된 바와 같이, 본 발명에 따른 USN 미들웨어 장치(40)의 센서 네트워크 추상화부(41)는 메시지 전송과 관련된 프로토콜을 참조하여 센싱 데이터를 추출하기 위한 센서 네트워크 인터페이스(411)와, 센서 네트워크 인터페이스(411)가 작업을 수행하기 위한 메시지 전송 프로토콜에 대한 규칙을 관리하기 위한 센서

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네트워크 인터페이스 프로토콜 저장부(412)와, 센서 네트워크 인터페이스(411)로부터 수신한 데이터를 바탕으로 센서 네트워크의 상태 관리를 위한 감시를 수행하기 위한 센서 네트워크 모니터링부(413)를 포함한다.

<40> 또한, USN 미들웨어 장치(40)의 센서 네트워크 지능화부(42)는 센서 네트워크 추상화부(41)에서 처리된 센싱 데이터를 분석(정제, 분류 및 통합)하기 위한 센싱 데이터 분석부(421)와, 응용 프로그램(50)에서 설정한 규칙에 따라 이벤트(지식 콘텐츠)를 생성 및 관리하기 위한 이벤트 처리부(422)와, 분석(정제, 분류 및 통합)된 센싱 데이터 정보를 바탕으로 환경 상황 정보를 감지 및 생성하기 위한 상황 정보 관리부(423)를 포함한다.

<41> 여기서, 센서 네트워크 지능화부(42)에서는 이벤트(지식 콘텐츠)와 환경 상황 정보를 생성하기 위하여, 특정 단일 센서 네트워크로부터의 센싱 데이터만을 대상으로 분석하는 방안, 복수의 이기종 센서 네트워크로부터의 센싱 데이터를 결합하여 분석하는 방안, 그리고 센서 네트워크로부터의 센싱 데이터를 기 정의된 레거시(legacy) 데이터와 연계하여 분석하는 방안을 선택적으로 사용할 수 있다.

<42> 또한, USN 미들웨어 장치(40)의 서비스 플랫폼 관리부(43)는 센서 네트워크(20)의 자원을 식별하고, 검색하기 위한 디렉토리 서비스 관리부(431)와, 응용 프로그램(50)에 따라 원하는 정보 서비스를 획득하기 위해 USN 미들웨어 장치(40)의 센서 네트워크 모니터링부(413), 센싱 데이터 분석부(421), 이벤트 처리부(422), 상황 정보 관리부(423) 및 디렉토리 서비스 관리부(431)의 작업 순서를 설계 및 관리하기 위한 서비스 프로세스 관리부(432)와, 센서 네트워크 모니터링부(413), 센

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싱 데이터 분석부(421), 이벤트 처리부(422), 상황 정보 관리부(423) 및 디렉토리 서비스 관리부(431)에서 처리된 결과를 응용 프로그램(50)이 원하는 형태의 정보 서비스로 응용 프로그램(50)에게 제공하기 위한 응용 프로그램 인터페이스(433)를 포함한다.

<43> 여기서, 서비스 플랫폼 관리부(43)에서는 응용 프로그램(50)에게 정보 서비스를 제공하기 위하여, 응용 프로그램에서 요청한 정보 서비스를 일회성으로 제공하는 방안, 응용 프로그램에서 일정한 기간 동안 주기적으로 제공받기를 요청한 정보 서비스를 주기적으로 제공하는 방안, 그리고 응용 프로그램에서 특정 시점에 제공받기를 요청한 정보 서비스를 해당 시점에 제공하는 방안을 모두 제공할 수 있다.

<44> 도 4 는 본 발명에 따른 이기종 센서 네트워크 기반의 정보 서비스 제공 방법에 대한 일실시예 흐름도이다.

<45> 먼저, 센서 네트워크(20)를 구성하고 있는 각 센서 노드(10)에서 주위 환경에 대한 센싱 데이터를 감지하고(401), 센서 네트워크(20)는 센서 노드(10)에 의해 감지된 센싱 데이터를 게이트웨이(30)를 통해 USN 미들웨어 장치(40)로 메시지 형태로 전달한다(402).

<46> 이후, USN 미들웨어 장치(40)는 센서 네트워크(20)로부터 수신된 메시지로부터 센서 네트워크(20)의 작동 상태 및 센서 노드(10)에 의해 감지된 센싱 데이터를 추출하고(403), 추출된 센싱 데이터를 분석(정제, 분류 및 통합)하여(404), 사물 및 환경 정보를 추출하고(405) 응용 프로그램(50)에서 설정된 규칙에 따라 이벤트

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(지식 콘텐츠) 및 환경 상황 정보(상황 인식 정보)를 생성한다(406).

<47> 마지막으로, USN 미들웨어 장치(40)는 응용 프로그램(50)으로 정보 서비스(이벤트(지식 콘텐츠) 및 환경 상황 정보)를 응용 프로그램(50)이 원하는 형태로 제공한다(407).

<48> 상기와 같은 과정을 통해 USN 미들웨어 장치(40)는 센서 네트워크(20)에서 수집한 센싱 데이터로부터 응용 프로그램(50)이 원하는 정보 서비스를 분석 및 가공하여 응용 프로그램(50)으로 제공한다.

<49> 도 5 는 본 발명에 따른 USN 미들웨어 장치의 동작 방법에 대한 일실시예 상세 흐름도이다.

<50> 먼저, USN 미들웨어 장치(40) 내의 센서 네트워크 추상화부(41)의 센서 네트워크 모니터링부(413)는 센서 네트워크 인터페이스(411)를 통해 추출된 센싱 데이터를 바탕으로 센서 네트워크의 상태 관리를 위한 감시를 수행한다(501).

<51> 이후, 센서 네트워크 지능화부(42)의 센싱 데이터 분석부(421)는 센서 네트워크 추상화부(41)에 의해 처리된 센싱 데이터를 분석(정제, 분류 및 통합)하고(502), 센서 네트워크 지능화부(42)의 상황 정보 관리부(423)는 센싱 데이터 분석부(421)에 의해 분석(정제, 분류 및 통합)된 센싱 데이터로부터 사물 및 환경 정보를 추출하고, 추출된 사물 및 환경 정보를 바탕으로 환경 상황 정보(상황 인식 정보)를 생성하며(503), 센서 네트워크 지능화부(42)의 이벤트 처리부(422)는 응용 프로그램(50)에서 설정된 규칙에 따라 이벤트(지식 콘텐츠)를 생성한다(504).

<52> 그리고, 서비스 플랫폼 관리부(43)의 서비스 프로세스 관리부(432)는 응용

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프로그램(50)으로 정보 서비스를 제공하기 위한 작업 순서를 설계하여 설계된 작업 순서에 따라 센서 네트워크 모니터링부(413), 센싱 데이터 분석부(421), 이벤트 처리부(422), 상황 정보 관리부(423) 등의 수행 결과(정보 서비스(이벤트 및 환경 상황 정보 등))를 응용 프로그램 인터페이스(433)를 통해 응용 프로그램(50)으로 제공한다(505).

<53> 상술한 바와 같은 본 발명의 방법은 프로그램으로 구현되어 컴퓨터로 읽을 수 있는 형태로 기록매체(씨디롬, 램, 롬, 플로피 디스크, 하드 디스크, 광자기 디스크 등)에 저장될 수 있다. 이러한 과정은 본 발명이 속하는 기술 분야에서 통상의 지식을 가진 자가 용이하게 실시할 수 있으므로 더 이상 상세히 설명하지 않기로 한다.

<54> 이상에서 설명한 본 발명은, 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자에게 있어 본 발명의 기술적 사상을 벗어나지 않는 범위 내에서 여러 가지 치환, 변형 및 변경이 가능하므로 전술한 실시예 및 첨부된 도면에 의해 한정되는 것이 아니다.

【발명의 효과】

<55> 상기와 같은 본 발명은, 센서 노드에 설치된 주변 환경이 시시각각으로 변화하는 상황을 실시간으로 자동 수집하며, 센서 네트워크의 작업 상태를 지속적으로 모니터링하므로, 정보 서비스의 실효성 및 신뢰성도 크게 높일 수 있고, 센서 노드들과 게이트웨이로 구성된 하나 이상의 이기종 센서 네트워크들에서 센싱된 데이터

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를 정보 서비스로 가공하여 이를 필요로 하는 다수의 응용 프로그램에게 효과적으로 제공함으로써, 센서 네트워크 기반 정보 서비스의 활용 가능성을 높이고, 응용 프로그램의 개발 및 확장을 용이하게 할 수 있는 효과가 있다.

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【특허청구범위】

【청구항 1】

이기종 센서 네트워크 기반의 정보 서비스 제공 시스템에 있어서,

센서 네트워크를 구성하며, 주변 환경의 정보를 센싱하기 위한 센싱수단;

상기 센싱수단으로부터 실시간으로 센싱된 데이터를 취합하여 USN 미들웨어 수단에 메시지로 전달하기 위한 센서 네트워크 데이터 전송수단; 및

상기 센서 네트워크 데이터 전송수단을 통해 전달받은 메시지를 정제, 분류 및 통합하여 사물 및 환경 정보를 추출하고, 상기 추출한 사물 및 환경 정보로부터 상황 인식 정보(환경 상황 정보) 및 지식 콘텐츠를 생성하여, 상기 센서 네트워크가 설치된 환경과 관련된 정보를 사용자에게 제공하는 응용 프로그램으로 정보 서비스를 제공하기 위한 상기 USN 미들웨어 수단

을 포함하는 이기종 센서 네트워크 기반의 정보 서비스 제공 시스템.

【청구항 2】

제 1 항에 있어서,

상기 USN 미들웨어수단은,

상기 센서 네트워크 데이터 전송수단을 통해 전달받은 메시지로부터 센싱 데이터를 추출하기 위한 센서 네트워크 추상화수단;

상기 센서 네트워크 추상화수단에서 추출된 센싱 데이터를 분석하여 사물 및

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환경 정보를 추출하고, 상기 추출한 사물 및 환경 정보로부터 이벤트(지식 콘텐츠) 및 환경 상황 정보를 생성하기 위한 센서 네트워크 지능화 수단; 및

상기 센서 네트워크 지능화 수단에서 생성된 이벤트(지식 콘텐츠) 및 환경 상황 정보를 상기 응용 프로그램이 원하는 형태로 상기 응용 프로그램에게 제공하기 위한 서비스 플랫폼 관리수단

을 포함하는 이기종 센서 네트워크 기반의 정보 서비스 제공 시스템.

【청구항 3】

제 2 항에 있어서,

상기 센서 네트워크 추상화수단은,

메시지 전송과 관련된 프로토콜을 참조하여 센싱 데이터를 추출하기 위한 센서 네트워크 인터페이스수단;

상기 센서 네트워크 인터페이스수단이 작업을 수행하기 위한 메시지 전송 프로토콜에 대한 규칙을 관리하기 위한 센서 네트워크 인터페이스 프로토콜 저장수단; 및

상기 센서 네트워크 인터페이스수단으로부터 수신한 데이터를 바탕으로 상기 센서 네트워크의 상태 관리를 감시하기 위한 센서 네트워크 모니터링수단

을 포함하는 이기종 센서 네트워크 기반의 정보 서비스 제공 시스템.

【청구항 4】

제 3 항에 있어서,

상기 센서 네트워크 지능화수단은,

상기 센서 네트워크 추상화수단에서 처리된 센싱 데이터를 분석(정제, 분류 및 통합)하기 위한 센싱 데이터 분석수단;

상기 응용 프로그램에서 설정된 규칙에 따라 이벤트(지식 콘텐츠)를 생성 및 관리하기 위한 이벤트 처리수단; 및

상기 센싱 데이터 분석수단에서 분석(정제, 분류 및 통합)된 센싱 데이터 정보를 바탕으로 환경 상황 정보를 감지 및 생성하기 위한 상황 정보 관리수단

을 포함하는 이기종 센서 네트워크 기반의 정보 서비스 제공 시스템.

【청구항 5】

제 4 항에 있어서,

상기 서비스 플랫폼 관리수단은,

상기 센서 네트워크의 자원을 식별하고, 검색하기 위한 디렉토리 서비스 관리수단;

상기 응용 프로그램에 따라 원하는 정보 서비스를 획득하기 위해 상기 센서 네트워크 모니터링수단, 상기 센싱 데이터 분석수단, 상기 이벤트 처리수단, 상기 상황 정보 관리수단 및 상기 디렉토리 서비스 관리수단의 작업 순서를 설계 및 관

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리하기 위한 서비스 프로세스 관리수단; 및

상기 센서 네트워크 모니터링수단, 상기 센싱 데이터 분석수단, 상기 이벤트 처리수단, 상기 상황 정보 관리수단 및 상기 디렉토리 서비스 관리수단에서 처리된 결과를 상기 응용 프로그램이 원하는 형태의 정보 서비스로 상기 응용 프로그램에게 제공하기 위한 응용 프로그램 인터페이스수단

을 포함하는 이기종 센서 네트워크 기반의 정보 서비스 제공 시스템.

【청구항 6】

이기종 센서 네트워크 기반의 정보 서비스 생성을 위한 USN 미들웨어 장치에 있어서,

센서 네트워크로부터 수신된 메시지로부터 센싱 데이터를 추출하기 위한 센서 네트워크 추상화수단;

상기 센서 네트워크 추상화수단에서 추출된 센싱 데이터를 분석(정제, 분류 및 통합)하여 사물 및 환경 정보를 추출하고, 상기 추출한 사물 및 환경 정보로부터 이벤트(지식 콘텐츠) 및 환경 상황 정보를 생성하기 위한 센서 네트워크 지능화수단; 및

상기 센서 네트워크 지능화수단에서 생성된 이벤트(지식 콘텐츠) 및 환경 상황 정보를 응용 프로그램이 원하는 형태로 상기 응용 프로그램에게 제공하기 위한 서비스 플랫폼 관리수단

을 포함하는 이기종 센서 네트워크 기반의 정보 서비스 생성을 위한 USN 미들웨어 장치.

【청구항 7】

제 6 항에 있어서,

상기 센서 네트워크 추상화수단은,

메시지 전송과 관련된 프로토콜을 참조하여 센싱 데이터를 추출하기 위한 센서 네트워크 인터페이스수단;

상기 센서 네트워크 인터페이스수단이 작업을 수행하기 위한 메시지 전송 프로토콜에 대한 규칙을 관리하기 위한 센서 네트워크 인터페이스 프로토콜 저장수단; 및

상기 센서 네트워크 인터페이스수단으로부터 수신한 데이터를 바탕으로 상기 센서 네트워크의 상태 관리를 감시하기 위한 센서 네트워크 모니터링수단

을 포함하는 이기종 센서 네트워크 기반의 정보 서비스 생성을 위한 USN 미들웨어 장치.

【청구항 8】

제 7 항에 있어서,

상기 센서 네트워크 지능화수단은,

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상기 센서 네트워크 추상화수단에서 처리된 센싱 데이터를 분석(정제, 분류 및 통합)하기 위한 센싱 데이터 분석수단;

상기 응용 프로그램에서 설정된 규칙에 따라 이벤트(지식 콘텐츠)를 생성 및 관리하기 위한 이벤트 처리수단; 및

상기 센싱 데이터 분석수단에서 분석(정제, 분류 및 통합)된 센싱 데이터 정보를 바탕으로 환경 상황 정보를 감지 및 생성하기 위한 상황 정보 관리수단

을 포함하는 이기종 센서 네트워크 기반의 정보 서비스 생성을 위한 USN 미들웨어 장치.

【청구항 9】

제 8 항에 있어서,

상기 서비스 플랫폼 관리수단은,

상기 센서 네트워크의 자원을 식별하고, 검색하기 위한 디렉토리 서비스 관리수단;

상기 응용 프로그램에 따라 원하는 정보 서비스를 획득하기 위해 상기 센서 네트워크 모니터링수단, 상기 센싱 데이터 분석수단, 상기 이벤트 처리수단, 상기 상황 정보 관리수단 및 상기 디렉토리 서비스 관리수단의 작업 순서를 설계 및 관리하기 위한 서비스 프로세스 관리수단; 및

상기 센서 네트워크 모니터링수단, 상기 센싱 데이터 분석수단, 상기 이벤트

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처리수단, 상기 상황 정보 관리수단 및 상기 디렉토리 서비스 관리수단에서 처리된 결과를 상기 응용 프로그램이 원하는 형태의 정보 서비스로 상기 응용 프로그램에게 제공하기 위한 응용 프로그램 인터페이스수단

을 포함하는 이기종 센서 네트워크 기반의 정보 서비스 생성을 위한 USN 미들웨어 장치.

【청구항 10】

USN 미들웨어 장치에서 이기종 센서 네트워크 기반의 정보 서비스 생성 방법에 있어서,

센싱 데이터를 추출하여 상기 추출한 센싱 데이터를 바탕으로 센서 네트워크의 상태 관리를 위한 감시를 수행하는 단계;

상기 추출한 센싱 데이터를 분석(정제, 분류 및 통합)하는 분석 단계;

상기 분석(정제, 분류 및 통합)한 센싱 데이터로부터 사물 및 환경 정보를 추출하고, 상기 사물 및 환경 정보를 바탕으로 환경 상황 정보를 생성하는 단계;

응용 프로그램에서 설정된 규칙에 따라 이벤트(지식 콘텐츠)를 생성하는 단계;

상기 응용 프로그램으로 정보 서비스를 제공하기 위한 작업 순서를 설계하는 단계; 및

상기 설계한 작업 순서에 따른 각각의 수행 결과(정보 서비스(이벤트 및 환

경 상황 정보 등))를 상기 응용 프로그램으로 제공하는 결과 제공 단계

를 포함하는 USN 미들웨어 장치에서 이기종 센서 네트워크 기반의 정보 서비스 생성 방법.

【청구항 11】

제 10 항에 있어서,

상기 분석 단계는,

특정 단일 센서 네트워크로부터의 센싱 데이터를 분석하거나 복수의 센서 네트워크로부터의 센싱 데이터를 분석하거나 상기 센서 네트워크로부터의 센싱 데이터와 사전 정의된 레거시 데이터를 연계하여 분석하는 것을 특징으로 하는 USN 미들웨어 장치에서 이기종 센서 네트워크 기반의 정보 서비스 생성 방법.

【청구항 12】

제 10 항 또는 제 11 항에 있어서,

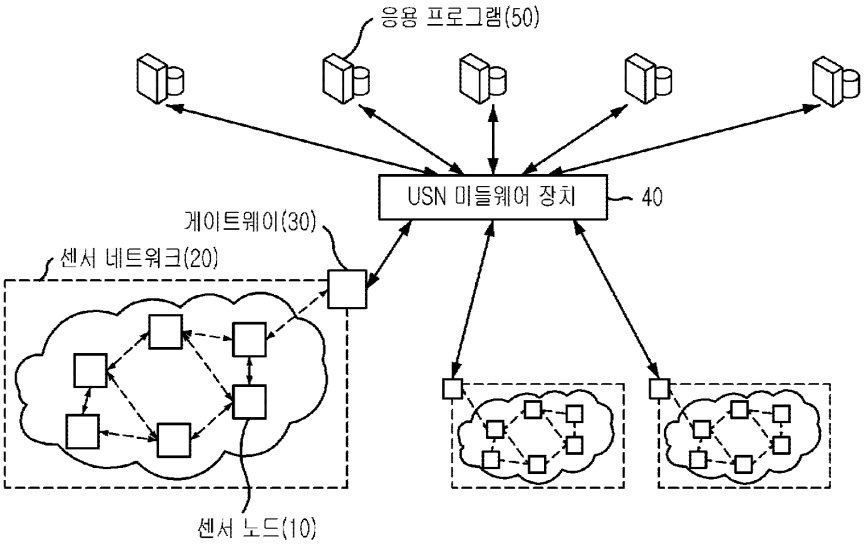
상기 결과 제공 단계는,

상기 응용 프로그램에게 정보 서비스를 일회성으로 제공하거나, 상기 응용 프로그램으로부터의 요청 기간 동안 주기적으로 제공하거나 상기 응용프로그램으로부터의 요구사항을 만족하는 특정 시점이 되었을 때 제공하는 것을 특징으로 하는 USN 미들웨어 장치에서 이기종 센서 네트워크 기반의 정보 서비스 생성 방법.

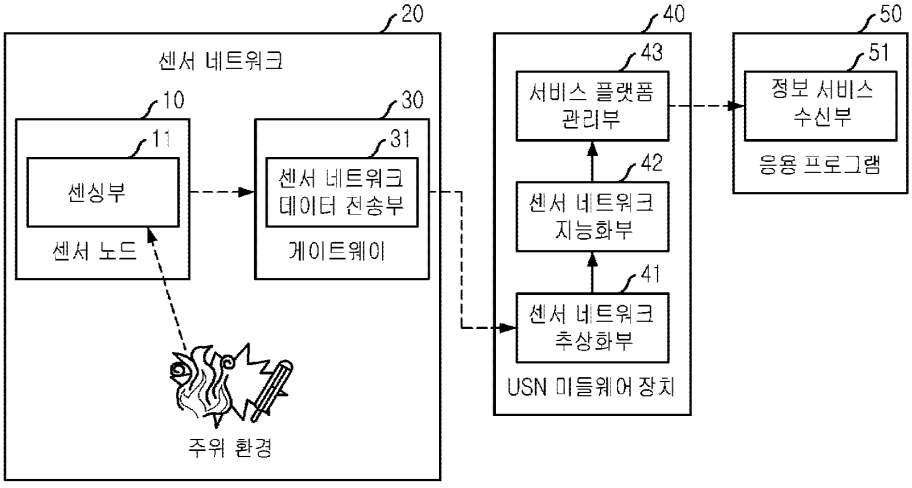
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【도면】

【도 1】

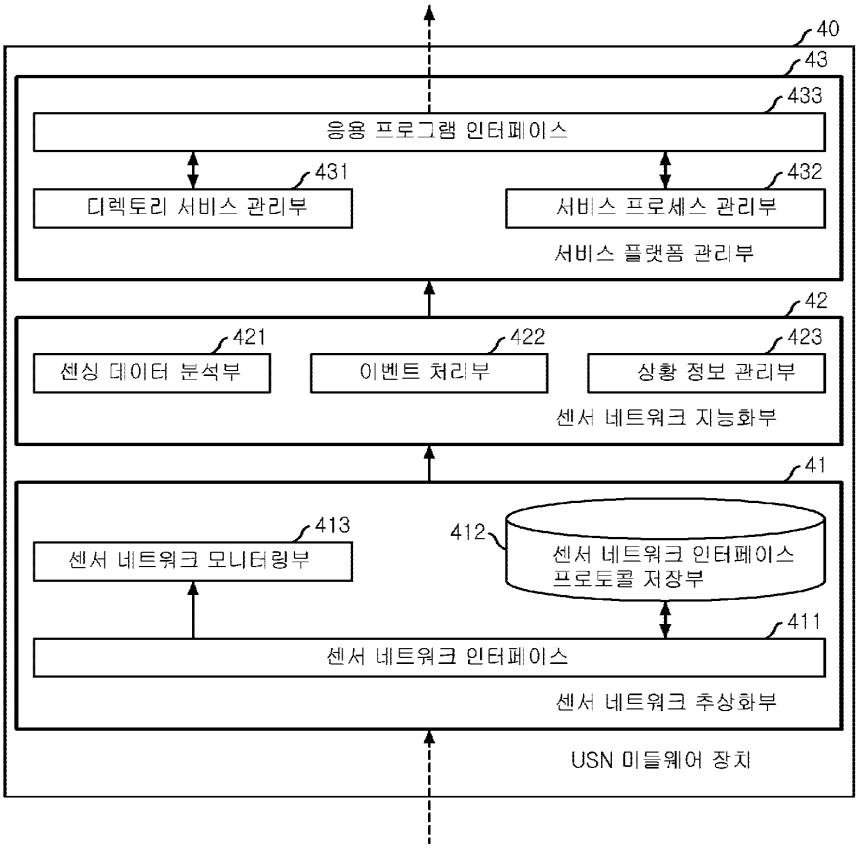


【도 2】



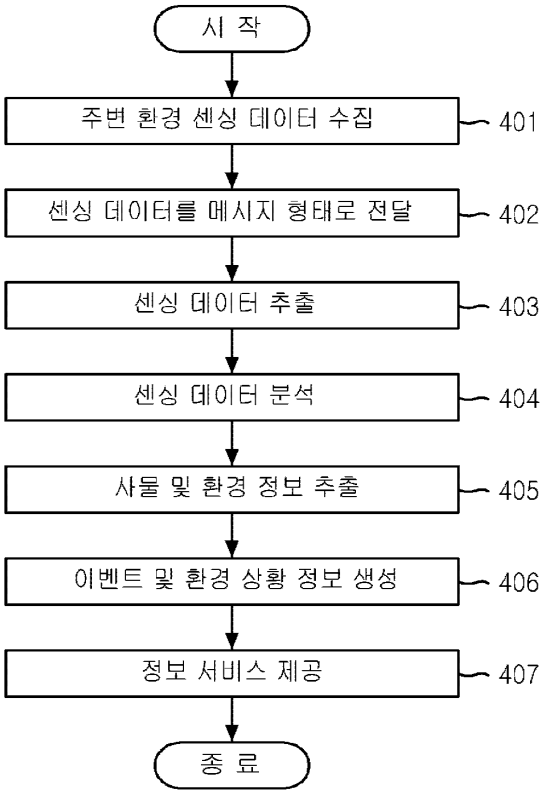
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【도 3】

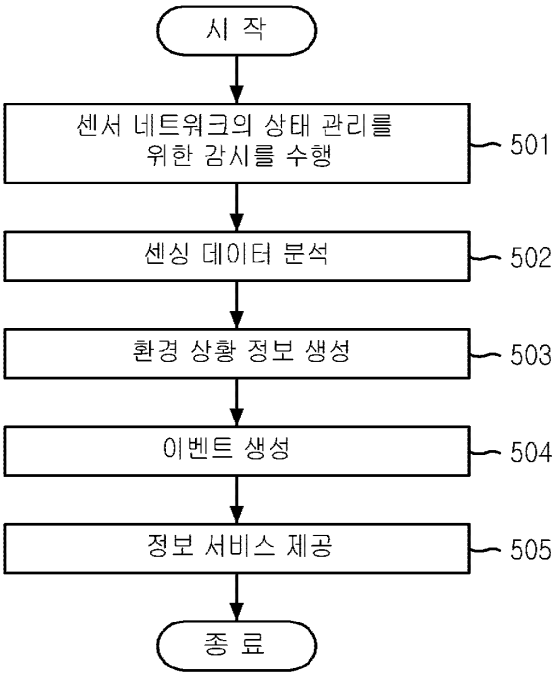


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【도 4】


시 작
주변 환경 센싱 데이터 수집
401
센싱 데이터를 메시지 형태로 전달
402
센싱 데이터 추출
403
센싱 데이터 분석
404
사물 및 환경 정보 추출
405
이벤트 및 환경 상황 정보 생성
406
정보 서비스 제공
407
종 료

【도 5】


시 작
센서 네트워크의 상태 관리를 위한 감시를 수행
501
센싱 데이터 분석
502
환경 상황 정보 생성
503
이벤트 생성
504
정보 서비스 제공
505
종 료

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- ☐ **PCT/IPEA/409 - IPER** (check Examination Authority) : ☐ EP ☐ JP ☐ SE ☐ AU ☐ US ☐ FR ☐ CN ☐ ES ☐ RU ☐ AT ☐ CA ☐ KR ☐ ___
- ☐ **Annexes to 409**
- ☑ **PCT/ISA/237** (check Searching Authority) : ☐ EP ☐ JP ☐ SE ☐ AU ☐ US ☐ FR ☐ CN ☐ ES ☐ RU ☐ AT ☐ CA ☑ KR ☐ ___
- ☐ **Other :** _____
- ☐ **PCT/IB/306**
- ☐ **Request form PCT/RO/101**
- ☑ **PCT/ISA/210 - Search Report** (check Searching Authority) : ☐ EP ☐ JP ☐ SE ☐ AU ☐ US ☐ FR ☐ CN ☐ ES ☐ RU ☐ AT ☐ CA ☑ KR ☐ ___ ☐ NONE
- ☐ **Search Report References**
- ☑ **Priority Document (s) No.** 1 ☐ N/A ☐ Priority Document was NOT AVAILABLE at the time of paralegal review
- ☐ **Other :** _____

RECEIPTS FROM THE APPLICANT *(filed with the application unless noted otherwise) :*

- ☑ **Basic National Fee** *(or authorization to charge)*
- ☑ **Description** ☑ **Claims** ☑ **Abstract**
- ☑ **Number of Drawing Sheets :** 4
- ☐ **Translation of Article 19 Amendments** ☐ entered ☐ not entered : ☐ not a page for page substitution ☐ replaced by Article 34 Amendment
- ☐ **Annexes to 409** ☐ entered ☐ not entered : ☐ not a page for page substitution ☐ no translation ☐ other : _____
- ☐ **Application Data Sheet**
- ☐ **Power of Attorney**
- ☐ **Change of Address**
- ☐ **PG Pub Early Publication Request**
- ☑ **Express Request to Begin Nat'l Examination Procedures**
- ☑ **Preliminary Amendment(s) Filed on :** 1. ☑ same as 371 request date 2. _____ 3. _____
- ☑ **Information Disclosure Statement(s) Filed on :** 1. ☑ same as 371 request date 2. _____ 3. _____
- ☐ **Assignee Statement Under 37 CFR 3.73(b)**
- ☐ **Assignee PG Publication Notice**
- ☐ **Substitute Specification Filed on :** 1. ☐ same as 371 request date 2. _____ 3. _____
- ☐ **Verified Small Status Statement**
- ☒ **Oath/ Declaration (executed)**
- ☐ **Defective Oath/ Declaration** ☐ unsigned ☐ no citizenship ☐ other
- ☐ **DNA Diskette** ☐ **Sequence Listing**
- ☐ **Other :** _____
- ☐ **Other :** _____

NOTES :

35 U.S.C. 371 - Receipt of Request (PTO-1390)	9/27/07
Date Acceptable Oath/ Declaration Received	9/27/07
Date of Completion of requirements under 35 U.S.C. 371	9/27/07
Date of Completion of DO/ EO 903 - Notification of Acceptance	5/10/08
Date of Completion of DO/ EO 905 - Notification of Missing Requirements	
Date of Completion of DO/ EO 909 - Notification of Abandonment	
Date of Completion of DO/ EO 916 - Notification of Defective Response	
Date of Completion of DO/ EO 922 - Notification to Comply w/ Requirements for Patent Applications Containing Nucleotide and/or Amino Acid Sequence Disclosures	
Date of Completion of DO/ EO 923	

MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET
(FOR USE WITH FORM PTO-875)

SERIAL NO.	FILING DATE
17/435,424	
APPLICANT(S)	

CLAIMS

	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT	
	IND.	DEP.	IND.	DEP.	IND.	DEP.
1	1		1			
2		1		1		
3		1		1		
4		1		1		
5		1		1		
6	1		1			
7		1		1		
8		1		1		
9		1		1		
10	1		1			
11		1		1		
12		1		1		
13				1		
14						
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49						
50						
TOTAL IND.	3	⬇	3	⬇		⬇
TOTAL DEP.	5	⬅	5	⬅		⬅
TOTAL CLAIMS	8		8			

	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT	
	IND.	DEP.	IND.	DEP.	IND.	DEP.
51						
52						
53						
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96						
97						
98						
99						
100						
TOTAL IND.		⬇		⬇		⬇
TOTAL DEP.		⬅		⬅		⬅
TOTAL CLAIMS						

[illegible] Number

[illegible]

CLAIMS - PART I

	(Column 1)	(Column 2)	SMALL ENTITY RATE	SMALL ENTITY FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
U.S. NATIONAL STAGE FEES							
BASIC FEE	SMALL ENT = $ 130	LARGE ENT = $ 300	BASIC FEE	65	OR	BASIC FEE	
EXAMINATION FEE	Satisfies PCT Article 33(1)-(4) = $ 50 / $ 100	All other situations = $ 100 / $ 200	EXAM FEE	44		EXAM FEE	
SEARCH FEE	U.S. is ISA = $ 50 / $ 100 ALL other countries = $ 200 / $ 400	ALL other situations = $ 250 / $ 500	SEARCH FEE	219		SEARCH FEE	
FEE FOR EXTRA SPEC. PGS.	minus 100 =	/ 50 =	X $ 130 =			X $ 260 =	
TOTAL CHARGEABLE CLAIMS	20 minus 20 =	—	X $ 25 =		OR	X $ 50 =	
INDEPENDENT CLAIMS	1 minus 3 =	—	X $ 105 =		OR	X $ 210 =	
MULTIPLE DEPENDENT CLAIM PRESENT	☐		+ $ 185 =		OR	+ $ 370 =	
			TOTAL	458	OR	TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2

CLAIMS AS AMENDED - PART II

AMENDMENT A		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
	Total	*	Minus	**	=
	Independent	*	Minus	***	=
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

	SMALL ENTITY RATE	SMALL ENTITY ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY ADDITIONAL FEE
X $ 25 =			OR	X $ 50 =	
X $ 105 =			OR	X $ 210 =	
+ $ 185 =			OR	+ $ 370 =	
TOTAL ADDIT. FEE			OR	TOTAL ADDIT. FEE	

AMENDMENT B		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
	Total	*	Minus	**	=
	Independent	*		***	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

	SMALL ENTITY RATE	SMALL ENTITY ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY ADDITIONAL FEE
X $ 25 =			OR	X $ 50 =	
X $ 105 =			OR	X $ 210 =	
+ $ 185 =			OR	+ $ 370 =	
TOTAL ADDIT. FEE			OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than "20", enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than "3", enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
12/439,421	02/27/2009	

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☒		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	02/27/2009	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 12	Minus	** 20	= 0	X $26 =	0	OR	X $ =	
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $110 =	0	OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/PAMELA V. THERATT/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
12/439,421	Se-Won Oh	2044.1022

21171
STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

INTERNATIONAL APPLICATION NO.	
PCT/KR2006/005715	
I.A. FILING DATE	PRIORITY DATE
12/26/2006	09/01/2006

CONFIRMATION NO. 3680
371 ACCEPTANCE LETTER

OC000000038060750

Date Mailed: 10/06/2009

NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office in its capacity as a Designated / Elected Office (37 CFR 1.495), has determined that the above identified international application has met the requirements of 35 U.S.C. 371, and is ACCEPTED for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above and the relevant dates are:

02/27/2009	02/27/2009
DATE OF RECEIPT OF 35 U.S.C. 371(c)(1), (c)(2) and (c)(4) REQUIREMENTS	DATE OF COMPLETION OF ALL 35 U.S.C. 371 REQUIREMENTS

A Filing Receipt (PTO-103X) will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE " FILING DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 (c)(1), (c)(2) and (c)(4) REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN ABOVE.** *The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363).* Once the Filing Receipt has been received, send all correspondence to the Group Art Unit designated thereon.

The following items have been received:

- Indication of Small Entity Status
- Copy of the International Application filed on 02/27/2009
- Copy of the International Search Report filed on 02/27/2009
- Copy of IPE Report filed on 02/27/2009
- Preliminary Amendments filed on 02/27/2009
- Information Disclosure Statements filed on 02/27/2009
- Oath or Declaration filed on 02/27/2009
- Request for Immediate Examination filed on 02/27/2009
- U.S. Basic National Fees filed on 02/27/2009
- Priority Documents filed on 02/27/2009
- Specification filed on 02/27/2009
- Claims filed on 02/27/2009
- Abstracts filed on 02/27/2009
- Drawings filed on 02/27/2009

FORM PCT/DO/EO/903 (371 Acceptance Notice)

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

RODERICK M JONES

Telephone: (703) 756-1460

FORM PCT/DO/EO/903 (371 Acceptance Notice)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
12/439,421	02/27/2009	2612	490	2044.1022	12	3

CONFIRMATION NO. 3680

21171
STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

FILING RECEIPT

OC00000038060749

Date Mailed: 10/06/2009

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Se-Won Oh, Daejon, KOREA, REPUBLIC OF;
Yong-Joon Lee, Daejon, KOREA, REPUBLIC OF;
Jong-Hyun Park, Daejon, KOREA, REPUBLIC OF;

Power of Attorney: The patent practitioners associated with Customer Number 21171

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/KR2006/005715 12/26/2006

Foreign Applications

REPUBLIC OF KOREA 10-2006-0084353 09/01/2006

If Required, Foreign Filing License Granted: 09/30/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/439,421**

Projected Publication Date: 01/14/2010

Non-Publication Request: No

Early Publication Request: No
** **SMALL ENTITY** **

Title

USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

Preliminary Class

340

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/439,421	02/27/2009	Se-Won Oh	2044.1022

CONFIRMATION NO. 3680

21171
STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

PUBLICATION NOTICE

OC000000039660017

Title:USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

Publication No.US-2010-0007483-A1
Publication Date:01/14/2010

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/439,421	02/27/2009	Se-Won Oh	2044.1022	3680

21171 7590 02/18/2011

STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

EXAMINER	
NGUYEN, TAI T	
ART UNIT	**PAPER NUMBER**
2612	

MAIL DATE	DELIVERY MODE
02/18/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	12/439,421	OH ET AL.	
	Examiner	Art Unit	
	Tai T. Nguyen	2612	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 2 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 February 2009*.

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☒ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *1-12* is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *02/27/2009*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

2. This application is in condition for allowance except for the following formal matters:

Claim 6, lines 6-7, "extracting the object" should read as ----extracting object---- to avoid 112 2nd rejection.

Claim 10, line 3, “comprising the steps” should read as ----comprising steps---- to avoid 112 2nd rejection.

Prosecution on the merits is closed in accordance with the practice under *Ex parte Quayle*, 25 USPQ 74, 453 O.G. 213, (Comm’r Pat. 1935).

A shortened statutory period for reply to this action is set to expire **TWO MONTHS** from the mailing date of this letter.

Conclusion

3. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Kim et al. (Us 2009/0006522).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tai T. Nguyen whose telephone number is (571) 272-2961. The examiner can normally be reached on Monday-Friday from 7:30am-5:00pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Razavi can be reached on (571) 272-7664. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tai T. Nguyen/
Primary Examiner, Art Unit 2612

February 15, 2011

Notice of References Cited	Application/Control No. 12/439,421	Applicant(s)/Patent Under Reexamination OH ET AL.	
	Examiner Tai T. Nguyen	Art Unit 2612	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2009/0006522	01-2009	KIM et al.	709/201
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	(se-won near4 oh).IN.	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 11:44
L2	170	(usn near4 (apparatus system module))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 11:49
L3	10	2 and ((environment$3 tempterature pressure humidity motion accelerat$3) near4 (sensor detector))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 11:52
L4	10754	3 annd ((generat$3 collect$3 emit$4 transmit$4 provid$3) near4 (service adj (information data notificat$3 alarm alert $3 indicat$3)))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 11:55
L5	0	3 and ((generat$3 collect$3 emit$4 transmit$4 provid$3) near4 (service adj (information data notificat$3 alarm alert $3 indicat$3)))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 11:55
L6	79025	((receiv$3 collect$3 analyz$3 calculat$3 process$3) near4 ((sens detect$3) adj (data signal information)))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 11:58
L7	13	2 and 6	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 11:59
L8	0	7 and ((generat$3 emit $4 transmit$4 provid$3) near4 (service adj (information data notificat$3 alarm alert $3 indicat$3)))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 11:59

L9	1	7 and ((generat$3 emit $4 transmit$4 provid$3) near4 (servic$3 maintain $3 replac$3))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:00
L10	5	("20050114493" | "20060095518" | "20060149905" | "5870605" | "6801943").PN.	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:09
L11	1	("077084765" "20060123053").pn.	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:13
L12	1	("77084765" "20060123053").pn.	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:13
L13	2	("7084765" "20060123053").pn.	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:13
L14	2	("7084765" "20060123053").pn.	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:14
L15	4	((usn adj (middleware module unit decvice)) near4 (apparatus system module))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:17
L16	6	("20040006614" | "20060149905" | "20060155818" | "20070236346" | "20090276525" | "20100007483").PN.	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:24
L17	25	2 and ((sensor detector) near4 (node module terminal))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:29
L18	8	17 and "340"/$.ccls.	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:29

2/14/2011 12:33:48 PM
C:\Documents and Settings\TNguyen35\My Documents\EAST\Workspaces\Default EAST Workspace 1600x1200.wsp

FORM PTO-1449 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY DOCKET NO.	APPLICATION NO.
	2044.1022	12/439,421
	FIRST NAMED INVENTOR	
	Se-Won OH, et al.	
INFORMATION DISCLOSURE STATEMENT *(Use several sheets if necessary)*	FILING DATE	GROUP ART UNIT
	February 27, 2009	2612

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NO.	DATE	NAME	CLASS	SUB-CLASS	FILING DATE
	AA	2006/0149905 A1	7/6/2006	Park et al.			
	AB	2006/0095518 A1	5/4/2006	Davis et al.			
	AC	6,801,943 B1	10/5/2004	Pavan et al.			
	AD	5,870,605	2/9/1999	Bracho et al.			
	AE	2005/0114493 A1	5/26/2005	Mandato et al.			
	AF						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NO.	DATE	COUNTRY	TRANSLATION YES	TRANSLATION NO	ABSTRACT
	AG	2006/065098 A1	6/22/2006	WIPO	Published in English		
	AH	10-2004-0108623	12/24/2004	Republic of Korea		X	X
	AI	1545069 A1	6/22/2005	Europe			
	AJ	10-0372788 B1	2/19/2003	Republic of Korea		X	X
	AK	10-2006-0009788	2/1/2006	Republic of Korea		X	X
	AL						

OTHER REFERENCES (INCLUDING AUTHOR, TITLE, DATE, PERTINENT PAGES, ETC.)

			TRANSLATION YES	TRANSLATION NO
	AM	Dae-Young Kim, et al. (Real-Time Embedded System Laboratory, Information & Communication College of Korea), "**Technical Trend of Sensor Network Operating System/Middleware**", *ITFIND*, Issue 1221, November 9, 2005, 10pp.	Partial	
	AN			

EXAMINER /Tai Nguyen/	DATE CONSIDERED 02/14/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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Revised April 2006

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /TN/

ATTACHMENT 1(e)

EXPLANATIONS OF RELEVANCY OF REFERENCES	ATTORNEY DOCKET NO. **2044.1022**	APPLICATION NO.
	FIRST NAMED INVENTOR **Se-Won OH, et al.**	
	FILING DATE **February 27, 2009**	GROUP ART UNIT

References **AA**, **AB**, **AG**, **AH**, and **AI** are cited on the attached International Search Report.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /TN/

ATTACHMENT 1(g)

LIST OF ADDITIONAL SUBMITTED DOCUMENTS	ATTORNEY DOCKET NO. 2044.1022	APPLICATION NO. 12/439,421
	FIRST NAMED INVENTOR Se-Won OH, et al.	
	FILING DATE February 27, 2009	GROUP ART UNIT 2612

The following document(s) is/are listed in accordance with the duty of disclosure provisions of 37 CFR § 1.56, so that the Examiner may consider same should he deem any thereof to be material to examination of the subject application.

It is requested that the Examiner acknowledge his consideration of document(s) below-listed by initialling same in the space provided adjacent each such application and that the Examiner sign and date this form at the bottom thereof to confirm such consideration having been given.

This submission in no way represents an admission that any of the information listed herein constitutes prior art with respect to the subject application; and unless and until such prior art status is established, this submission is not a request that the information presented herein be printed on the face of any patent issuing from the subject application in which this information is being filed.

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NO.	DATE	NAME	CLASS	SUB-CLASS	FILING DATE
	BA						
	BB						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NO.	DATE	COUNTRY	CLASS	SUB-CLASS	TRANSLATION YES	TRANSLATION NO
	BC							
	BD							

OTHER DOCUMENTS **(Including Author, Title, Date, Pertinent Pages, Etc.)**			TRANSLATION YES	TRANSLATION NO
	BE	**International Search Report for International Application No. PCT/KR2006/005715, mailed May 30, 2007.**	X	

EXAMINER /Tai Nguyen/	DATE CONSIDERED 02/14/2011
*EXAMINER: Initial if document considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /TN/

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12439421	OH ET AL.
	Examiner	Art Unit
	Tai T Nguyen	2612

SEARCHED			
Class	Subclass	Date	Examiner
340	521, 523, 524, 534, 539.26, 540, 541, 286.02	02/15/2011	TN
709	218, 223, 224, 201, 206	02/15/2011	TN

SEARCH NOTES		
Search Notes	Date	Examiner
EAST SEARCH AND INVENTOR SEARCH	02/15/2011	TN

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
SAME AS ABOVE	SAME AS ABOVE	02/152/2011	TN

	/Tai T Nguyen/ Primary Examiner.Art Unit 2612

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 3680

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/439,421	02/27/2009 RULE	340	2612	2044.1022

APPLICANTS

Se-Won Oh, Daejon, KOREA, REPUBLIC OF;
Yong-Joon Lee, Daejon, KOREA, REPUBLIC OF;
Jong-Hyun Park, Daejon, KOREA, REPUBLIC OF;

**** CONTINUING DATA **************************

This application is a 371 of PCT/KR2006/005715 12/26/2006

**** FOREIGN APPLICATIONS **************************

REPUBLIC OF KOREA 10-2006-0084353 09/01/2006

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **

09/30/2009

Foreign Priority claimed	35 USC 119(a-d) conditions met	Verified and Acknowledged	Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
☑ Yes ☐ No	☑ Yes ☐ No	/TAI T. NGUYEN/ Examiner's Signature	☐ /TN/ Initials	KOREA, REPUBLIC OF	4	12	3

ADDRESS

STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005
UNITED STATES

TITLE

USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
490	No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	213143	((sens$3 detect$3) near3 (node terminal module))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:34
L2	6276	1 and (((sensor detector) near4 (network)) (USN near4 (middleware notwork)))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:36
L3	122052	(collect$3 receiv$3 process$3 calculat $3 analyz$3) near4 ((sens$3 detect$3) adj (signal data information))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:37
L4	1860	2 and 3	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:38
L5	19807	(provid$3 emit$4 generat$3 transmit $4) near4 ((service maintain) near4 (alarm alert$3 indicat$3 notificat $3 display$3))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:39
L6	1280	(provid$3 emit$4 generat$3 transmit $4) near4 ((service maintain) adj (alarm alert$3 indicat$3 notificat $3 display$3))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:39
L7	3	4 AND 6	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/02/14 12:39

2/14/2011 12:41:39 PM
C:\Documents and Settings\TNguyen35\My Documents\EAST\Workspaces\Default

EAST Workspace 1600x1200.wsp

Docket No.: 2044.1022

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Se-Won OH, et al.

Serial No. 12/439,421 Group Art Unit: 2612

Confirmation No. 3680

Filed: February 27, 2009 Examiner: Tai T. Nguyen

For: USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

AMENDMENT

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Sir:

This is in response to the Quayle Office Action mailed February 18, 2011, and having a period for response set to expire on April 18, 2011.

The following amendments and remarks are respectfully submitted. Reconsideration of the claims is respectfully requested.

IN THE CLAIMS:

The text of all pending claims, (including withdrawn claims) is set forth below. Cancelled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~strikethrough~~. The status of each claim is indicated with one of (original), (currently amended), (cancelled), (withdrawn), (new), (previously presented), or (not entered).

1. (Original) A system for providing an information service based on heterogeneous sensor networks, comprising:

a sensor node constructing a sensor network to sense environment information;

a sensor network data transmitter for collecting sensed data sensed by the sensor in real-time and transmitting the collected sensed data in a message form; and

a Ubiquitous Sensor Network (USN) middleware for extracting object and environment information by cleaning, classifying and integrating the message received from the sensor network data transmitter, generating conditional events, context aware information, and knowledge contents from the extracted object and environment information, and providing the information service to an application program, the application program providing a user with information related to environment where the sensor network is installed.

2. (Original) The system as recited in claim 1, wherein the ubiquitous sensor network middleware comprises:

a sensor network abstraction unit for extracting the sensed data from the message received from the sensor network data transmitter;

a sensor network intelligence unit for extracting the object and environment information by analyzing the sensed data extracted by the sensor network abstraction unit, and generating the conditional events including notification and alarm about a certain condition, and the context aware information from the extracted object and environment information; and

a service platform management unit for providing the events and the context aware information to the application program in a form suitable for the application program.

3. (Original) The system as recited in claim 2, wherein the sensor network abstraction unit comprises:

a sensor network interface for extracting the sensed data by referring to a message transfer

protocol;

a sensor network interface protocol storage for managing a rule for the message transfer protocol; and

a sensor network monitor for monitoring a state of the sensor network, based on the data received from the sensor network interface.

4. (Original) The system as recited in claim 3, wherein the sensor network intelligence unit comprises:

a sensed data analyzer for performing an analysis operation to clean, classify and integrate the sensed data processed by the sensor network abstraction unit;

an event processor for generating the conditional events including notification and alarm according to a rule set by the application program and managing the generated events; and

a context information manager for sensing and generating the context aware information, based on the sensed data analyzed by the sensed data analyzer.

5. (Original) The system as recited in claim 4, wherein the service platform management unit comprises:

a directory service manager for identifying and searching resources of the sensor network;

a service process manager for scheduling and managing an operation sequence of the sensed data analyzer, the event processor, the context information manager, and the directory service manager in order to obtain a desired information service according to the application program; and

an application program interface for providing the application program with the results processed by the sensor network monitor, the sensed data analyzer, the event processor, the context information manager, and the directory service manager in an information service form suitable for the application program.

6. (Currently Amended) A Ubiquitous Sensor Network (USN) middleware apparatus for generating an information service based on heterogeneous sensor networks, comprising:

a sensor network abstraction unit for extracting sensed data from a message received from a sensor network;

a sensor network intelligence unit for extracting ~~the~~ object and environment information by performing an analysis operation to clean, classify and integrate the sensed data extracted by the sensor network abstraction unit, and generating an event, including notification and alarm, and context aware information from the extracted object and environment information; and

a service platform management unit for providing the event and the context aware information to

the application program in a form suitable for the application program.

7. (Original) The ubiquitous sensor network middleware apparatus as recited in claim 6, wherein the sensor network abstraction unit comprises:

a sensor network interface for extracting the sensed data by referring to a message transfer protocol;

a sensor network interface protocol storage for managing a rule for the message transfer protocol; and

a sensor network monitor for monitoring a state of the sensor network, based on the data received from the sensor network interface.

8. (Original) The ubiquitous sensor network middleware apparatus as recited in claim 7, wherein the sensor network intelligence unit comprises:

a sensed data analyzer for performing an analysis operation to clean, classify and integrate the sensed data processed by the sensor network abstraction unit;

an event processor for generating the event including the knowledge contents according to a rule set by the application program and managing the generated event; and

a context information manager for sensing and generating the environment condition information, based on the sensed data analyzed by the sensed data analyzer.

9. (Original) The ubiquitous sensor network middleware apparatus as recited in claim 8, wherein the service platform management unit comprises:

a directory service manager for identifying and searching resources of the sensor network;

a service process manager for scheduling and managing an operation order of the sensed data analyzer, the event processor, the context information manager, and the directory service manager in order to obtain a desired information service according to the application program; and

an application program interface for providing the application program with the results processed by the sensor network monitor, the sensed data analyzer, the event processor, the context information manager, and the directory service manager in an information service form suitable for the application program.

10. (Currently Amended) A method for generating an information service based on heterogeneous sensor networks in a ubiquitous sensor network middleware apparatus, comprising:

extracting sensed data and monitoring a state management of a sensor network, based on the extracted sensed data;

performing an analysis operation to clean, classify and integrate the extracted sensed data;

extracting ~~the~~ object and environment information from the analyzed sensed data, and generating context aware information based on the extracted object and environment information;

generating an event including notification event, alarm, and knowledge contents according to a rule set by an application program;

scheduling an operation sequence for providing an information service to the application program; and

providing the application program with the information service obtained according to the scheduled operation sequence, the information service including events and context aware information.

11. (Previously Presented) The method as recited in claim 10, wherein the performing an analysis operation to clean, classify and integrate the extracted sensed data analyzes sensed data from a specific single sensor network, or analyzes sensed data from a plurality of sensor networks, or analyzes sensed data from the sensor network in association with predefined legacy data.

12. (Previously Presented) The method as recited in claim 10, wherein the providing the application program with the information service obtained according to the scheduled operation sequence, the information service including events and context aware information provides the information service to the application program only one time, or periodically provides the information service during a request period of the application program, or provides the information service at a specific time point when a requirement from the application program is satisfied.

REMARKS

In accordance with the foregoing, the specification and claim 6 and 10 have been amended. Claims 1-12 are pending and under consideration.

The Action objected to claims 5, 6, and 10 and these claims have been amended.

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

Date: 2/28/11

By: /J. Randall Beckers/
J. Randall Beckers
Registration No. 30,358

1201 New York Avenue, N.W., 7th Floor
Washington, D.C. 20005
Telephone: (202) 434-1500
Facsimile: (202) 434-1501

S&H Form: (10/08)

REPLY/AMENDMENT FEE TRANSMITTAL		Attorney Docket No.	2044.1022
		Application Number	12/439,421
		Filing Date	February 27, 2009
		First Named Inventor	Se-Won OH, et al.
		Group Art Unit	2612
AMOUNT ENCLOSED	0.00	Examiner Name	Tai T. Nguyen

FEE CALCULATION (fees effective 10/02/08)

CLAIMS AS AMENDED	Claims Remaining After Amendment	Highest Number Previously Paid For	Number Extra	Rate	Calculations
TOTAL CLAIMS	12	- 20 =	0	X $ 52.00 =	$ 0.00
INDEPENDENT CLAIMS	3	- 3 =	0	X $ 220.00 =	0.00

Since an Official Action set an original due date of April 18, 2011, petition is hereby made for an extension to cover the date this reply is filed for which the requisite fee is enclosed (1 month ($130)); (2 months ($490)); (3 months ($1,110)); (4 months ($1,730)); (5 months ($2,350):	
If Notice of Appeal is enclosed, add ($540.00)	
If Statutory Disclaimer under Rule 20(d) is enclosed, add fee ($140.00)	
Information Disclosure Statement (Rule 1.17(p)) ($180.00)	
Total of above Calculations =	$ 0.00
Reduction by 50% for filing by small entity (37 CFR 1.9, 1.27 & 1.28)	
TOTAL FEES DUE =	$ 0.00

(1) If entry (1) is less than entry (2), entry (3) is "0".

(2) If entry (2) is less than 20, change entry (2) to "20".

(4) If entry (4) is less than entry (5), entry (6) is "0".

(5) If entry (5) is less than 3, change entry (5) to "3".

METHOD OF PAYMENT

☐ Check enclosed as payment.

☐ Charge "TOTAL FEES DUE" to the Deposit Account No. below.

☒ No payment is enclosed.

GENERAL AUTHORIZATION

☒ If the above-noted "AMOUNT ENCLOSED" is not correct, the Commissioner is hereby authorized to credit any overpayment or charge any additional fees necessary to:

Deposit Account No.	19-3935
Deposit Account Name	STAAS & HALSEY LLP

☒ The Commissioner is also authorized to credit any overpayments or charge any additional fees required under 37 CFR 1.16 (filing fees) or 37 CFR 1.17 (processing fees) during the prosecution of this application, including any related application(s) claiming benefit hereof pursuant to 35 USC § 120 (e.g., continuations/divisionals/CIPs under 37 CFR 1.53(b) and/or continuations/divisionals/CPAs under 37 CFR 1.53(d)) to maintain pendency hereof or of any such related application.

SUBMITTED BY: STAAS & HALSEY LLP

Typed Name	J. Randall Beckers	Reg. No.	30,358
Signature	/J. Randall Beckers/	Date	2/28/11

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Electronic Acknowledgement Receipt

EFS ID:	9544542
Application Number:	12439421
International Application Number:	
Confirmation Number:	3680
Title of Invention:	USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME
First Named Inventor/Applicant Name:	Se-Won Oh
Customer Number:	21171
Filer:	Randall J. Beckers/Brian Formagus
Filer Authorized By:	Randall J. Beckers
Attorney Docket Number:	2044.1022
Receipt Date:	28-FEB-2011
Filing Date:	27-FEB-2009
Time Stamp:	12:51:52
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	Amendment.pdf	36537 f92a37d17fa394ce96568459df2eaf4d7c193609	no	7

Warnings:	
Information:	

Total Files Size (in bytes):	36537

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
12/439,421	02/27/2009	

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☒		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	02/28/2011	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 12	Minus	** 20	= 0	X $26 =	0	OR	X $ =	
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $110 =	0	OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/DIANA BATES/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

21171 7590 03/28/2011

STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

EXAMINER
NGUYEN, TAI T

ART UNIT	PAPER NUMBER
2612	

DATE MAILED: 03/28/2011

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/439,421	02/27/2009	Se-Won Oh	2044.1022	3680

TITLE OF INVENTION: USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	06/28/2011

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 02/11)

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

21171 7590 03/28/2011
STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/439,421	02/27/2009	Se-Won Oh	2044.1022	3680

TITLE OF INVENTION: USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	06/28/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, TAI T	2612	340-521000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): (**Please first reapply any previously paid issue fee shown above**)
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
- ❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/439,421	02/27/2009	Se-Won Oh	2044.1022	3680

21171 7590 03/28/2011

STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

EXAMINER	
NGUYEN, TAI T	

ART UNIT	PAPER NUMBER
2612	

DATE MAILED: 03/28/2011

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 297 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 297 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No.	Applicant(s)	
	12/439,421	OH ET AL.	
	Examiner	Art Unit	
	Tai T. Nguyen	2612	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment filed on 02/28/2011*.

2. ☒ The allowed claim(s) is/are *1-12*.

3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
      1. ☒ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/Tai T. Nguyen/
Primary Examiner, Art Unit 2612

DETAILED ACTION

Allowable Subject Matter

1. Claims 1-12 are allowed.

2. The following is an examiner's statement of reasons for allowance: The prior art of record does not teach or suggest, in the claimed combination, a system for providing an information service based on heterogeneous sensor networks, comprising:

a sensor node constructing a sensor network to sense environment information;

a sensor network data transmitter for collecting sensed data sensed by the sensor in real-time and transmitting the collected sensed data in a message form; and

a Ubiquitous Sensor Network (USN) middleware for extracting object and environment information by cleaning, classifying and integrating the message received from the sensor network data transmitter, generating conditional events, context aware information, and knowledge contents from the extracted object and environment information, and providing the information service to an application program, the application program providing a user with information related to environment where the sensor network is installed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tai T. Nguyen whose telephone number is (571) 272-2961. The examiner can normally be reached on Monday-Friday from 7:30am-5:00pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Razavi can be reached on (571) 272-7664. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tai T. Nguyen/
Primary Examiner, Art Unit 2612

March 23, 2011

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12439421	OH ET AL.
	Examiner	**Art Unit**
	Tai T Nguyen	2612

ORIGINAL		INTERNATIONAL CLASSIFICATION	
CLASS	SUBCLASS	CLAIMED	NON-CLAIMED
340	521	G 0 8 B 19 / 00 (2006.01.01)	

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
340	523	524	534	539.26	540
340	541	286.02			
709	218	223	224	201	206

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1														
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														
	11														
	12														

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 12	
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SEARCHED			
Class	Subclass	Date	Examiner
340	521, 523, 524, 534, 539.26, 540, 541, 286.02	3/23/2011	TN
709	218, 223, 224, 201, 206	3/23/2011	TN

SEARCH NOTES		
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U.S. PATENT DOCUMENTS

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	AB						
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		DOCUMENT NO.	DATE	COUNTRY	TRANSLATION YES	TRANSLATION NO	English ABSTRACT
	AG	10-2006-0068518	06/2006	Korea			X
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	AI	03-274939	12/1991	Japan			X
	AJ	2000-047894	02/2000	Japan	X		X
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OTHER REFERENCES **(Including Author, Title, Date, Pertinent Pages, Etc.)**

			TRANSLATION YES	TRANSLATION NO
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KIM, JIN WON

(54) SERVICE SYSTEM AND METHOD FOR PROVIDING A UBIQUITOUS-BASED CONTEXT INFORMATION, ESPECIALLY FOR COLLECTING USER CONTEXT INFORMATION IN REAL TIME THROUGH A UBIQUITOUS SENSOR NETWORK AND PROVIDING AN OPTIMIZED SERVICE TO EACH USER BASED ON THE COLLECTED INFORMATION

(57) Abstract:

PURPOSE: A service system and method for providing a ubiquitous-based context information are provided to allow a user to receive various convenient services through minimum operations. CONSTITUTION: Sensor nodes(10) collect context information of each user. A context recognition middleware(20) converts the user context information received from the sensor nodes(10) into a request for being stored in a context recognizing server(30) and transfers it to the context recognizing server(30), and transfers a service usage request received from users to the context recognizing server(30). The context recognizing server(30) stores context information of each user according to the context information storage request and provides a corresponding service by using the stored context information of each user according to the service usage request.

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(74) 대리인 특허법인 신성

심사청구 : 있음

(54) 유비쿼터스 기반의 상황 정보 제공 서비스 시스템 및 그방법

요약

1. 청구범위에 기재된 발명이 속하는 기술분야

본 발명은, 유비쿼터스 기반의 상황 정보 제공 서비스 시스템 및 그 방법에 관한 것임.

2. 발명이 해결하려고 하는 기술적 과제

본 발명은, 유비쿼터스 네트워크를 통하여 사용자의 상황 정보를 실시간으로 수집하고, 이를 바탕으로 사용자마다 최적화된 서비스를 제공함으로써, 사용자가 최소한의 동작으로 여러가지 편리한 서비스를 제공받을 수 있도록 하기 위한, 유비쿼터스 기반의 상황 정보 제공 서비스 시스템 및 그 방법을 제공하는데 그 목적이 있음.

3. 발명의 해결 방법의 요지

본 발명은, 유비쿼터스 기반의 상황 정보 제공 서비스 시스템에 있어서, 각 사용자의 상황(Context) 정보를 수집하기 위한 센싱 수단; 상기 센싱 수단으로부터 전달받은 사용자의 상황 정보를 상황 인식 수단에 저장시키기 위한 요청으로 변환하여 상기 상황 인식 수단으로 전달하고, 사용자로부터 전달받은 서비스 이용 요청을 상기 상황 인식 수단으로 전달하기 위한

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매개 수단; 및 상기 매개 수단을 통하여 전달받은 상황 정보 저장 요청에 따라 각 사용자의 상황 정보를 저장하고, 상기 매개 수단을 통하여 전달받은 서비스 이용 요청에 따라 자신이 저장하고 있는 사용자의 상황 정보를 이용하여 해당 서비스를 제공하기 위한 상황 인식 수단을 포함함.

4. 발명의 중요한 용도

본 발명은 위치 정보 제공 시스템 등에 이용됨.

대표도

도 1

색인어

유비쿼터스, 상황 인식, 위치 추적, 센서 네트워크, 지능형 센서

명세서

도면의 간단한 설명

도 1은 본 발명에 따른 유비쿼터스 기반의 상황 정보 제공 서비스 시스템의 일실시예 구성도,

도 2는 본 발명에 따른 유비쿼터스 기반의 상황 정보 제공 서비스 시스템 중 센서 노드의 일실시예 상세 구성도,

도 3은 본 발명에 따른 유비쿼터스 기반의 상황 정보 제공 서비스 시스템 중 상황 인식 미들웨어의 일실시예 상세 구성도,

도 4는 본 발명에 따른 유비쿼터스 기반의 상황 정보 제공 서비스 시스템 중 상황 인식 서버의 일실시예 상세 구성도,

도 5는 본 발명에 따른 유비쿼터스 기반의 상황 정보 제공 서비스 시스템 중 센싱 센서의 구성에 대한 일실시예 설명도,

도 6은 본 발명에 따른 유비쿼터스 기반의 상황 정보 제공 서비스 방법에 대한 일실시예 설명도이다.

* 도면의 주요 부분에 대한 부호 설명

10 : 센서 노드 20 : 상황 인식 미들웨어

30 : 상황 인식 서버 21 : 태그(Tag)-센서

22 : 센싱(Sensing)-센서 23 : 싱크(Sink)-센서

31 : 센서 네트워크 통신부 32 : 상황 정보 관리부

33 : 상황 정보 처리부 34 : 상황 처리 정책 설정부

35 : 센서 네트워크 관리부 36 : 응용부

41 : 통신부 42 : 데이터베이스 관리부

43 : 상황 정보 데이터베이스

발명의 상세한 설명

발명의 목적

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발명이 속하는 기술 및 그 분야의 종래기술

본 발명은, 유비쿼터스 기반의 상황 정보 제공 서비스 시스템 및 그 방법에 관한 것으로, 더욱 상세하게는 유비쿼터스 센서 네트워크를 통하여 사용자의 상황 정보를 실시간으로 수집하고, 이를 바탕으로 사용자마다 최적화된 서비스를 제공함으로써, 사용자가 최소한의 동작으로 여러가지 편리한 서비스를 제공받을 수 있도록 하기 위한, 유비쿼터스 기반의 상황 정보 제공 서비스 시스템 및 그 방법에 관한 것이다.

그리고, 본 발명에서 상황(Context) 정보란 사용자와 사물간의 상호 작용에 연관된 존재물(사람, 장소, 사물 등)을 특정 짓는 모든 형태의 정보로서, 사용자가 사용하는 계산 능력을 갖춘 도구에서 발생되는 자원 정보 및 사용자의 행동에 기초하여 변화되는 주변 정보를 포함한다.

일반적으로 상황 정보 중 가장 중요한 것은 위치 정보이다. 위치 정보를 수집하는 대표적인 기술로는 GPS(Global Positioning System) 또는 기지국을 이용한 휴대폰 위치 추적 기술이 있다.

기존의 위치 추적 시스템 중에서 GPS(Global Positioning System)는 서로 다른 궤도를 가지고 지구 대기권을 회전하고 있는 27개의 GPS위성으로부터 대상물의 위치 정보를 획득하는 시스템으로서, 최소 4개의 위성으로부터 받아들인 신호로 위치 정보를 획득하지만 실외에서만 동작하는 시스템이다. 또한, GPS 신호를 수신할 수 있는 수신기를 구비한 단말 만이 위치 정보를 획득할 수 있기 때문에 획득한 위치 정보를 다른 응용에 적용시킬 수 없었다.

다른 기술로서 기지국을 이용하는 방식은 CDMA의 특성 중 하나인 위치 추적 기능을 이용한 것이다. 기지국 내에 CDMA 방식의 단말을 사용하는 이용자의 위치 추적이 가능하다. 기지국을 이용하는 방식은 기존 휴대폰으로도 위치 추적 서비스를 받을 수 있다는 장점이 있으나 현재로서는 오차 범위가 다소 크고 기지국이 없는 '음영지역'에서는 서비스가 불가능한 단점이 있었다.

상기와 같이 종래의 위치 인식 시스템은 실내에서 인식이 불가능하거나 정밀도가 떨어지는 약점이 있고, 개별적인 센서들을 통한 센싱 정보의 수집만을 하는 수동적 시스템이었다.

따라서, 언제 어디서나 정확한 위치 정보를 제공할 뿐만 아니라 개별적인 센서로부터 수집한 온도, 습도, 소리, 밝기, 진동 등의 정보를 통합하여 제공할 수 있는 서비스가 절실히 요구된다.

발명이 이루고자 하는 기술적 과제

본 발명은, 상기와 같은 요구에 부응하기 위하여 제안된 것으로, 유비쿼터스 센서 네트워크를 통하여 사용자의 상황 정보를 실시간으로 수집하고, 이를 바탕으로 사용자마다 최적화된 서비스를 제공함으로써, 사용자가 최소한의 동작으로 여러가지 편리한 서비스를 제공받을 수 있도록 하기 위한, 유비쿼터스 기반의 상황 정보 제공 서비스 시스템 및 그 방법을 제공하는데 그 목적이 있다.

본 발명의 다른 목적 및 장점들은 하기의 설명에 의해서 이해될 수 있으며, 본 발명의 실시예에 의해 보다 분명하게 알게 될 것이다. 또한, 본 발명의 목적 및 장점들은 특허 청구 범위에 나타낸 수단 및 그 조합에 의해 실현될 수 있음을 쉽게 알 수 있을 것이다.

발명의 구성 및 작용

상기의 목적을 달성하기 위한 본 발명의 장치는, 유비쿼터스 기반의 상황 정보 제공 서비스 시스템에 있어서, 각 사용자의 상황(Context) 정보를 수집하기 위한 센싱 수단; 상기 센싱 수단으로부터 전달받은 사용자의 상황 정보를 상황 인식 수단에 저장시키기 위한 요청으로 변환하여 상기 상황 인식 수단으로 전달하고, 사용자로부터 전달받은 서비스 이용 요청을 상기 상황 인식 수단으로 전달하기 위한 매개 수단; 및 상기 매개 수단을 통하여 전달받은 상황 정보 저장 요청에 따라 각 사용자의 상황 정보를 저장하고, 상기 매개 수단을 통하여 전달받은 서비스 이용 요청에 따라 자신이 저장하고 있는 사용자의 상황 정보를 이용하여 해당 서비스를 제공하기 위한 상황 인식 수단을 포함하는 것을 특징으로 한다.

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또한, 본 발명의 방법은, 유비쿼터스 기반의 상황 정보 제공 서비스 방법에 있어서, 유비쿼터스 네트워크를 이용하여 사용자의 상황(Context) 정보를 수집하는 상황 정보 수집 단계; 상기 수집한 상황 정보를 각 사용자 별로 저장하는 상황 정보 저장 단계; 및 사용자로부터의 서비스 제공을 요청에 따라 해당 사용자의 상황 정보를 검색하여 그에 따른 서비스를 제공하는 서비스 제공 단계를 포함하는 것을 특징으로 한다.

상술한 목적, 특징 및 장점은 첨부된 도면과 관련한 다음의 상세한 설명을 통하여 보다 분명해 질 것이며, 그에 따라 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자가 본 발명의 기술적 사상을 용이하게 실시할 수 있을 것이다. 또한, 본 발명을 설명함에 있어서 본 발명과 관련된 공지 기술에 대한 구체적인 설명이 본 발명의 요지를 불필요하게 흐릴 수 있다고 판단되는 경우에 그 상세한 설명을 생략하기로 한다. 이하, 첨부된 도면을 참조하여 본 발명에 따른 바람직한 일실시예를 상세히 설명하기로 한다.

도 1은 본 발명에 따른 유비쿼터스 기반의 상황 정보 제공 서비스 시스템의 일실시예 구성도이다.

도 1에 도시된 바와 같이, 유비쿼터스 기반의 상황 정보 제공 서비스 시스템은, 사용자가 위치한 서비스 환경의 변화(위치, 온도, 습도, 시설 이용 등의 상황 정보(Context))를 실시간으로 검출(수집)하여 애드 혹(ad-hoc) 라우팅의 자가 구성을 통하여 유선네트워크에 연결된 상황 인식 미들웨어(20)로 전달하기 위한 센서 노드(10), 상기 센서 노드(10)로부터 전달받은 사용자의 상황 정보를 상황 인식 서버(30)에 저장시키기 위한 요청으로 변환하여 상기 상황 인식 서버(30)로 전달하고, 사용자로부터 전달받은 서비스 이용 요청에 따라 사용자의 서비스 선호도, 사용자가 보유한 기기의 상태, 및 주변 상황 정보 등을 체크하여 상기 상황 인식 서버(30)로 서비스를 요청하기 위한 상황 인식 미들웨어(20), 및 상기 상황 인식 미들웨어(20)를 통하여 전달받은 서비스 상황 정보 저장 요청에 따라 사용자의 상황 정보를 저장하고, 상기 상황 인식 미들웨어(20)를 통하여 전달받은 서비스 이용 요청에 따라 자신이 저장하고 있는 사용자의 상황 정보에 따라 해당 서비스를 제공하기 위한 상황 인식 서버(30)를 포함한다.

도 2를 참조하여 센서 노드(10)의 구성에 대하여 보다 상세히 살펴보기로 한다.

도 2는 본 발명에 따른 유비쿼터스 기반의 상황 정보 제공 서비스 시스템 중 센서 노드의 일실시예 상세 구성도이다.

도 2에 도시된 바와 같이, 유비쿼터스 기반의 상황 정보 제공 서비스 시스템 중 센서 노드(10)는, 사용자 또는 서비스를 제공할 기기에 부착되어 실시간으로 사용자의 상황 정보를 감지하기 위한 태그-센서(21), 상기 태그-센서(21)로부터의 신호를 감지하여 사용자의 위치를 인식하고, 사용자로부터의 서비스 요청과 같은 능동형 서비스 데이터와 불법 침입 탐지와 같이 사용자의 개입이 필요없는 수동형 서비스 데이터를 라우팅을 통하여 싱크(Sink)-센서(23)로 전달하기 위한 센싱(Sensing)-센서(22), 및 다수의 센싱(Sensing)-센서(22)로부터 능동형 서비스 데이터 및 수동형 서비스 데이터를 수집하여 상황 인식 미들웨어(20)로 전달하며, 상기 센싱(Sensing)-센서의 상태를 제어하기 위한 싱크(Sink)-센서(23)를 포함한다.

상기 태그(Tag)-센서(21)는 사용자 또는 서비스를 제공할 기기에 부착되며, 서비스 기기의 내부에 내장되거나 외부에 장착될 수 있다. 상황 인식을 통한 서비스를 제공하기 위한 첫 번째 단계는 사용자의 위치 인식이다. 본 발명에서 위치 인식은 사용자가 부착한 태그(Tag)-센서(21)와 건물에 부착된 센싱-센서(22)와의 통신 정보를 이용하여 좌표를 계산하는 방식을 이용한다.

즉, 센싱-센서(22)에서 무선(RF) 통신, 지그비(Zigbee) 통신, 초광대역 무선(UWB : UltraWideBand) 통신과 같은 무선통신을 이용하여 임의의 태그(Tag)-센서(21)로 신호(위치 정보)를 전송하면, 상기 태그(Tag)-센서(21)가 3개 이상의 센싱-센서로부터 수신한 위치 정보를 이용하여 자신의 위치 좌표를 계산한 후, 다시 상기 센싱-센서(22)로 전달하여 상황 인식 서버(30)가 위치를 인지하도록 하는 2-웨이 커뮤니케이션(2-way communication) 방식을 이용한다.

그 반대로, 태그(Tag)-센서(21)가 외부에 존재하는 센싱-센서(22)로 신호를 전송하고, 외부의 센싱-센서(22)들이 이 신호를 사용하여 그 위치를 계산할 수도 있다. 이 때, 태그(Tag)-센서(21)의 위치 정보는 센서 네트워크에서 컨텍스트(Context), 즉 상황 정보 중의 하나이며, 본 발명에서 이에 대한 정의는 다음과 같다.

즉, 본 발명에서 상황(Context) 정보란 앞에서도 설명한 바와 같이, 사용자와 사물간의 상호 작용에 연관된 존재물(사람, 장소, 사물 등)을 특정 짓는 모든 형태의 정보로서, 사용자가 사용하는 계산 능력을 갖춘 도구에서 발생되는 자원 정보 및 사용자의 행동에 기초하여 변화되는 주변 정보를 포함한다.

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태그(Tag)-센서(21)의 위치 정보를 포함한 상황 정보를 도 5에 도시된 바와 같은 네트워크 토폴로지로 구성된 센싱(Sensing)-센서(22)를 통하여 상황 인식 서버(30)로 전달된다. 이 때, 태그(Tag)-센서(21)로부터 수집한 상황 정보를 처리할 수 있을 때에는 상황 인식 서버(30)로 전달하지 않고, 센싱-센서(22)가 자체적으로 처리할 수도 있다.

한편, 태그(Tag)-센서(21)로부터 수집한 상황 정보를 전달하기 위한 네트워크 토폴로지는 서비스에 필요한 정보를 감지하기 위한 센싱(Sensing)-센서(22)들 만으로 이루어진 센싱(Sensing)-센서층, 감지한 정보를 지역별, 서비스별, 네트워크별로 요약하는 헤더(Header)-센서층으로 나뉠 수 있다. 헤더(Header)-센서는 센싱(Sensing)-센서 가운데 선출된다.

한편, 헤더(Header)-센서에서 요약된 정보는 센서 네트워크와 상황 인식 시스템(상황 인식 미들웨어 및 상황 인식 서버)을 연결해 주는 게이트웨이 역할을 수행하는 싱크(Sink)-센서(23)로 전달된다.

상기에서 설명한 센서들은 "RF", "Zigbee", "UWB"와 같은 무선 통신 또는 유선 통신을 통하여 자유자재로 동일 계층간 통신이 이루어지며, 센서들이 그룹을 형성하여 서로 제어 메시지나 데이터를 교환하고, 형성한 그룹에 새로운 센서가 새롭게 추가되거나 삭제될 수 있다.

또한, 헤더(Header)-센서층과 싱크(Sink)-센서층은 상황 정보가 포함된 패킷에 TTL(Time To Live)값을 설정(1로 설정)하는 방식 등을 이용하여 센서 네트워크의 트래픽 폭주를 방지한다. 이 때, 헤더(Header)-센서는 필수사항이 아니며 각 센싱-센서(22)가 직접 싱크(Sink)-센서(23)로 연결될 수도 있다. 도 3을 참조하여 상황 인식 미들웨어의 구성에 대하여 보다 상세히 살펴보기로 한다.

도 3은 본 발명에 따른 유비쿼터스 기반의 상황 정보 제공 서비스 시스템 중 상황 인식 미들웨어의 일실시예 상세 구성도이다.

도 3에 도시된 바와 같이, 본 발명에 따른 유비쿼터스 기반의 상황 정보 제공 서비스 시스템 중 상황 인식 미들웨어(20)는, 센서 네트워크 통신부(31), 상황 정보 관리부(32), 상황 정보 처리부(33), 상황 처리 정책 설정부(34), 센서 네트워크 관리부(35), 및 응용부(36)를 포함한다.

상기 센서 네트워크 통신부(31)는 센서 노드(10)로부터의 상황 정보와 사용자 서비스 요청을 입력받는다. 상기 센서 네트워크 통신부(31)는 사용자 서비스 요청에 대하여 사용자의 서비스 계속 여부를 판단하는 인증 기능을 부가적으로 제공하며, 서비스가 해당 사용자에게 올바르게 제공되었는지를 검사하여 실패시 재전송하는 기능을 제공한다.

상기 상황 정보 관리부(32)는 상기 센서 네트워크 통신부(31)를 통하여 전달받은 상황 정보와 사용자 서비스 요청을 데이터베이스에 저장한다. 이 때, 상황 정보를 XML 형태로 변환하여 저장할 수도 있다. 서비스 요청이 아닌 상황 정보는 센서 네트워크 통신부(31)를 통하여 상황 인식 서버(30)로 전달된다. 그리고, 서비스 요청은 상황 정보 처리부(33)로 전달된다.

상기 상황 정보 처리부(33)는 사전에 입력받은 사용자의 선호도와 서비스 제공을 위한 장비의 제한 등이 저장된 상황 처리 정책 설정부(34)의 정보와 실시간으로 상황 인식 서버로 질의하여 획득한 사용자 위치 및 장비의 상태(상황 정보)에 따라 현재 상태에서 활용가능한 최적의 서비스를 검색하여 해당 애플리케이션을 실행시키는 역할을 수행한다.

상기 상황 처리 정책 설정부(34)는 사전에 입력받은 사용자의 선호도와 서비스 제공을 위한 장비의 제한 등과 같은 사용자 기본 정보를 저장하고 있다.

상기 센서 네트워크 관리부(35)는 전력의 소모에 민감한 센서의 특성을 고려하여 센서들의 상태를 주기적으로 점검하여 운영의 신뢰성을 보장한다.

상기 응용부(36)는 센서 노드들을 활용하여 특정 서비스를 제공하고자 할때 개별의 센서 노드들이 운영하는 응용프로그램을 동작시킨다.

한편, 상황 인식 서버(30)는 상황 인식 미들웨어(20)로부터 실시간으로 입력되는 상황 정보를 저장하고, 이를 바탕으로 최적의 서비스를 검색하기 위한 기본 정보를 제공한다. 이 때, 제공되는 기본 정보로는 사용자가 원하는 서비스 요청에 대한 선호도, 메모리, 대역폭, 에너지 등과 같은 사용자 장치의 상태, 및 사용자의 위치 정보, 온도, 습도 정보 등이 포함된다.

도 4는 본 발명에 따른 유비쿼터스 기반의 상황 정보 제공 서비스 시스템 중 상황 인식 서버의 일실시예 상세 구성도이다.

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도 4에 도시된 바와 같이, 본 발명에 따른 유비쿼터스 기반의 상황 정보 제공 서비스 시스템 중 상황 인식 서버(30)는, 상황 인식 미들웨어(20)를 통하여 실시간으로 입력받은 상황 정보를 전달받기 위한 통신부(41), 상기 통신부(41)을 통하여 전달받은 상황 정보를 그 종류 별로 분류하여 상황 정보 데이터베이스(43)에 저장하고, 상기 통신부(41)를 통하여 전달받은 사용자 서비스 요청에 따라 상기 상황 정보 데이터베이스(43)로부터 해당 데이터를 검색, 저장, 삭제하는 역할을 수행하기 위한 데이터베이스 관리부(42) 및 상기 데이터베이스 관리부(42)의 제어에 따라 상황 정보를 저장하고 관리하기 위한 상황 정보 데이터베이스(43)를 포함한다.

상기 상황 인식 서버(30)는 웹서버의 기능과 코드 이동성을 지원하는 프로그램 등을 내장할 수 있다. 즉, 상기 데이터베이스 관리부(42)는 웹서버 기능을 구비하여 여러가지 상황 정보 제공 서비스를 사용자에게 제공한다.

도 6을 참조하여 본 발명의 구체적인 일실시예를 살펴보기로 한다.

도 6은 본 발명에 따른 유비쿼터스 기반의 상황 정보 제공 서비스 방법에 대한 일실시예 설명도로서, 스마트 공원에 적용된 경우를 일예로 들어 살펴보기로 한다.

사용자가 본 발명에 따른 상황 인식 시스템이 설치된 놀이공원 시설을 이용하면서 미아찾기, 이용시간/사용횟수 별 이용대금 자동부과, 및 실시간 공원 내 행사 안내 등과 같은 서비스 정보를 제공받는 상황을 가정한다.

먼저, 사용자는 태그(Tag)-센서(21)가 내장된 정액제/종량제의 공원 이용권, 또는 PDA와 같이 휴대가 가능한 무선 안내 장치를 발급받는다. 그리고, 놀이기구 입구 및 동물원, 벤치, 가로등에 설치된 센싱(Sensing)-센서(22)가 상기 태그(Tag)-센서(21)의 위치를 감지하여 실시간으로 "RF", "UWB", "Zigbee"와 같은 근거리 무선통신을 통하여 싱크(Sink)-센서(23)로 상황 정보를 전송한다.

그러면, 상기 싱크(Sink)-센서(23)로부터 상황 정보를 수신한 상황 인식 미들웨어(20)는 상황 정보를 분석하여 상황 인식 서버(30)에 저장 요청한다.

그러면, 상기 상황 인식 서버(30)는 상황 인식 미들웨어(20)를 통하여 실시간으로 수집한 사용자의 상황 정보를 자신이 관리하는 상황 정보 데이터베이스(33)에 저장한다. 앞에서도 설명하였듯이, 상기 상황 인식 서버(30)는 외부에서 접근 가능한 웹 서버 기능을 가지고 있다.

예를 들어, 태그(Tag)-센서(21)를 소지하고 있는 미아가 발생하면 사용자는 웹 서버를 통하여 미아의 위치를 제공받을 수 있다.

또한, 공원 내 특정 행사가 시작될 때 이를 알리는 광고 메시지 또는 음성 메시지를 출력시키도록 명령을 전송하면, 사용자는 이를 이용하여 특정 장소에서 진행 중인 행사와 행사 위치를 알 수 있게 된다. 장애인를 위하여 버튼 또는 PDA에 내장된 음성 인식 도구를 이용하여 이벤트를 발생시킬 수도 있으며, 이러한 이벤트는 센서 네트워크를 통해 상황 인식 서버(30)에 저장되어 있는 위치를 기준으로 길안내 서비스를 제공하는데 이용된다.

또한, 종량제 공원 이용권을 소지한 사용자가 놀이기구 이용 시에는 놀이기구에 설치된 센싱(Sensing)-센서(20)를 통하여 놀이기구 이용에 대한 이력, 즉 ID, 놀이기구 종류, 이용 횟수 등과 같은 정보가 상황 인식 서버(30)에 실시간으로 전달되어 놀이공원을 벗어날 때 자동 과금 서비스를 제공할 수 있도록 한다.

또한, 상황 인식 서버(30)는 이처럼 사용자로부터 획득한 상황 정보로부터 놀이기구 별 이용자 수용 측정, 동물원 내 환경 측정을 통한 온도 및 습도 조절 등의 서비스를 센서 네트워크를 통하여 수행할 수 있다.

본 발명에 따른 유비쿼터스 기반의 상황 정보 제공 서비스 방법을 다시 한번 살펴보면 다음과 같다.

먼저, 센싱(Sensing)-센서(22)가 태그(Tag)-센서(21)들의 위치를 감지하거나, 기후 상태(온도, 습도, 압력) 등의 상황 정보를 수집한다. 그리고, 상기 수집한 상황 정보를 상황 인식 미들웨어(20)를 통하여 상황 인식 서버(30)로 전달한다.

이후, 상기 센싱(Sensing)-센서(22)가 사용자로부터 서비스 제공을 요청받으면 상황 인식 미들웨어(20)를 통하여 상기 상황 인식 서버(30)로 전달한다.

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그러면 상기 상황 인식 서버(30)가 사용자의 상황 정보를 검색하여 그에 따른 서비스를 제공한다.

이처럼, 본 발명에 따른 유비쿼터스 기반의 상황 정보 제공 서비스 시스템은, 여러 센서를 가지고 있는 소형 센서 노드들과 사용자가 가지고 있는 단말을 이용하여 사용자 위치 정보 및 환경 정보를 인식하고, 인식한 위치 정보 및 환경 정보에 따라 적절한 서비스를 사용자 단말로 제공한다.

이 때, 사용자 단말에 제공될 수 있는 서비스로는 실내외에서의 위치 정보에 기반한 길 안내, 분실물 찾기 서비스, 미아 찾기 서비스 등이 있다.

상술한 바와 같은 본 발명의 방법은 프로그램으로 구현되어 컴퓨터로 읽을 수 있는 형태로 기록매체(씨디롬, 램, 롬, 플로피 디스크, 하드 디스크, 광자기 디스크 등)에 저장될 수 있다. 이러한 과정은 본 발명이 속하는 기술 분야에서 통상의 지식을 가진 자가 용이하게 실시할 수 있으므로 더 이상 상세히 설명하지 않기로 한다.

이상에서 설명한 본 발명은, 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자에게 있어 본 발명의 기술적 사상을 벗어나지 않는 범위 내에서 여러 가지 치환, 변형 및 변경이 가능하므로 전술한 실시예 및 첨부된 도면에 의해 한정되는 것이 아니다.

발명의 효과

상기와 같이 본 발명은, 센서 네트워크를 통하여 사용자의 상황 정보를 실시간으로 수집하고, 이를 바탕으로 사용자마다 최적화된 서비스를 제공함으로써, 사용자가 최소한의 동작으로 여러가지 편리한 서비스를 제공받을 수 있는 효과가 있다.

(57) 청구의 범위

청구항 1.

유비쿼터스 기반의 상황 정보 제공 서비스 시스템에 있어서,

각 사용자의 상황(Context) 정보를 수집하기 위한 센싱 수단;

상기 센싱 수단으로부터 전달받은 사용자의 상황 정보를 상황 인식 수단에 저장시키기 위한 요청으로 변환하여 상기 상황 인식 수단으로 전달하고, 사용자로부터 전달받은 서비스 이용 요청을 상기 상황 인식 수단으로 전달하기 위한 매개 수단; 및

상기 매개 수단을 통하여 전달받은 상황 정보 저장 요청에 따라 각 사용자의 상황 정보를 저장하고, 상기 매개 수단을 통하여 전달받은 서비스 이용 요청에 따라 자신이 저장하고 있는 사용자의 상황 정보를 이용하여 해당 서비스를 제공하기 위한 상황 인식 수단

을 포함하는 유비쿼터스 기반의 상황 정보 제공 서비스 시스템.

청구항 2.

제 1 항에 있어서,

상기 상황(Context) 정보는,

사용자와 사물간의 상호 작용에 연관된 존재물을 특정 짓는 형태의 정보로서, 사용자가 사용하는 계산 능력을 갖춘 도구에서 발생되는 자원 정보 및 사용자의 행동에 기초하여 변화되는 주변 정보를 포함하는 것을 특징으로 하는 유비쿼터스 기반의 상황 정보 제공 서비스 시스템.

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청구항 3.

제 2 항에 있어서,

상기 센싱 수단은,

사용자 또는 서비스를 제공할 기기에 부착되어 실시간으로 사용자의 상황 정보를 감지하기 위한 태그(Tag)-센서;

상기 태그-센서로부터의 신호를 감지하여 수집한 사용자의 상황 정보를 라우팅을 통하여 싱크(Sink)-센서로 전달하기 위한 센싱(Sensing)-센서; 및

상기 다수의 센싱-센서로부터 사용자의 상황 정보를 수집하여 상기 매개 수단으로 전달하며, 상기 센싱-센서를 제어하기 위한 상기 싱크(Sink)-센서

를 포함하는 유비쿼터스 기반의 상황 정보 제공 서비스 시스템.

청구항 4.

제 3 항에 있어서,

상기 태그(Tag)-센서와 상기 센싱-센서와의 통신은,

무선(RF) 통신을 이용하는 것을 특징으로 하는 유비쿼터스 기반의 상황 정보 제공 서비스 시스템.

청구항 5.

제 3 항에 있어서,

상기 태그(Tag)-센서와 상기 센싱-센서와의 통신은,

지그비(Zigbee) 통신을 이용하는 것을 특징으로 하는 유비쿼터스 기반의 상황 정보 제공 서비스 시스템.

청구항 6.

제 3 항에 있어서,

상기 태그(Tag)-센서와 상기 센싱-센서와의 통신은,

초광대역 무선(UWB : UltraWideBand) 통신을 이용하는 것을 특징으로 하는 유비쿼터스 기반의 상황 정보 제공 서비스 시스템.

청구항 7.

제 3 항 내지 제 5 항 중 어느 한 항에 있어서,

상기 센싱-센서가 상기 태그-센서를 통하여 위치 정보를 수집하는 과정은,

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3 개 이상의 센싱-센서가 자신의 위치 정보를 상기 태그(Tag)-센서로 전송하고, 상기 태그(Tag)-센서가 상기 3개 이상의 센싱-센서로부터 수신한 위치 정보를 이용하여 계산한 위치 좌표를 상기 센싱-센서로 전달하여 이루어지는 것을 특징으로 하는 유비쿼터스 기반의 상황 정보 제공 서비스 시스템.

청구항 8.

제 3 항 내지 제 5 항 중 어느 한 항에 있어서,

상기 센싱-센서가 상기 태그-센서를 통하여 위치 정보를 수집하는 과정은,

상기 센싱-센서가 상기 태그(Tag)-센서로부터 수신한 신호로부터 그 위치를 계산하여 이루어지는 것을 특징으로 하는 유비쿼터스 기반의 상황 정보 제공 서비스 시스템.

청구항 9.

제 2 항에 있어서,

상기 매개 수단은,

상기 센싱 수단 및 상기 상황 인식 수단과 데이터를 송수신하기 위한 통신 수단;

상기 통신 수단을 통하여 전달받은 상황 정보와 사용자 서비스 요청을 상기 통신 수단을 통하여 상기 상황 인식 수단으로 전달하기 위한 상황 정보 관리 수단; 및

상기 센싱 수단의 상태를 주기적으로 점검하여 운영의 신뢰성을 보장하기 위한 관리 수단

을 포함하는 유비쿼터스 기반의 상황 정보 제공 서비스 시스템.

청구항 10.

제 9 항에 있어서,

상기 매개 수단은,

사전에 입력받은 사용자 기본 정보를 저장하고 있는 정책 설정 수단;

상기 상황 정보 관리 수단을 통하여 전달받은 사용자 서비스 요청에 따라 상기 정책 설정 수단에 저장되어 있는 사용자 기본 정보와 실시간으로 상기 상황 인식 서버로 질의하여 획득한 상황 정보에 따라 최적의 애플리케이션을 실행시키기 위한 상황 정보 처리 수단; 및

다수의 애플리케이션을 저장하고 있으며, 상기 상황 정보 처리 수단의 제어에 따라 해당 애플리케이션을 실행시키기 위한 실행 수단

을 더 포함하는 유비쿼터스 기반의 상황 정보 제공 서비스 시스템.

청구항 11.

제 9 항 또는 제 10 항에 있어서,

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상기 통신 수단은,

상기 센싱 수단으로부터 전달받은 사용자의 상황 정보가 포함된 패킷에 TTL(Time To Live) 값을 설정하여 트래픽 폭주를 방지하는 것을 특징으로 하는 유비쿼터스 기반의 상황 정보 제공 서비스 시스템.

청구항 12.

제 9 항 또는 제 10 항에 있어서,

상기 통신 수단은,

상기 센싱 수단으로부터 전달받은 사용자 서비스 요청에 대한 인증 기능을 더 수행하는 것을 특징으로 하는 유비쿼터스 기반의 상황 정보 제공 서비스 시스템.

청구항 13.

제 9 항 또는 제 10 항에 있어서,

상기 통신 수단은,

상기 센싱 수단으로부터 전달받은 사용자 서비스 요청에 대한 결과가 해당 사용자에게 올바르게 제공되었는지를 검사하여, 실패시 재전송하는 기능을 더 수행하는 것을 특징으로 하는 유비쿼터스 기반의 상황 정보 제공 서비스 시스템.

청구항 14.

제 1 항 또는 제 2 항에 있어서,

상기 상황 인식 수단은,

상기 매개 수단을 통하여 실시간으로 입력받은 상황 정보 및 사용자 서비스 요청을 전달받기 위한 통신 수단;

상기 통신 수단을 통하여 전달받은 상황 정보를 그 종류 별로 분류하여 상황 정보 데이터베이스에 저장하고, 상기 통신 수단을 통하여 전달받은 사용자 서비스 요청에 따라 상기 상황 정보 데이터베이스로부터 해당 데이터를 검색, 저장, 삭제하여 상황 정보 제공 서비스를 제공하기 위한 데이터베이스 관리 수단; 및

상기 데이터베이스 관리 수단의 제어에 따라 상황 정보를 저장하기 위한 상기 상황 정보 데이터베이스

를 포함하는 유비쿼터스 기반의 상황 정보 제공 서비스 시스템.

청구항 15.

유비쿼터스 기반의 상황 정보 제공 서비스 방법에 있어서,

유비쿼터스 네트워크를 이용하여 사용자의 상황(Context) 정보를 수집하는 상황 정보 수집 단계;

상기 수집한 상황 정보를 각 사용자 별로 저장하는 상황 정보 저장 단계; 및

사용자로부터의 서비스 제공을 요청에 따라 해당 사용자의 상황 정보를 검색하여 그에 따른 서비스를 제공하는 서비스 제공 단계

를 포함하는 유비쿼터스 기반의 상황 정보 제공 서비스 방법.

청구항 16.

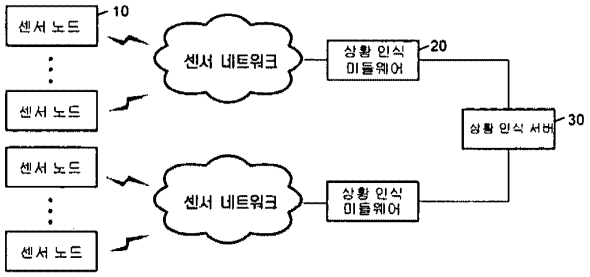
제 15 항에 있어서,

상기 상황(Context) 정보는,

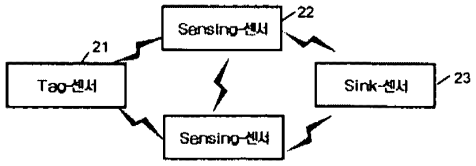
사용자와 사물간의 상호 작용에 연관된 존재물을 특정 짓는 형태의 정보로서, 사용자가 사용하는 계산 능력을 갖춘 도구에서 발생되는 자원 정보 및 사용자의 행동에 기초하여 변화되는 주변 정보를 포함하는 것을 특징으로 하는 유비쿼터스 기반의 상황 정보 제공 서비스 방법.

도면

도면1

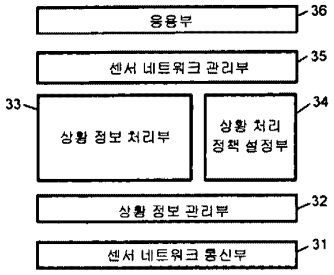


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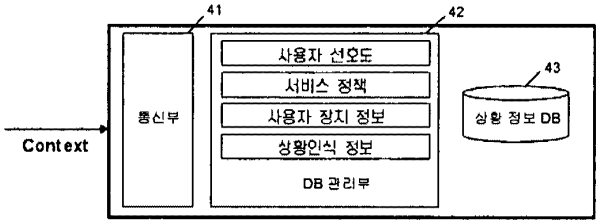


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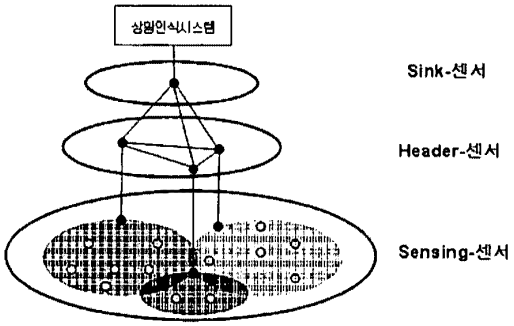
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도면4

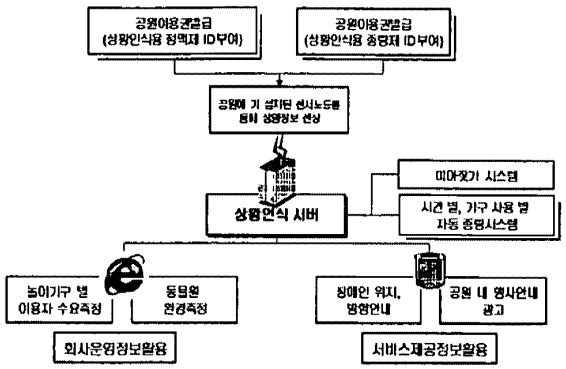


도면5



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도면6


공원이용권발급
(생황인식용 정액제 ID부여)
공원이용권발급
(생황인식용 종량제 ID부여)
공원에 기 설치된 센서노드를
통해 생황정보 센싱
상황인식 서버
미아찾기 시스템
시간 별, 가구 사용 별
자동 통행시스템
놀이기구 별
이용자 수요측정
동물원
환경측정
회사운영정보활용
장애인 위치,
방향안내
공원 내 영사안내
광고
서비스제공정보활용

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Agent	OH, BYEONG SEOK | Han Yang Patent Firm
Inventor	LEE,JaeGyeong | JEONG,HakJin | CHOI,HaeSool | BAE,JooCheon
Applicant	Xelpower Co..Ltd.
Title of Invention	A SYSTEM FOR COLLECTING AND TRANSMITTING A FAULT INFORMATION OF A POWER SYSTEM

Abstract

The invention relates to the condition information collecting and analysis system of the electric power system in which the malfunction alert of the electric power system is collected through DPR and fault recorder (hereinafter the field equipment) of the variable types installed at each electric power substation and which stores, and the collected malfunction alert is transmitted in the power companies or the power management center of center, analyzed with hour. And the serial communications terminal connection part (311-314) and traffic data are and take given through data bus (DATA BUS) part (315): data BUS part (315) connecting data in a plurality of DPRs (301-303) and fault recorder (304) between a plurality of serial communications terminal connection parts (311-314): each serial communications terminal connection part communication-contacted to the respective communications connection mode coping with the respective serial and microprocessor (316). And the serial communications terminal connection part is controlled and data is acquired from the field equipment (301-304). Data acquired from the field equipment described in the above is stored Moreover, it has the effect that data acquisition / transmitting device (310) comprising the microprocessor (316) controlling the telecommunication connection part (318) which drives modem in order to remotely communicate data acquired as described above to the high position personal computer apparatus is included. The electric power system wanting in the distant country or the field can be and analyzes observed by applying and installing the apparatus looked at regardless of the kinds of the field equipment.

Representative drawing

Fig. 4

Description

■ Background Art

The invention relates to the condition information collecting and data transmission system of the electric power system, more specifically, to the condition information collecting and data transmission system of the electric power system in which the malfunction alert of the electric power system is collected through DPR and fault recorder of the c kinds (多 機種) installed at each electric power substation and which stores, and the collected malfunction alert is transmitted in the power companies or the power management center of the high position, analyzed with hour.

Generally, in electric power substations (10a,10b,10c,10d) taking charge of the control about the transmission system of the power companies and protection, the DPR (Digital Protection Relay) (13) in which the malfunction on the transmission system is judged rapidly and which automatically blocks the corresponding system track and the fault recorder (Fault Recorder) (14) recording and saves necessary data of the malfunction either before or after on each electric power system are included as shown in fig. 1 on the electric power system transmission line (12) between the bus lines (11) of each electric power substation and the electric power substation and electric power substation installation.

Particularly, the DPR (13) interior stores the information including the operation state of the relay related to the malfunction etc. Therefore, the task in which the saved information is collected rapidly and grasping and analyzed very for the recovery of damage due to the accident prevention on the electric power system and accident the important task.

But DPR installed at the generating station of the power companies and/or the electric power substation and fault recorder the kinds is the various. It is respectively manufactured with the other manufacturer and it is especially installed each electric power substation the delivery of goods. And the communications access method and the transmission mode transmitting fault data dissimilar according to each product. Therefore the indivisual communications transmission line is secured with classification and fault data is collected.

In this way, in the remote host system in generation including the malfunction accident on the electric power system due to the member of the interface standardizing for transmitting and receiving of data etc, manually one by one had to get the malfunction alert of the electric power substation unit collection to troublesome. And fault data was unable to be collected from DPR and the fault recorder which was not secured up the communications transmission line which was furthermore indivisual in the remote. It had to

troublesome.

Fig. 2 shows one example in the condition information collecting of the conventional electric power system and configuration of data transmission system. It is composed of the DPRs (21,22,23) and fault recorder (24) of the different kinds installed in the corresponding edge burnout (20), modems (21a,22a,23a,24a) of the respective plurality of, the remote failure analysis personal computer apparatus (25) which is installed from the electric power substation (20) in the remote site and, and the switched telephone network or the private communications network (26) connecting communications each modem (21a,22a,23a,24a) liver of the modem (25a) of the personal computer apparatus (25) and DPRs (21,22,23) and fault recorder (24). Modems (21a,22a,23a,24a) of the respective plurality of is correspondence installed in each DPR (21,22,23) and fault recorder (24) it hits for the communications connection specification of each kinds. As to the remote failure analysis personal computer apparatus (25) which is installed from the electric power substation (20) in the remote site and, all kinds of the malfunction alerts of the electric power system are gotten from DPRs (21,22,23) and fault recorder (24) and analyzed.

In this way, in convention, DPRs (21,22,23) and the fault recorder (hereinafter ' field equipment ') (24) which is installed in the electric power substation (20) of the power companies and is used have separate communications transmitting and receiving connection specification according to the kinds. Therefore it communicates through modems (21a,22a,23a,24a) and the communications network (26) which is correspondence installed in order to hit for each kinds with the personal computer apparatus (25) of the high position. The software the software which it monitors data transmited from each field equipment (21~24) in the personal computer (25b) of the high class has to be included comprises all softwares that are offered from the manufacturer of each field equipment (21~24) since it is different at manufacturer.

By using the software of each manufacturer, it monitors data which has been being transmited from each field equipment (21~24) or the personal computer (25b) analyzes. Therefore, in the high position control office of the distant country, the personal computer (25b) and modem (25a) are included. After activating the personal computer (25b), the software corresponding to the field equipment, wanting among the field equipment (21~24) of the low rank plurality for example, DPR of the reference number 21 is executed and the corresponding menu is selected. In that way data is gotten through the corresponding modem (21a), the communications network (26) and modem (25a). It monitors the obtained data as described above according to the menu which is decided by using the corresponding to analysis software or the personal computer (25b) analyzes.

Thereafter, when it connects to the field equipment of the other kinds installed at the electric power substation (20) in which the personal computer (25b) binds, for example, DPR of the reference number 22 and data tries to be gotten, after closing the software of the previous, the software corresponding to the DPR (22) is executed and data is gotten as described above through the corresponding modem (22a), the communications network (26) and modem (25a). Obtained data is monitored or it analyzes.

In the meantime, when it selects as identical communications connection specifications of the manufacturer in which DPRs bind and it establishes in the electric power substation unit, installed each DPR is interlinked as the reciprocity communications network and data is upon concentrated. In that way data can be transmitted through one modem with the high position remote personal computer apparatus (25). But DPR manufacturers does not manufacture the fault recorder. The replace of each field equipment and/or the new establishment work light cannot be moreover presently always uniform. Therefore the very difficult actual condition to uniform to the homogeneous of the identical company and newly establish the field equipments of the electric power substation unit and/or replace.

■ Summary of Invention

Effects of the Invention

As described in detail in the above, it has the effect that according to the condition information collecting and analysis system of the electric power system according to the present invention, the malfunction alert of the electric power system is collected from DPR and fault recorder of the different variable types and it stores. The collected malfunction alert is transmitted in the power companies or the power management center of center, it analyzes with hour. In that way the apparatus looked at is applied regardless of the kinds of the field equipment and the electric power system wanting in the distant country or the field can be and analyzes observed.

■ Brief explanation of the drawing

Figure 1 is a view of whole configuration of the electrical power system showing the install-operation state of DPR for the protection of the electric power system and control and error record and fault recorders

Figure 2 is a drawing showing an example of the condition information collecting of the conventional electric power system and configuration of data transmission system

Figure 3 is a configuration diagram showing the condition information collecting of the electric power system according to a preferred embodiment of the present invention and the whole communications network state of data transmission system

Figure 4 is a block diagram of data acquisition / transmitting device of fig. 3

Figure 5 is a configuration diagram according to the function of the remote failure analysis personal computer apparatus of the fig. 3 installed at the remote, the high position power manager, or the head office control station

In data acquisition / transmitting device of the fig. 6 silver drawing 3, the drawing showing one room example of the serial communications terminal connection part configuration with the field equipment.

※ The description of reference numerals showing the main elements in drawings.

300: electric power substation 301- 303: DPR or the protective relay.

304: fault recorder 310: data acquisition / transmitting device.

311- 314: serial communications terminal connection part 315: data BUS part.

316: microprocessor 317: data storage module.

318: telecommunication connection part 319: digital data input part.

320: display / alert potion 321: local control unit communications connector.

322: SCADA communications connector 330: the control device of the electric power substation local control room.

340,410: modem 400: the high position personal computer apparatus of the distant country.

420: personal computer 401,501: the switched telephone network or the private communications network.

500: the SCADA system of the high position power management department.

■ Technical Task

The present invention is to provide the condition information collecting and data transmission system of the electric power system which is to solve problems described in the above created, and in which the purpose is composed of the one-piece unit, and in which the malfunction alert of the electric power system is collected from DPR and fault recorder of the different variable types and which can store, and the collected malfunction alert is transmitted in the power companies or the power management center of the high position, can analyze with hour.

■ Structure & Operation of the Invention

It transmits power the electricity of being developed from the generating station by the medium of the transmission line interlinking a plurality of electric power substations and electric power substation liver. And it acquires various information data about the electric power system state as to the electrical power system in which the fault recorder recording and saves necessary data of the malfunction either before or after on DPR which rapidly detects the malfunction on the transmission system and automatically blocks the corresponding system track on the transmission line of each electric power substation of the variable types plurality and each electric power system of the variable types plurality is installed from DPR and fault recorder of the variable types plurality. It manages and it stores. It receives a message the transmited data as described above through data acquisition / transmitting device: modem: connecting data acquisition / transmitting device in the communications network and the modem connected to the communications network. Transmits remotely the obtained data as described above through the simplex communications net (one former communications network which is for example early established) that is early established to the high position it executes the software program according with the corresponding field equipment and it analyzes and indicates the received data as described above. The personal computer apparatus of the high position communicating mutually with data acquisition / transmitting device is comprised. And it decreases traffic data with the serial communications terminal connection part through data bus lifter data BUS part connecting data in a plurality of DPRs and fault recorder between microprocessor with a plurality of serial communications terminal connection parts: each serial communications terminal connection part communication-contacted to the respective communications connection mode coping with the respective serial and especially, data acquisition / transmitting device receives. The serial communications terminal connection part is controlled and data is acquired from the field equipment. Data acquired from the field equipment described in the above is stored. The microprocessor controlling the telecommunication connection part which drives modem in order to remotely communicate moreover, data which acquire as described above to the high position personal computer apparatus is comprised. Each serial communications terminal connection part serially changes parallel data received according to the command of microprocessor from data BUS part. The serial section word controller, the communications channel selection part, data storage module storing inputted various information data in the microprocessor described in the above, the telecommunication connection part, and the SCADA communications connector for transmitting a message data in SCADA having in the power management center (the electricity light off) is comprised. The serial section word controller the reverse transformation about this is proceed. The communications channel selection part selects the communications channel because of having the channel which can connect communications two field equipments and serial of 2 inside moreover, each serial communications terminal connection part described in the above. As to the telecommunication connection part, the parallel data signal which acquires from the field equipment is changed into serial and transmitting remotely to the personal computer apparatus, and in which serial data which is the remote transmission is transmitted from the personal computer apparatus through modem and changing into the parallel data signal and offering to microprocessor.

Hereinafter, it particularly explains with reference to the attached view for the condition information collecting of the electric power system according to the preferred embodiment of the present invention and data transmission system.

Figure 3 is a configuration diagram showing the condition information collecting of the electric power system according to a preferred embodiment of the present invention and the whole communications network state of data transmission system. A lot, it network is connected between the SCADA (500) of the remote failure analysis personal computer apparatus (400) of field equipment (the DPR (301-303) and fault recorder (304)) having within the unit substation (300) and data acquisition / transmitting device (310) and high position and high position power management department (the electricity minor) through the switched telephone network or private communications networks (401,501) in order to be communicated the reciprocity.

In the unit substation (300), the fault recorder (304) recording and saves necessary data of the malfunction either before or after on

DPRs (301,302,303) in which the malfunction on the transmission system is detected rapidly and which automatically block the corresponding system track on the transmission line of the electric power substation (300) of the variable types plurality and each electric power system is installed and various information data about the electric power system state is acquired from DPRs (301,302,303) and fault recorder (304) of the variable types plurality. It manages and it stores. Along with this data acquisition / transmitting device (310) transmitting remotely the obtained information data as described above to the high class remote personal computer apparatus (400) or the SCADA (500) through the modem (340) and communications networks (401, 501) is installed. And moreover, the external controller (330) like computer is installed in order to possible data acquisition / transmitting device (310) and reciprocity serial data communication.

The high class remote personal computer apparatus (400) comprises the modem (410) for data communications between the personal computer (420) through the personal computer (420), and the communications network (401) and data acquisition / transmitting device (310) and printer (430).

Figure 4 is a block diagram of data acquisition / transmitting device (310) of fig. 3. It is composed of a plurality of serial communications terminal connection parts (311,312,313,314) communication-contacted in a plurality of DPRs (301,302,303) and fault recorder (304) to the respective communications connection mode coping with the respective serial, data BUS part (315) connecting data between each serial communications terminal connection part (311,312,313,314) and microprocessor, the microprocessor (316) which decreases through data BUS part of traffic data with the serial communications terminal connection part and which receives, and, the kiwi heartburnings data storage module (317) in the storage data acquired from the field equipments (301,302,303,304) described in the above and data received from the digital data sink (319) etc, and the telecommunication connection part (318) which moreover transmits remotely data to the high position personal computer apparatus (400), As to the microprocessor (316) which decreases through data BUS part of traffic data with the serial communications terminal connection part and which receives, and, the serial communications terminal connection part is controlled and acquiring data from the field equipment. As to the telecommunication connection part (318) which moreover transmits remotely data to the high position personal computer apparatus (400), and, data is a message received from the personal computer apparatus (400) and offered to the microprocessor (316). It changes the parallel data signal acquired from field equipments (301,302,303, 304) into serial and the telecommunication connection part (318) of data acquisition / transmitting device (310) described in the above transmits remotely to the personal computer apparatus (400). Serial data which is the remote transmission is transmitted from the personal computer apparatus (400) through the modem (340) and it changes into the parallel data signal and it offers to the microprocessor (316).

Moreover, the display / alert potion (320) performing the digital data sink (319) which data acquisition / transmitting device (310) receives a message all kinds of offered digital datas from each field equipment DPR, and the display based on digital data inputted through the digital data sink (319) and emergency signal is comprised more.

Moreover, the list of all field equipments (301,302,303,304) installed at moreover, each corresponding edge burnout through the control device communications connector (321) according to demand from the external controller (330) list is offered of all field equipments (301,302.303,304) installed at each corresponding edge burnout (300) through the telecommunication connection part (318) according to demand from the personal computer apparatus (400) in which data acquisition / transmitting device (310) more comprises the SCADA communications connector (322) for communication, and which is installed in the power management center (electricity light off) and which manages consisting of the personal computer within the microprocessor (316) and electric power substation which the microprocessor (316) of data acquisition / transmitting device (310) here locates in the remote are offered If the select instruction data signal selecting one is transmited from the personal computer apparatus (400) or the external control device (330) among the offered field equipment list as described above, it characterizes to control through the communications channel selection part (73) within the serial communications terminal connection part coming under based on the transmited selection signal as described above through data BUS part (315) among each series communications part word connection unit (311, 312, 313,314) and control the communications channel selection with the corresponding field equipment.

Moreover, in the external control device (330) installed at the personal computer apparatus (400) or the electric power substation control room which the controller (316) of the field data acquisition / transmitting device (310) is located in the remote, after completing the selected corresponding field equipment as described above and communications linkage, data is acquired according to the demand of the external controller (330) and personal computer apparatus (400) in the corresponding field equipment and data acquired in the corresponding field equipment is transmitted through the respective telecommunication connection part (318) or the control device communications connector (321) in the respective personal computer apparatus (400) or the external control device (330). It characterizes to store moreover, data acquired as described above in data storage module (317).

Figure 5 is a configuration diagram according to the function of the remote failure analysis personal computer apparatus (420) of the fig. 3 installed at the remote, the high position power manager, or the head office control station. The malfunction display performing function including the relay display, in which the basis operating program is to the window, and which is installed with the serial communications routine connection, and the electric power substation status indication. The data storage, the manufacturer failure analysis tool moving driver etc and access program are included. Moreover, the manufacturer remote failure analysis program operating by the manufacturer failure analysis tool moving driver is included. The manufacturer (A #A, a #B, the #C . #D corp. etc) respectively can analyze the operation state of field equipments (301,302,303,304) of the different variable types.

Subsequently, it classifies about the operation of the present invention into by technique and it explains.

In data acquisition / transmitting device (310), the serial communications connection function between DPRs (301,302,303) and the field equipment of the different various kind fault recorder (30) has the first. That is, in the field equipment DPR, the physical connection standard of the serial communications respectively dissimilars according to manufacturer from RS232C or the RS422C / RS485 etc. Therefore it altogether offers the standards for telecommunications and an plurality of serial communications terminal connection parts (311,312,313,314) included in data acquisition / transmitting device (310) can connect with communications in all field equipment (301~304).

The fig. 6 is same thed as described in detail about the serial communications function between the field equipment (301~304) and this kind of data acquisition / transmitting device (310) than reference like next.

In the fig. 6, the microprocessor (316) is put through the BUS interface (71) within the serial communications terminal connection part which comes under if it transmits command and data signal about series communications part word connection units (311,312,313,314) through data BUS part (315) with parallel data and signal comes in. It is transformed according to the programmed fixed format to serial data and the parallel data described in the above is in advance offered with the serial section word controller (72) to the microprocessor (316) to the communications channel selection part (315). If select the communications channel connected to the microprocessor (316) and the field equipment coming under the corresponding serial section word controller (72), the channel of the communications channel selection part (315) is selected, the transformed serial data as described above is transmited through corresponding serial communications terminal connection parts (311,312,313 or 314) through the route of being selected to interface including the corresponding RS232C or the RS422C / RS485 etc. The power separation is at this time included with the isolation module (74). In corresponding serial communications terminal connection parts (311,312,313 or 314), it is transmited after the external Interface (External Interface) (75) to corresponding field equipments (301,301,303 or 304) and serial data transformed according to the corresponding standards for telecommunications demands data transmission from corresponding field equipments.

In the meantime, serial communications data of the field equipment (301~304) coming in contrary to the above-described route through the external Interface (75) passes the isolation module (74) within the serial communications terminal connection part (311-314). And serial data is transformed through the serial PCS controller (72) to parallel data and it is transmited through the BUS interface (71) to the microprocessor (316). In order to transmit necessary data with the microprocessor (316) with the external controller (330) within the corresponding edge burnout, the high class personal computer apparatus (400) locating in the remote and SCADA system (500) etc., has in the power management department (electricity light off) etc. datas of the corresponding field equipment (301~304) which has been being transmited to the microprocessor (316) are processed according to situation. Moreover, the microprocessor (316) stores data which it is transmitted from the field equipment (301~304) described in the above in data storage module (317).

The recognition function of the field equipment has the second.

The microprocessor (316) according to the present invention automatically can recognize the manufacturer of the corresponding DPR and fault recorder and model name etc. based on traffic data which has been being transmited from the field equipment (301~304). And it looks at format or the form of traffic data coming in the field equipment and it compares and analyzes with the field equipment model date pre-stored in data storage module (317) and this recognizes and controls.

By using the control device (330) of the personal computer (420) of the high position personal computer apparatus (400) of the distant country or the field, the access object wanting among the field DPR (301-303) and fault recorder (314) can be established. And it with respect to this as described in detail thes same the third like next.

Firstly, in the failure analysis personal computer apparatus (400) having in the high position (the maintenance control room of the head office or the power management department) of the distant country, when it approaches to corresponding DPRs (301,302 or 303) or the fault recorder (304) of the corresponding edge burnout communications and data wants to be received, the set signal is delivered through the modem (410), the communications network (401), and the modem (340) and telecommunication connection part (318) to the microprocessor (316) if the corresponding edge burnout (300) is established in the personal computer (420) of the failure analysis personal computer apparatus (400). The microprocessor (316) of the corresponding edge burnout (300) offers the list of the field equipment (301~304) saved in data storage module (317) through the reverse path of the set signal to the personal computer (420). If one field equipment (1 among 301-304) is selected through the personal computer (420) between the offered list as described above, the selection signal is delivered through the transmission path of the set signal to the microprocessor (316). The microprocessor (316) controls series communications part word connection units (1 among 311,312,313,314) connected based on the delivered selection signal as described above to the field equipment, the communications connection with the personal computer (420) of the corresponding field equipment and distant country are included. If the communications connection is included, the personal computer (420) of the distant country is transmitted data of the necessary field equipment.

In the personal computer (420) of the distant country like being above mentioned, the order connecting as the field equipment is like the corresponding DPR receiving the list of field equipment installed at the corresponding system track, which wants the system track of the object electric power substation selected the object electric power substation selection → and list of the bus lines are received the corresponding system track and the bus lines selected the bus lines selection → in a plurality of electric power substation lists and wants and the corresponding field equipment (301,302,303 or 304) Y communications connection selected the fault recorder with the selection → personal computer (420), and department to the tri (Tree) syndetic structure. And moreover, the communications connection between the control device (330) of the field electric power substation control room and the desired field equipment is communication-contacted to the tri access method as described above and necessary fault data can be transmitted.

The fourth, and data acquisition / transmitting device (310) comprise the f, in which the function of storing it acquires data from the field equipment (301-304) has the content of data which it firstly acquires through communications with the DPR (301-303) is the time - to-failure, the malfunction location and trouble occurrence kind, including, the malfunction alert history, three phase voltage / current sampling data of the fixing generation either before or after, the relay output state information of the trouble occurrence either before or after, the relay operation state information by the relay check and monitoring, all data etc. the besides relay offers to communication.

The content of data acquired through communications with the fault recorder (304) comprise three phase voltage / current sampling data of the trouble occurrence either before or after, which the fault recorder stores all kinds of data of state information etc. the fault recorder stores.

Therefore, fault data of the corresponding field equipment generating the radical saved without the need communications is connected stubbornly to the field equipment in order to be transmitted fault data of corresponding field equipments (301-303, 304) of the corresponding edge burnout (300) in which the failure analysis personal computer (420) described in the above having in the distant country generates radical and to receive data in data storage module (317) within data acquisition / transmitting device (310) can be transmitted.

Moreover, the store method the obtained various datas as described above is saved with the control of the microprocessor (316) in data storage module (317) is as follows.

① The storage in data storage module (317) DPR and fault recorder sort, and the time -to-failure trouble breakdown and current / current data are processed the index.

② It divides into 3 kinds division (or category) including three phase voltage / current sampling data of breakdown history management data including time -to-failure, malfunction location, and the status information about all kinds of the malfunctions including the trouble occurrence kind etc and malfunction either before or after and miscellaneous information etc. and it stores.

③ The storage successively stores in data storage module (317). Data in which automaticallymost old data is deleted firstly in the memory capacity in short of data storage module (317) of data acquisition / transmitting device (310) and which it at this time overwrites the overwrite (Over Write) box 3 phase voltage / current sampling data.

④ Three phase voltage / current sampling data is deleted in the f in which the earthquake / manual delete function about 3 phase voltage / current sampling data has among data saved through the control device (330) of the personal computer (420) of the distant country or the field in the memory location of data storage module (317) of data acquisition / transmitting device (310), and the memory capacity in short of data storage module (317) to the mode data the overwrite. Data is deleted in at this time according to the automatic / manual configuration. Content, including, history management data including the generation time and sort of trouble of the malfunction alert etc. always stores and the history management about the malfunction alert however possibles. Moreover, in history management data about the malfunction alert, user arbitrarily cannot delete. Only in case the memory capacity is insufficient, with being certainly proceed the separate emergency signal, it informs to the display / alert potion (320) to the high position personal computer apparatus (400) of the distant country and data saved by user is deleted the manual.

The telecommunication function between the high position personal computer apparatus (400) of data acquisition / transmitting device (310) of the field and the distant country are included as been already above mentioned. And it this is described in more detail that thes same the fifth like next.

① The high-speed dual - up (Dual-up) modem (340) is established in data acquisition / transmitting device (310) and it is connected to the exclusive public switch telephone network of one former. The high-speed dual - up modem (410) is used in the personal computer (420) of the high position personal computer apparatus (400) of the distant country installation.

② One telephone number is given to data acquisition / transmitting device (310).

③ The communications speed is controled according to the state of the telecommunication line in which in data acquisition / transmitting device (310), the traffic data transfer rate automatic adjustment function with the distant country is included and coming under.

④ Each address number is given according to data acquisition / transmitting device (310). The password and user name are annexed from the high position personal computer (420) of the distant country in the communications connection and the man without the just right will not allow to communicate through the personal computer (420). In that way the confidential of communications is guaranteed.

⑤ It automatically suspends telephone through the high-speed dual - up modem (340) due to the personal computer (420) of the distant country and data acquisition / transmitting device (310) connects with communication. When field equipments (301-303,304) of the corresponding edge burnout act and this has with fault data, in order to transmit the fault data described in the above to the personal computer (420) described in the above having in the high class which is in advance registered through the microprocessor (316) of data acquisition / transmitting device (310) and is recognized, telephone is suspended automatically in data acquisition / transmitting device (310) on the prior of the distant country due to the recognized personal computer (420). The personal computer (420) and communications connection are attempted and fault data of field equipments (301-303,304) is transmitted.

⑥ In order to be transmitted fault data of corresponding field equipments (301-303,304) of the corresponding edge burnout (300), it suspends telephone through the high-speed dual - up modem (340) due to data acquisition / transmitting device (310) and it connects with communications and the failure analysis personal computer (420) described in the above having in the distant country can receive fault data of *** paper field equipment.

The sixth, and data acquisition / transmitting device (310) is the digital DC data Input part is included. And the field equipment (301-304) described in the above includes the communications port in order to transmit fault data in outside. However, whether the field equipment (301-304) anytime most recently stored data or not data acquisition / transmitting device (310) cannot know. Therefore because in the field equipment (301-304), the digital output signal informing data store point of time for the trouble occurrence has, it receives this digital output signal and data acquisition / transmitting device (310) described in the above can be transmitted recent fault data of this digital signal after within the field equipment to communication. Of course, in case of will transmitting data through the outside communications port of the field equipment with outside as soon as fault data be stored in the telecommunication function itself of the field equipment (301-304), it be no need to ***. However, the digital DC data Input part is left for the unity of product in data acquisition / transmitting device (310) and the fault data storing point of the field equipment (301-304) is input always. Moreover, in case of protective relaies (301,302,303) equipped with the outside communications port, the fault data input digital DC data Input part is included so that data acquisition / transmitting device (310) described in the above acquire the operation state of the alarm lamp and the malfunction alert of DPRs (301,302,303). At this time, there can be the operation state information of all kinds of the alarm lamps including operation, the carrier signal cut off, the breaker pressure drop etc as the information can acquire in the protective relaies (301,302,303) described in the above equipped with the outside communications port is malfunction alert data of the ground fault, the short circuit, the Main / Backup, the Z1 / Z2 / Z3 etc and line part line, *** fault, the synchronous step out detection, the DC power source fault, the carrier number, the auto switching.

Finally, the function (local monitoring port offer) capable of data acquisition / transmitting device (310) is the failure analysis through the control device (330) of the field is included. And as to the connection tube new method, RS232C, and the use PC environment as

the external controller (330) the notebook computer / OS environment more than the IBM *** 486, and the window. The control device (330) can print data which the control device processes through the local PC printer the processing analysis.

Scope of Claims

■ Claim 1:

The condition information collecting and data transmission system of the electric power system wherein the electricity of being developed from the generating station is power transmitted by the medium of the transmission line interlinking a plurality of electric power substations and electric power substation liver; various information data about the electric power system state is acquired as to the electrical power system in which the fault recorder recording and saves necessary data of the malfunction either before or after on DPR in which the malfunction on the transmission system is detected rapidly and which automatically blocks the corresponding system track on the transmission line of each electric power substation of the variable types plurality and each electric power system of the variable types plurality is installed from DPR and fault recorder of the variable types plurality; and it manages and data acquisition / transmitting device, and the personal computer apparatus it receives a message the transmited data as described above; the target software program corresponding to received data is executed and it analyzes the received data as described above and it indicates; and for communicating mutually with data acquisition / transmitting device is comprised, and data acquisition / transmitting device stores; and transmits remotely the obtained data as described above to the high position through the simplex communications net the single modem to intermediation.

■ Claim 2:

The condition information collecting and data transmission system of the electric power system, wherein data acquisition / transmitting device as to the first claim a plurality of serial communications terminal connection parts communication-contacted in a plurality of DPRs and fault recorder to the respective communications connection mode coping with the respective serial, data bus portion connecting data between microprocessor with each serial communications terminal connection part, and the microprocessor is comprised, and the microprocessor decreases the serial communications terminal connection part and traffic data through data bus portion and it receives; the serial communications terminal connection part is controlled and it acquires data from DPR and fault recorder; and controls the telecommunication connection part which drives modem in order to remotely communicate to the high position personal computer apparatus with storing data acquired as described above in the storage means.

■ Claim 3:

The condition information collecting and data transmission system of the electric power system, wherein: the serial communications terminal connection part as to claim 2 according to the command of microprocessor, the serial section word controller, the communications channel selection part, data storage module storing various information data inputted to microprocessor, the telecommunication connection part, and the SCADA communications connector for transmitting a message data in the SCADA having in the power management center is comprised; the serial section word controller serially changes parallel data received from data BUS part; and the reverse transformation about this is proceed; the communications channel selection part selects the communications channel after having a plurality of channels; and the telecommunication connection part the parallel data signal which acquires from DPR and fault recorder is changed into serial and it transmits remotely to the personal computer apparatus; and serial data which is the remote transmission is transmitted from the personal computer apparatus through modem and it changes into the parallel data signal and offers to microprocessor.

■ Claim 4:

The condition information collecting and data transmission system of the electric power system, wherein data acquisition / transmitting device as to claim 3 the display / alert potion performing the display and emergency signal is comprised more based on the digital data sink: receiving a message offered digital data from each DPR and fault recorder and received digital data as described above.

■ Claim 5:

The condition information collecting and data transmission system of the electric power system, wherein microprocessor as to claim 4 the communications channel selection of the communications channel selection part is controlled based on digital data received in the digital data sink.

■ Claim 6:

The condition information collecting and data transmission system of the electric power system, wherein data acquisition / transmitting device as to claim 2 the communications connector for the serial data communications between microprocessor and the external control device is comprised more.

■ Claim 7:

The condition information collecting and data transmission system of the electric power system, wherein microprocessor as to claim 6 the communications channel selection of the communications channel selection part is controlled based on command data inputted from the external controller.

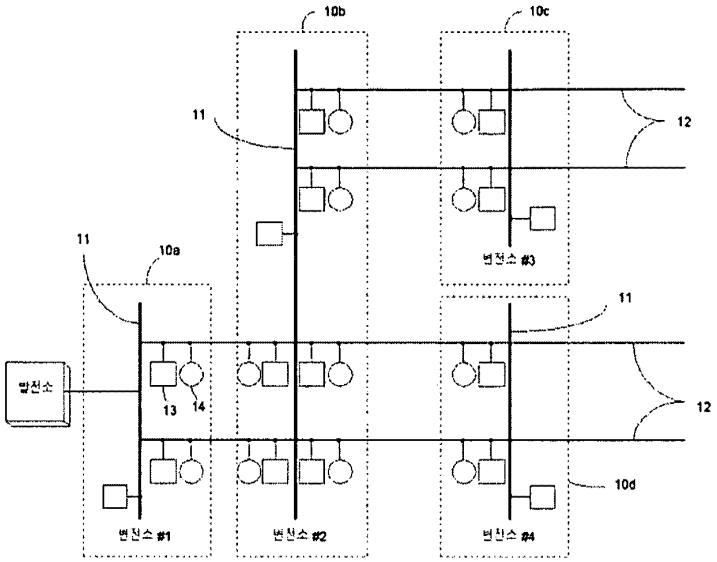
■ Claim 8:

The condition information collecting and data transmission system of the electric power system of claim 2 or 5, wherein microprocessor the list of the fault recorder and all DPRs installed at each corresponding edge burnout according to demand from the

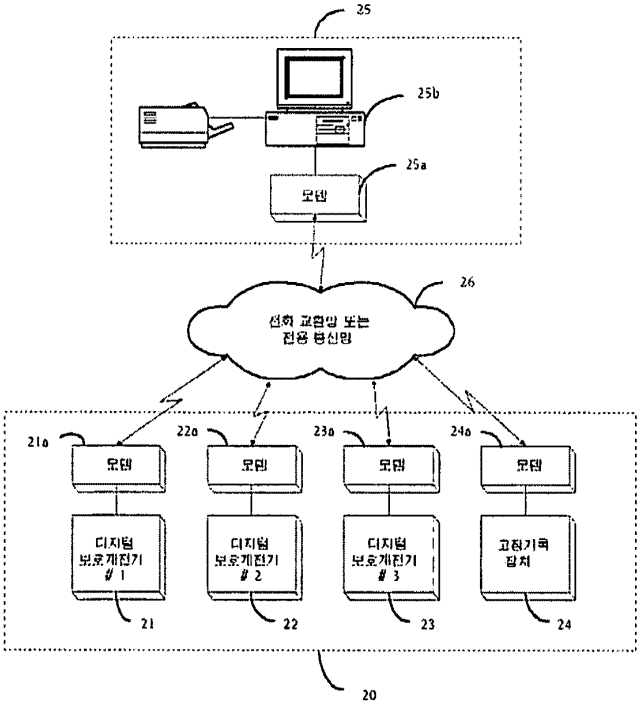
personal computer apparatus or the external control device is offered; the selection signal selecting one is transmited from the personal computer apparatus or the external control device among the offered list as described above; and the communications channel selection of the communications channel selection part is controlled based on the transmited selection signal as described above.

Drawing

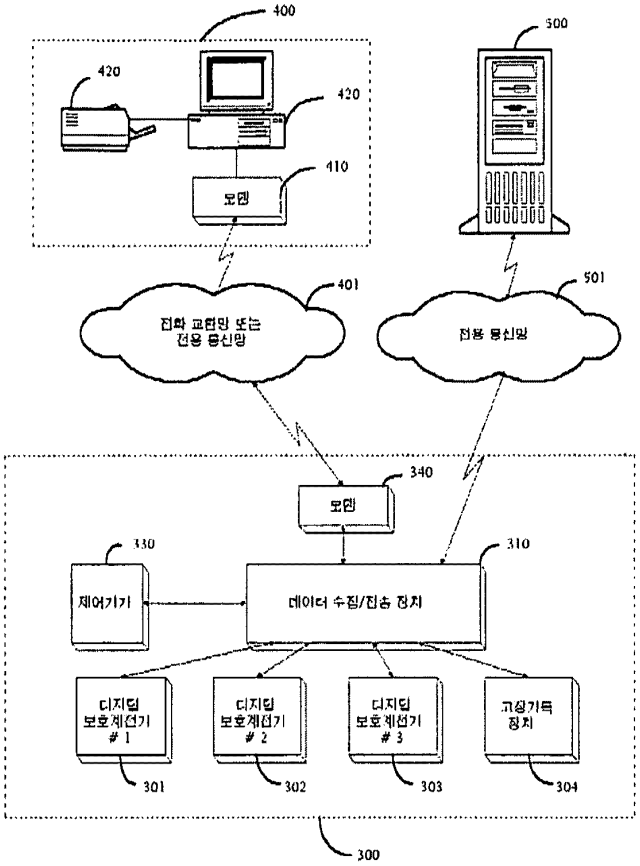
■ Fig. 1



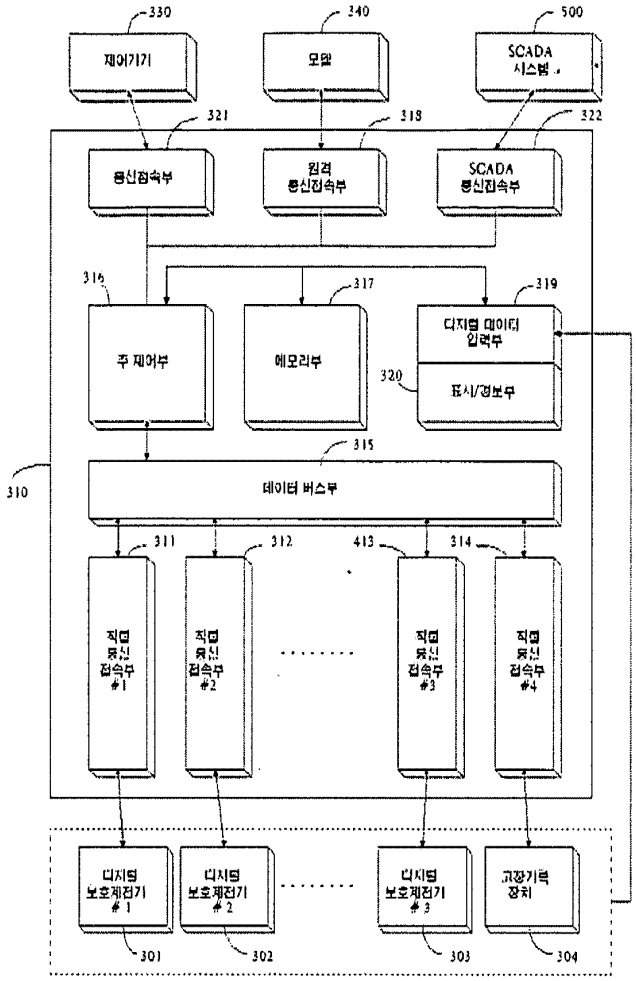
■ Fig. 2



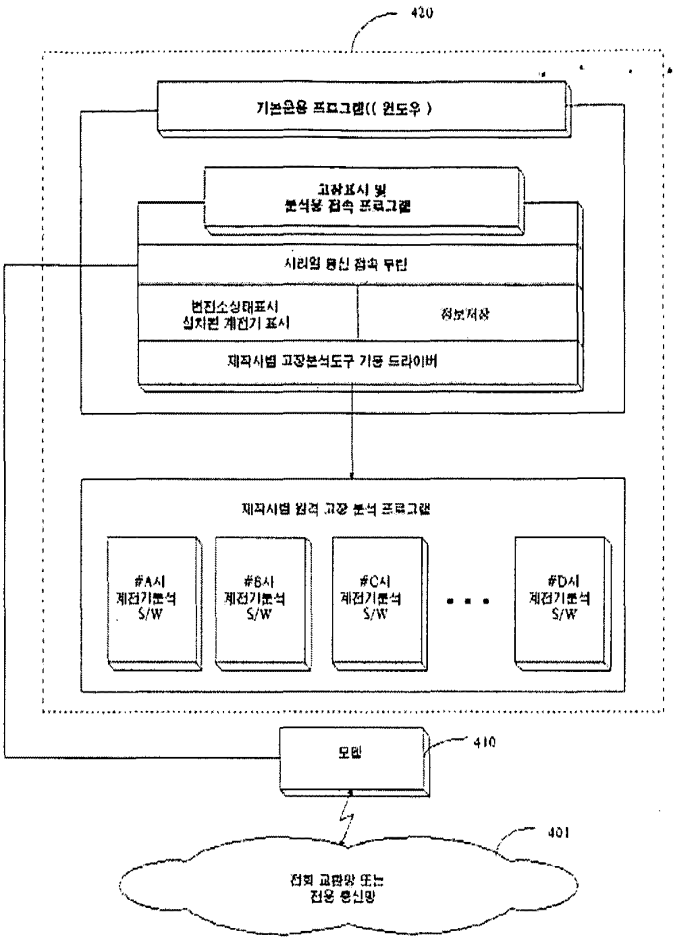
■ Fig. 3


400
420
420
410
모뎀
500
401
전화 교환망 또는
전용 통신망
501
전용 통신망
340
모뎀
330
제어기기
310
데이터 수집/전송 장치
디지털
보호계전기
1
디지털
보호계전기
2
디지털
보호계전기
3
고장기록
장치
301
302
303
304
300

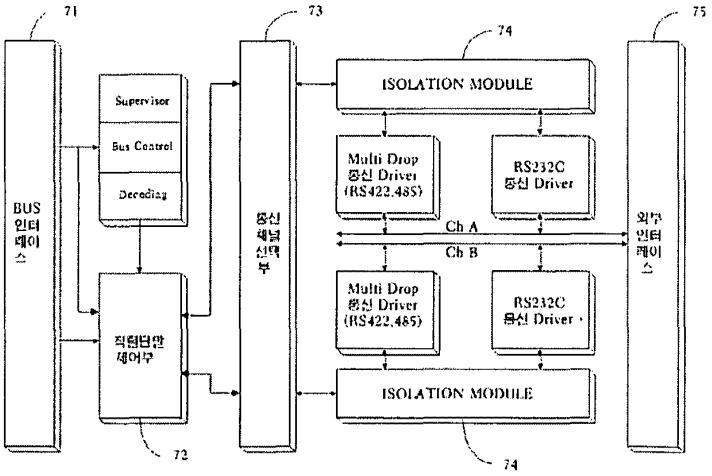
■ Fig. 4


330
340
500
제어기기
모뎀
SCADA 시스템
321
318
322
통신접속부
원격 통신접속부
SCADA 통신접속부
316
317
319
주 제어부
메모리부
디지털 데이터 입력부
320
표시/경보부
315
310
데이터 버스부
311
312
413
314
직렬 통신 접속부 #1
직렬 통신 접속부 #2
직렬 통신 접속부 #3
직렬 통신 접속부 #4
디지털 보호계전기 #1
디지털 보호계전기 #2
디지털 보호계전기 #3
고장기록 장치
301
302
303
304

■ Fig. 5



■ Fig. 6



Legal Status

Date	Type of Document	Status
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2001.03.26	Notification of change of applicant's information	수리 (Acceptance)
2001.08.30	Notification of reason for refusal	발송처리완료 (Dispatched)
2001.10.30	Written Opinion	수리 (Acceptance)
2001.10.30	Amendment to Description, etc.	보정승인 (Acceptance of amendment)
2002.04.30	Decision to grant	발송처리완료 (Dispatched)
2004.06.15	Notification of change of applicant's information	수리 (Acceptance)

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(54) 출원명 전력계통의 상태 정보 수집 및 데이터 전송 시스템

요약

본 발명은 각 변전소에 설치되어 있는 다기종(多機種)의 디지털 보호 계전기 및 고장기록장치(이하 현장장치라 함)를 통해 전력계통의 고장정보를 수집하여 저장하고, 수집된 고장정보를 중앙의 전력회사나 전력관리센터에 전송하여 감시 및 분석하도록 하는 전력계통의 상태 정보 수집 및 분석 시스템에 관한 것으로서, 상기 복수개의 디지털 보호계전기(301-303)와 고장기록장치(304)에 각각 대응하는 통신 접속방식으로 각각 직렬 통신 접속된 복수개의 직렬 통신 단말 접속부(311-314); 상기 각 직렬통신 단말접속부(311-314)와 주제어부(316) 간에 데이터를 접속시키는 데이터 버스(DATA BUS)부(315); 상기 데이터 BUS부(315)를 통해서 상기 직렬통신 단말접속부(311-314)와 통신 데이터를 주고받으며, 상기 직렬통신 단말접속부를 제어하여 현장장치(301-304)로부터 데이터를 취득하게 하고, 상기의 현장장치로부터 취득한 데이터를 저장시키고, 또한 상기 취득한 데이터를 상위 퍼스컴 장치로 원격 통신하기 위해서 모뎀을 구동하는 원격 통신접속부(318)를 제어하는 주제어부(316)를 포함하여 구성된 데이터 수집/전송장치(310)를 구비하여, 현장장치의 기종에 관계없이 본 장치를 적용 설치함으로써 원방 또는 현장에서 원하는 전력계통을 감시 분석할 수 있는 효과가 있다.

대표도

도4

명세서

도면의 간단한 설명

도 1은 전력계통의 보호와 제어 및 고장기록을 위한 디지털 보호계전기 및 고장기록장치들의 설치 운용 상태를 나타낸 전력 시스템의 전체 구성도.

도 2는 종래의 전력계통의 상태정보 수집 및 데이터 전송 시스템의 구성의 일예를 도시한 도면,

도 3은 본 발명의 일 실시예에 따른 전력계통의 상태 정보 수집 및 데이터 전송 시스템의 전체적인 통신망 상태를 나타내는 구성도.

도 4는 도 3의 데이터 수집/전송장치의 블록 구성도,
도 5는 원격 또는 상위 전력 관리부나 본사 제어장소에 설치되는 도 3의 원격 고장 분석 퍼스컴장치의 기능에 따른 구성도,
도 6은 도 3의 데이터 수집/전송장치에서 현장장치와의 직렬 통신 단말 접속부 구성의 일실예를 나타낸 도면이다.

※ 도면의 주요부분에 대한 부호의 설명

300 : 변전소 301-303 : 디지털보호계전기 또는 보호계전기
304 : 고장기록장치 310 : 데이터 수집/전송장치
311-314 : 직렬통신 단말 접속부 315 : 데이터 BUS부
316 : 주 제어부 317 : 데이터 저장부
318 : 원격 통신접속부 319 : 디지털 데이터 입력부
320 : 표시/경보부 321 : 현장 제어기기 통신 접속부
322 : SCADA 통신 접속부 330 : 변전소 현장 제어품의 제어기기
340,410 : 모뎀 400 : 원방의 상위 퍼스컴장치
420 : 퍼스컴 401,501 : 전화 교환망 또는 전용 통신망
500 : 상위 전력관리처의 SCADA 시스템

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 전력계통의 상태 정보 수집 및 데이터 전송 시스템에 관한 것으로서, 보다 상세하게는 각 변전소에 설치되어 있는 다 기종(多 機種)의 디지털 보호 계전기 및 고장기록장치를 통해 전력계통의 고장정보를 수집하여 저장하고, 수집된 고장정보를 상위의 전력회사나 전력관리센터에 전송하여 감시 및 분석할 수 있도록 하는전력계통의 상태 정보 수집 및 데이터 전송 시스템에 관한 것이다.

일반적으로, 전력회사의 송전계통에 대한 제어와 보호를 담당하는 변전소(10a,10b,10c,10d)에는, 도 1에 도시된 바와 같이, 송전계통상의 고장을 신속하게 판정하여 자동으로 해당 계통 선로를 차단시키는 디지털 보호 계전기(Digital Protection Relay)(13) 및 각 전력계통상의 고장전후의 필요한 데이터를 기록 저장하는 고장기록장치(Fault Recorder)(14)가 각 변전소의 모선(11) 및 변전소와 변전소간의 전력계통 송전선로(12)상에 설치 구비되어 있다.
특히, 디지털 보호 계전기(13)는 고장과 연관된 계전기의 동작 상태 등의 정보를 내부적으로 저장하고 있으므로, 그 저장된 정보를 신속히 수집하여 파악하고 분석하는 작업은 전력계통상의 사고 예방 및 사고로 인한 피해 복구를 위하여 매우 중요한 작업이다.
그러나, 전력회사의 발전소 및/또는 변전소에 설치된 디지털 보호 계전기 및 고장기록 장치는 그 기종이 여러 가지이고, 각기 다른 제작사에 의해서 제작되어 각 변전소 별로 납품 설치되고 있으며, 고장 데이터를 전송해 주는 통신 접속 방식 및 전송 방식이 각 제품마다 다르기 때문에, 종류별로 개별적인 통신 전송선을 확보하여 고장 데이터를 수집하고 있는 실정이다.
이와 같이 데이터의 송수신을 위한 표준화된 인터페이스의 부재로 인해, 전력계통상의 고장 사고 등의 발생시 원격 상위 시스템에서 변전소 단위의 고장 정보를 수동적으로 하나씩 수집 획득해야 하는 번거로움이 있으며, 더욱이 개별적인 통신 전송선 마저 확보되지 않은 디지털 보호 계전기 및 고장기록장치로부터는 원격에서 고장데이터를 수집하지 못하고, 현장에서 직접 수집해야 하는 번거로움이 있었다.
도 2는 종래의 전력계통의 상태 정보 수집 및 데이터 전송 시스템의 구성에 일예를 도시한 것으로서, 해당 변전소(20)에 설치된 서로 다른 기종의 디지털 보호계전기(21,22,23)와 고장기록장치(24); 각 기종의 통신 접속 사양에 맞도록 상기 각 디지털 보호계전기(21,22,23)와 고장기록장치(24)에 각각 대응 설치된 복수개의 모뎀(21a,22a,23a,24a); 상기 변전소(20)로부터 원격지에 설치되어 상기 디지털 보호계전기(21,22,23)와 고장기록장치(24)로부터 전력계통의 각종 고장 정보를 획득하여 분석하는 원격 고장분석 퍼스컴장치(25); 상기 퍼스컴장치(25)의 모뎀(25a)과 상기 디지털 보호계전기(21,22,23)와 고장기록장치(24)의 각 모뎀(21a,22a,23a,24a)간을 통신 연결하는 전화 교환망 또는 전용 통신망(26)으로 구성되어 있다.
이와 같이 종래에는, 전력회사의 변전소(20)에 설치되어 운용되는 디지털 보호계전기(21,22,23)와 고장기록장치들(이하 '현장장치'라 함)(24)은 기종별로 별도의 통신 송수신 접속사양을 가지고 있기 때문에, 각 기종에 맞도록 대응 설치된 모뎀(21a,22a,23a,24a)과 통신망(26)을 통해서 상위의 퍼스컴장치(25)와 통신하게 된다. 상기 상위의 퍼스컴(25b)에는 상기 각 현장장치(21~24)로부터 전송되는 데이터를 모니터링 및 해석할 수 있는 소프트웨어가 구비되어야 하는 데, 상기 소프트웨어는 제작사 마다 상이하므로 상기 각 현장장치(21~24)의 제작사로부터 제공되는 모든 소프트웨어를 구비해야 한다.
상기 퍼스컴(25b)은 각 제작사의 소프트웨어를 이용하여 상기 각 현장장치(21~24)로부터 전송되어 온 데이터를 모니터링하거나 분석하게 된다. 따라서, 원방의 상위 제어사무실에서는 퍼스컴(25b)과 모뎀(25a)을 구비하여, 상기 퍼스컴(25b)를 동작시킨 후 하위 복수의 현장장치들(21~24) 중 원하는 현장장치, 예를 들어 참조번호 21의 디지털 보호계전기에 해당하는 소프트웨어를 실행시키고 해당 메뉴를 선택함으로써, 해당 모뎀(21a)과 통신망(26) 및 모뎀(25a)을 통해 데이터를 획득하게 된다. 상기 퍼스컴(25b)은 해당하는 해석 소프트웨어를 이용하여 정해진 메뉴에 따라 상기 획득된 데이터를 모니터링하거나 분석한다.
이후, 상기 퍼스컴(25b)이 동일 변전소(20)에 설치된 다른 기종의 현장장치, 예를 들어 참조번호 22의 디지털 보호계전기에 접속하여 데이터를 획득하고자 할 경우에는, 이전의 소프트웨어를 종료한 후 상기 디지털 보호계전기(22)에 해당하는 소프트웨어를 실행시켜 상기와 같이 해당

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모뎀(22a)과 통신망(26) 및 모뎀(25a)을 통해 데이터를 획득하고, 그 획득된 데이터를 모니터링하거나 분석한다.
한편, 디지털 보호계전기들이 동일 제작사의 동일 통신접속사양들로 선택하여 변전소 단위로 설치할 경우, 그 설치된 각 디지털 보호계전기를 상호 통신 네트워크로 연결하여 데이터를 집중함으로써, 하나의 모뎀을 통해 데이터를 상위 원격 퍼스컴장치(25)로 전송할 수 있으나, 디지털 보호계전기 제작사들은 고장기록장치를 제작하지 않고 있고, 또한 현재 각 현장장치의 교체 및/또는 신설 작업등이 언제나 획일적일 수는 없기 때문에, 변전소 단위의 현장장치들을 동일 회사의 동일 기종으로 획일하여 교체 및/또는 새로 설치하기가 매우 어려운 실정이다.

발명이 이루고자 하는 기술적 과제

본 발명은 상기와 같은 문제점을 해결하기 위하여 창작된 것으로서, 그 목적은 단일 장치로 구성되어, 서로 다른 다기종의 디지털 보호 계전기 및 고장기록장치로부터 전력계통의 고장정보를 수집하여 저장하고, 그 수집된 고장정보를 상위의 전력회사나 전력관리센터에 전송하여 감시 및 분석할 수 있도록 된 전력계통의 상태 정보 수집 및 데이터 전송 시스템을 제공하고자 하는 것이다.

발명의 구성 및 작용

상기와 같은 목적을 달성하기 위하여 본 발명에 따른 전력계통의 상태 정보 수집 및 분석 시스템는, 발전소로부터 발전된 전력을 복수개의 변전소 및 그 변전소간을 연결하는 송전선로를 매개로 송전하며, 상기 각 변전소의 송전선로상에는 송전계통상의 고장을 신속하게 검출하여 자동으로 해당 계통 선로를 차단시키는 다기종 복수의 디지털 보호 계전기 및 각 전력계통상의 고장전후의 필요한 데이터를 기록 저장하는 다기종 복수의 고장기록장치가 설치되어 있는 전력 시스템에 있어서, 다기종 복수의 상기 디지털 보호 계전기와 상기 고장 기록장치로부터 전력계통 상태에 관한 각종의 정보 데이터를 취득, 관리 및 저장하고, 상위로 기설된 단일 통신망(예를 들어, 기설된 한전 통신망)을 통해 상기 취득된 데이터를 원격 전송하는 데이터 수집/전송장치; 상기 데이터 수집/전송장치를 상기 통신망에 접속시키는 모뎀; 및 상기 통신망에 접속되어 있는 상기 모뎀을 통해서 상기 전송된 데이터를 수신하고, 해당 현장장치와 일치하는 소프트웨어 프로그램을 실행시켜 상기 수신된 데이터를 분석하고 표시하며, 상기 데이터 수집/전송장치와 상호 통신하는 상위의 퍼스컴 장치를 포함하여 구성되며,
특히 상기 데이터 수집/전송장치는, 상기 복수개의 디지털 보호계전기와 고장기록장치에 각각 대응하는 통신 접속방식으로 각각 직렬 통신 접속된 복수개의 직렬 통신 단말 접속부; 상기 각 직렬 통신 단말 접속부와의 주제어부 간에 데이터를 접속시키는 데이터 버스(DATA BUS)부; 상기 데이터 BUS부를 통해서 직렬통신 단말접속부와의 통신 데이터를 주고 받고, 직렬 통신 단말 접속부를 제어하여 현장장치로부터 데이터를 취득하게 하고, 상기의 현장장치로부터 취득한 데이터를 저장시키고, 또한 상기 취득한 데이터를 상위 퍼스컴 장치로 원격 통신하기 위해서 모뎀을 구동하는 원격 통신접속부를 제어하는 주제어부를 포함하여 구성되고,
상기 각 직렬 통신 단말 접속부는, 상기 주 제어부의 명령에 따라서 상기 데이터 BUS부로부터 받는 병렬 데이터를 직렬로 변환하고, 이에 대한 역방향 변환도 수행하는 직렬단말제어부; 또한 상기의 각 직렬 통신 단말 접속부 내부에는 두개의 현장장치와 시리얼 통신 연결할 수 있는 2개의 채널을 가지고 있기 때문에 통신채널을 선택하는 통신 채널 선택부; 상기의 주제어부에 입력되는 상기 각종의 정보 데이터를 저장하는 데이터 저장부; 및 상기 현장장치로부터 취득한 병렬 데이터 신호를 시리얼로 변환하여 상기 퍼스컴 장치로 원격 전송하고, 상기 퍼스컴 장치로부터 원격 전송된 시리얼 데이터를 모뎀을 통해서 전송받아서 병렬 데이터 신호로 변환하여 상기 주 제어부에 제공하는 원격 통신접속부; 전력관리센터(전력소등)에 있는 SCADA에 데이터를 송신하기 위한 SCADA 통신접속부를 포함하여 구성된다.

이하, 첨부 도면을 참조하여 본 발명의 바람직한 실시예에 따른 전력계통의 상태 정보 수집 및 데이터 전송 시스템에 대하여 상세히 설명한다.
도 3은 본 발명의 일 실시예에 따른 전력계통의 상태 정보 수집 및 데이터 전송 시스템의 전체적인 통신망 상태를 나타내는 구성도로서, 크게 단위 변전소(300)내에 있는 현장장치(디지털 보호계전기(301-303) 및 고장기록장치(304)) 및 데이터 수집/전송장치(310)와 상위의 원격 고장분석 퍼스컴장치(400) 및 상위 전력 관리처(전력소)의 SCADA(500)간에 전화 교환망 또는 전용 통신망(401,501)을 통해 상호 통신 가능하도록 망 연결되어 있다.
상기 단위 변전소(300)에는, 그 변전소(300)의 송전선로상에 송전계통상의 고장을 신속하게 검출하여 자동으로 해당 계통 선로를 차단시키는 다기종 복수의 디지털 보호 계전기(301,302,303) 및 각 전력계통상의 고장전후의 필요한 데이터를 기록 저장하는 고장기록장치(304)가 설치되어 있고; 상기 다기종 복수의 디지털 보호 계전기(301,302,303)와 고장 기록장치(304)로부터 전력계통 상태에 관한 각종의 정보 데이터를 취득, 관리 및 저장함과 아울러, 상기 상위 원격 퍼스컴 장치(400) 또는 상기 SCADA(500)로 모뎀(340)과 상기 통신망(401, 501)을 통해 상기 취득된 정보 데이터를 원격 전송하는 데이터 수집/전송장치(310)가 설치되어 있으며, 또한 컴퓨터와 같은 외부제어기기(330)가 상기 데이터 수집/전송장치(310)와 상호 직렬 데이터 통신 가능하도록 설치되어 있다.
상기 상위 원격 퍼스컴 장치(400)는 퍼스컴(420)과, 상기 통신망(401)을 통해 상기 퍼스컴(420)과 상기 데이터 수집/전송장치(310)간의 데이터 통신을 위한 모뎀(410) 및 프린터(430)를 구비하고 있다.
도 4는 도 3의 상기 데이터 수집/전송장치(310)의 블록 구성도로서, 상기 복수개의 디지털 보호계전기(301,302,303)와 고장기록장치(304)에 각각 대응하는 통신 접속방식으로 각각 직렬 통신 접속된 복수개의 직렬 통신 단말 접속부(311,312,313,314); 상기 각 직렬 통신 단말 접속부(311,312,313,314)와 주제어부 간에 데이터를 접속시키는 데이터 BUS부(315); 상기 데이터 BUS부를 통해서 직렬통신 단말 접속부와의 통신 데이터의 주고 받고, 직렬 통신 단말 접속부를 제어하여 현장장치로부터 데이터를 취득하는 주 제어부(316); 상기의 현장장치(301,302,303, 304)로부터 취득한 데이터와 디지털 데이터 수신부(319)등으로부터 받은 데이터를 저장시키위한 데이터 저장부(317); 또한 상기 데이터를 상위 퍼스컴 장치(400)로 원격전송하고, 상기 퍼스컴 장치(400)로부터 데이터를 수신하여 상기 주 제어부(316)에 제공하는 원격 통신접속부(318)로 구성되어 있다. 상기의 데이터수집/전송장치(310)의 원격 통신접속부(318)는 현장장치(301,302,303, 304)로부터 취득한 병렬 데이터 신호를 시리얼로 변환하여 상기 퍼스컴 장치(400)로 원격 전송하고, 상기 퍼스컴 장치(400)로부터 원격 전송된 시리얼 데이터를 모뎀(340)을 통해서 전송받아서 병렬 데이터 신호로 변환하여 상기 주 제어부(316)에 제공한다.

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또한 상기 데이터 수집/전송장치(310)는, 상기 각 현장장치인 디지털 보호계전기로부터 제공되는 각종 디지털 데이터를 수신하는 디지털 데이터 수신부(319), 상기 디지털 데이터 수신부(319)를 통해 입력된 디지털 데이터에 의거하여 표시 및 경보를 수행하는 표시/경보부(320)를 더 포함하여 구성된다.

또한, 상기 데이터 수집/전송장치(310)는, 상기 주 제어부(316)와 상기 변전소내의 퍼스컴으로 이루어진 외부의 제어기기(330)간의 직렬 데이터 통신을 위한 제어기기 통신접속부(321)와, 상기 전력관리센터(전력소등)에 설치되어 운영중인 SCADA 시스템(500)과의 정보공유를 통신을 위한 SCADA 통신 접속부(322)를 더 포함하여 구성되어 있고, 여기서 상기 데이터 수집/전송장치(310)의 주 제어부(316)는 원격에 위치한 상기 퍼스컴 장치(400)로부터의 요구에 따라에 따라서 원격 통신 접속부(318)를 통해서 각 해당 변전소(300)에 설치된 모든 현장장치(301,302,303,304)의 목록을 제공하고, 또한 상기 외부 제어기기(330)로부터의 요구에 따라 제어기기 통신접속부(321)를 통해서 각 해당 변전소에 설치된 모든 현장장치(301,302,303,304)의 목록을 제공하고, 상기 퍼스컴 장치(400) 또는 상기 외부의 제어기기(330)로부터 상기 제공된 현장장치 목록중 하나를 선택하는 선택명령 데이터 신호가 전송되면, 상기 전송된 선택 신호에 의거하여 데이터 BUS부(315)를 통해서 상기 각 직렬 통신단말 접속부(311, 312, 313,314)중에서 해당하는 직렬 통신 단말 접속부내의 통신채널 선택부(73)를 통해서 제어하도록 하여 해당 현장장치와의 통신채널 선택을 제어하도록 함을 특징으로 한다.

또한, 상기 현장 데이터 수집/전송장치(310)의 상기 제어부(316)는, 원격에 위치된 상기 퍼스컴 장치(400) 또는 변전소 제어룸에 설치된 상기 외부의 제어기기(330)에서 상기 선택된 해당 현장장치와 통신연결을 완료한 다음에 상기 퍼스컴 장치(400) 및 외부 제어기기(330)의 요구에 따라서 해당 현장장치에서 데이터를 취득하여 각각 원격 통신접속부(318) 또는 제어기기 통신접속부(321)을 통해서 각각 상기 퍼스컴 장치(400) 또는 외부의 제어기기(330)에 상기 해당 현장장치에서 취득한 데이터를 전송하고, 또한 상기 취득한 데이터를 데이터 저장부(317)에 저장함을 특징으로 한다.

도 5는 원격 또는 상위 전력 관리부나 본사 제어장소에 설치되는 도 3의 원격 고장 분석 퍼스컴장치(420)의 기능에 따른 구성도로서, 기본 운용 프로그램은 윈도우로 되어 있되, 시리얼 통신 접속 루틴, 변전소 상태 표시 및 설치된 계전기 표시, 정보 저장, 제작사별 고장분석도구 기동 드라이버 등의 기능을 수행할 수 있는 고장 표시 및 접속 프로그램이 구비되어 있다. 또한, 상기 제작사별 고장분석도구 기동 드라이버에 의해 수행되는 제작사별 원격 고장 분석 프로그램이 구비되어, 제작사(#A, #B, #C ... #D사 등)가 서로 다른 다기종의 현장장치(301,302,303,304)들의 동작 상태를 각각 분석할 수 있도록 되어 있다.

이어 본 발명의 동작에 대하여 기능별로 분류하여 설명한다.

첫째, 상기 데이터 수집/전송장치(310)는 서로 다른 여러 종류의 현장장치인 디지털 보호계전기(301,302,303) 및 고장기록장치(30)와의 시리얼 통신 접속기능이 있다. 즉, 현장장치인 디지털 보호 계전기는 제작사 마다 시리얼 통신의 물리적 접속규격이 RS232C나 RS422C/RS485 등으로 각기 다르기 때문에, 상기 데이터 수집/전송장치(310)에 구비된 복수의 직렬통신 단말 접속부(311,312,313,314)는 상기 통신 규격을 모두 제공하여 모든 현장장치(301~304)에 통신 접속할 수 있도록 되어 있다.

이와 같은 상기 데이터 수집/전송장치(310)와 상기 현장장치(301~304)간의 시리얼 통신 기능에 대해 도 6을 참조로 보다 상세히 설명하면 다음과 같다.

도 6에서, 상기 주제어부(316)는 데이터 BUS부(315)를 통해 상기 직렬 통신단말접속부(311,312,313,314)에 대한 명령 및 데이터 신호를 병렬데이터로 전송하면 해당하는 직렬 통신 단말 접속부내의 BUS 인터페이스(71)통해서 신호가 들어온다. 상기의 병렬데이터는 상기 직렬단말 제어부(72)에 의해 사전에 주 제어부(316)에 프로그램되어 있는 소정 포맷에 따라 직렬 데이터로 변환되어 상기 통신 채널 선택부(315)로 제공된다. 상기 주 제어부(316)와 해당 상기 직렬단말 제어부(72)의 제어에 따라 해당하는 현장장치에 연결된 통신채널을 선택하기 위해서 상기 통신채널 선택부(315)의 채널이 선택되면, 그 선택된 경로를 통해 해당 RS232C 또는 RS422C/RS485 등의 접속규격으로 된 해당 직렬 통신 단말 접속부(311,312,313 또는 314)를 통해서 상기 변환된 직렬 데이터가 전송되고, 이때 아이솔레이션 모듈(74)에 의해 전원분리가 이루어진다. 상기 해당 직렬 통신 단말 접속부(311,312,313 또는 314)에서 해당 통신 규격에 맞게 변환된 직렬데이터는 외부 인터페이스(External Interface)(75)를 거쳐 해당 현장장치(301,301,303 또는 304)로 전송되어서 해당 현장장치들에 대해서 데이터 전송을 요구한다.

한편, 상기한 경로와 반대로 상기 외부 인터페이스(75)를 통해 들어오는 상기 현장장치들(301~304)의 시리얼 통신 데이터는 상기 직렬통신 단말접속부(311-314)내의 상기 아이솔레이션 모듈(74)을 거치며, 상기 직렬 단말 제어부(72)를 통해서 상기 시리얼 데이터가 병렬데이터로 변환되어서 상기 BUS 인터페이스(71)을 통해서 주 제어부(316)로 전송된다. 상기 주 제어부(316)으로 전송되어온 상기 해당 현장장치(301~304)의 데이터들은 상기 주제어부(316)에 의해서 해당 변전소내의 상기 외부제어기기(330), 원격에 위치한 상기 상위 퍼스컴장치(400) 및 전력관리처(전력소등)등에 있는 SCADA 시스템(500)등으로 필요한 데이터를 전송하기 위해서 상황에 맞게 가공처리된다. 또한 주제어부(316)는 상기의 현장장치(301~304)로부터 전송받는 데이터를 데이터 저장부(317)에 저장한다.

둘째, 현장장치의 인식기능이 있다.

본 발명에 따른 상기 주 제어부(316)는 상기 현장장치(301~304)로부터 전송되어 온 통신 데이터에 의거하여 해당 디지털 보호계전기 및 고장기록장치의 제작사 및 모델명 등을 자동으로 인식할 수 있는 바, 이것은 현장장치에서 오는 통신 데이터의 포맷이나 형태를 보고 데이터 저장부(317)에 기 저장되어 있는 현장장치 모델 데이터와 비교 분석하여 인식 제어하는 것이다.

셋째, 원방의 상위 퍼스컴 장치(400)의 퍼스컴(420)이나 현장의 제어기기(330)를 이용하여 현장 디지털 보호계전기(301-303) 및 고장기록장치(314) 중 원하는 접속대상을 설정할 수 있는 바, 이에 대해 상세히 설명하면 다음과 같다.

먼저, 원방의 상위(본사나 전력관리처의 관리제어룸)에 있는 고장분석 퍼스컴장치(400)에서 해당 변전소의 해당 디지털 보호계전기(301,302 또는 303) 또는 고장기록장치(304)로 통신 접근하여 데이터를 받고 싶을 때, 상기 고장분석 퍼스컴 장치(400)의 상기 퍼스컴(420)에서 해당 변전소(300)를 설정하면 그 설정 신호는 모뎀(410), 통신망(401), 모뎀(340) 및 원격 통신접속부(318)를 통해 주 제어부(316)에 전달되고, 해당 변전소(300)의 상기 주 제어부(316)는 데이터 저장부(317)에 저장되어 있는 현장장치(301~304)의 목록을 상기 설정 신호의 역방향

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경로를 통해 상기 퍼스컴(420)에 제공한다. 상기 퍼스컴(420)을 통해 상기 제공된 목록 중에 한 개의 현장장치(301-304 중 1개)가 선택되면, 상기 설정신호의 전달 경로를 통해 그 선택 신호가 상기 주 제어부(316)에 전달된다. 상기 주 제어부(316)는 상기 전달된 선택신호에 의거하여 상기 현장장치에 연결된 직렬통신단말 접속부(311,312,313,314중에 1개)를 제어함으로서, 해당 현장장치와 상기 원방의 퍼스컴(420)과의 통신 접속이 이루어지게 된다. 통신접속이 이루어지면, 상기 원방의 퍼스컴(420)은 필요한 현장장치의 데이터를 전송받게 된다.
상술된 바와 같은 원방의 상기 퍼스컴(420)에서 현장장치로 접속하는 순서는, 복수의 변전소 목록에서 대상 변전소 선택 → 선택된 대상 변전소의 계통 선로 및 모선의 목록을 접수하여 원하는 해당 계통선로 및 모선 선택 → 선택된 해당 계통선로 및 모선에 설치된 현장장치의 목록을 접수하여 원하는 해당 디지털 보호계전기 및 고장기록장치를 선택 → 상기 퍼스컴(420)과 선택된 해당 현장장치(301,302,303 또는 304)와이 통신접속, 과 같이 트리(Tree) 접속 구조로 되어 있어 있으며, 또한, 현장 변전소 제어룸의 제어기기(330)와 원하는 현장장치간의 통신 접속도 상기한 바와 같은 트리 접속 방식으로 통신 접속되어서 필요한 고장데이터를 전송받을 수 있도록 되어 있다.
넷째, 상기 데이터 수집/전송장치(310)는 현장장치들(301-304)로부터 데이터를 취득하고 저장하는 기능이 있는 바, 먼저 디지털 보호계전기(301-303)와의 통신을 통해 취득하는 데이터의 내용은, 고장발생시간, 고장위치 및 고장발생종류 등의 고장정보내역, 고정발생 전후의 3상 전압/전류 샘플링 데이터, 고장발생 전후의 계전기 출력상태 정보, 계전기 점검 및 감시에 의한 계전기 동작 상태 정보, 그외 계전기가 통신으로 제공하는 모든 데이터 등을 포함한다.
고장기록장치(304)와의 통신을 통해 취득하는 데이터의 내용은, 고장기록장치가 저장하고 있는 고장발생 전후의 3상 전압/전류 샘플링 데이터, 고장기록장치가 저장하고 있는 각종 상태 정보 데이터 등을 포함한다.
따라서, 원방에 있는 상기의 고장분석 퍼스컴(420)이 기 발생한 해당 변전소(300)의 해당 현장장치(301-303, 304)의 고장데이터를 전송받기 위해서 굳이 상기 현장장치까지 통신을 접속하여 데이터를 받을 필요없이 상기 데이터 수집/전송장치(310)내의 데이터 저장부(317)에 저장되어 있는 기 발생한 해당 현장장치의 고장데이터를 전송받을 수 있다.
또한, 상기 취득된 각종 데이터들은 상기 주 제어부(316)의 제어에 의해 데이터 저장부(317)에 저장되는 데, 그 저장 방식은 다음과 같다.
① 디지털 보호계전기 및 고장기록장치 별, 고장발생 시간별 고장내역과 전류/전류 데이터를 인덱스(Index) 처리하여 데이터 저장부(317)에 저장.
② 고장발생시간, 고장위치, 고장발생 종류등의 각종 고장에 대한 상태 정보를 포함한 고장 이력관리 데이터 와 고장 전후의 3상 전압/전류 샘플링 데이터 및 기타 정보등의 3가지 구분으로 나누어서 저장함.
③ 데이터 저장부(317)에 저장은 순차적으로 저장하고, 데이터 수집/전송장치(310)의 데이터 저장부(317)의 기억용량 부족시에는 자동으로 가장 오래된 데이터를 먼저 삭제하여 오버라이트(Over Write)함. 이때 오버라이트하는 데이터는 3상전압/전류 샘플링 데이터이다.
④ 원방의 상기 퍼스컴(420)이나 현장의 제어기기(330)를 통해서 상기 데이터 수집/전송장치(310)의 데이터 저장부(317)의 기억장소에 저장되어 있는 데이터 중 3상전압/전류 샘프링 데이터에 대한 자동/수동 삭제 기능이 있는 바, 데이터 저장부(317)의 기억용량 부족시에는 데이터를 오버라이트(Overwrite) 하는 방식으로 3상 전압/전류 샘플링 데이터를 삭제하는데, 이때에는 자동/수동 설정에 따라서 데이터를 삭제하되, 단 고장정보의 발생시간 및 고장종류 등의 내용등의 이력관리 데이터는 항상 저장하여 고장정보에 대한 이력관리가 가능하도록 한다. 또한, 상기 고장정보에 대한 이력관리 데이터는 사용자가 임의적으로 삭제할 수 없고, 기억용량이 부족할 경우에만 표시/경보부(320)를 통해 반드시 별도의 경보를 수행함과 아울러 원방의 상위 퍼스컴 장치(400)에 알려서 사용자에 의해 저장된 데이터를 수동 삭제하도록 한다.
다섯째, 이미 상술된 바와 같이 현장의 데이터 수집/전송장치(310)와 원방의 상위 퍼스컴장치(400)간의 통신 기능이 구비되어 있는 바, 이를 상세히 설명하면 다음과 같다.
① 상기 데이터 수집/전송장치(310)에 고속의 듀얼-업(Dual-up) 모뎀(340)을 설치하여 한전의 전용 일반 전화망에 접속되도록 하고, 원방의 상위 퍼스컴장치(400)의 퍼스컴(420)에도 고속의 듀얼-업 모뎀(410)을 설치 사용하도록 한다.
② 상기 데이터 수집/전송장치(310)에 1개의 전화번호를 부여하도록 되어 있다.
③ 상기 데이터 수집/전송장치(310)는 원방과의 통신데이터 전송속도 자동 조정기능이 구비되어 해당하는 통신선로의 상태에 따라서 통신속도가 조절되도록 한다.
④ 상기 데이터 수집/전송장치(310)별로 각각의 어드레스번호를 부여하고, 원방의 상위 퍼스컴(420)로부터 통신 접속시에, 패스워드(Password) 및 사용자명(User Name)을 부가하여 정당한 권리가 없는 사람은 상기 퍼스컴(420)을 통해서 통신할 수 없도록 함으로써, 통신의 비밀을 보장하도록 되어 있다.
⑤ 상기 데이터 수집/전송장치(310)는 상기 고속의 듀얼-업 모뎀(340)을 통해서 원방의 상기 퍼스컴(420)으로 자동으로 전화를 걸어 통신 접속할 수 있도록 한다. 이는 해당 변전소의 현장장치(301-303,304)가 동작하여 고장데이터를 가지고 있을 경우에는, 상기 데이터 수집/전송장치(310)의 주제어부(316)를 통해서 사전에 등록되고 승인된 상위에 있는 상기의 퍼스컴(420)에게 상기의 고장데이터를 전송하기 위해서 상기 데이터 수집/전송장치(310)에서 원방의 사전에 승인된 상기 퍼스컴(420)으로 자동으로 전화를 걸어서, 상기 퍼스컴(420)과 통신접속을 시도하여 상기 현장장치(301-303,304)의 고장 데이터를 전송한다.
⑥ 원방에 있는 상기의 고장분석 퍼스컴(420)는 해당변전소(300)의 해당 현장장치(301-303,304)의 고장데이터를 전송받기 위해서는 상기 고속의 듀얼-업 모뎀(340)을 통해서 상기 데이터 수집/전송장치(310)로 전화를 걸어서 통신접속을 하여 언제던지 상기 현장장치의 고장 데이터를 받을 수 있다.

여섯째, 상기 데이터 수집/전송장치(310)는 디지털 DC 데이터 입력부를 구비하고 있는 바, 상기의 현장장치(301-304)들은 외부에 고장 데이터를 전송해주기 위해서 통신포트를 구비하고 있지만, 상기 현장장치(301-304)가 언제 가장 최근에 데이터를 저장했는지 데이터수집/전송장치(310)는 알 수 없을 수 있기 때문에, 상기 현장장치(301-304)는 고장발생용 데이터 저장 싯점을 알리는 디지털 출력 신호가 있기 때문에 상기의 데이터 수집/전송장치(310)는 상기 이 디지털 출력신호를 받아서 상기 현장장치내 이 디지털 신호이후의 최신의

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고장데이터를통신으로 전송받을 수 있다. 물론 상기 현장장치(301~304)의 통신기능 자체에 고장데이터를 저장하자마자 상기 현장장치의 외부 통신 포트를 통해서 외부로 데이터를 전송하는 경우에는 그럴 필요가 없겠지만, 제품의 통일성을 위해서 상기 데이터수집/전송장치(310)에 디지털 DC 데이터 입력부를 두어서 항상 상기 현장장치(301~304)의 고장데이터 저장신점을 입력 받는다. 또한, 외부 통신포트를 구비하고 있지 않은 보호 계전기(301,302,303)의 경우에도 상기 디지털 보호 계전기(301,302,303)가 가지고 있는 고장정보 및 경보등의 동작상태를 상기의 데이터수집/전송장치(310)가 취득하기 위해서도 고장데이터 입력용 디지털 DC 데이터 입력부를 구비하고 있다. 이 때, 외부 통신포트를 구비하고 있지 않은 상기의 보호계전기(301,302,303)에서 취득할 수 있는 정보는 지락, 단락, Main/Backup, Z1/Z2/Z3 등의 고장정보데이터와 선로단선, 전압휴즈 불량, 동기탈조검출, DC전원불량, 캐리어 수신, 자동재폐로 동작, 전송신호 차단, 차단기 압력저하등의 각종 경보등의 동작상태정보가 있다.

마지막으로, 상기 데이터 수집/전송장치(310)는 현장의 제어기기(330)를 통해 고장분석이 가능하도록 된 기능(local monitoring port 제공)이 구비되어 있는 바, 접속통신방식은 RS232C, 상기 외부 제어기기(330)로서의 사용 PC 환경은 IBM 호환용 486 이상의 노트북 PC/OS 환경, 윈도우이고, 상기 제어기기(330)는 로컬 PC 프린터를 통해 제어기기가 가공분석 처리한 데이터를 프린팅할 수 있다.

발명의 효과

이상 상세히 설명한 바와 같이 본 발명에 따른 전력계통의 상태 정보 수집 및 분석 시스템에 의하면, 서로 다른 다기종의 디지털 보호 계전기 및 고장기록장치로부터 전력계통의 고장정보를 수집하여 저장하고, 그 수집된 고장정보를 중앙의 전력회사나 전력관리센터에 전송하여 감시 및 분석할 수 있도록 함으로써, 현장장치의 기종에 관계없이 본 장치를 적용하여 원방 또는 현장에서 원하는 전력계통을 감시 분석할 수 있는 효과가 있다.

(57) 청구의 범위

청구항 1.

발전소로부터 발전된 전력을 복수개의 변전소 및 그 변전소간을 연결하는 송전선로를 매개로 송전하며, 상기 각 변전소의 송전선로상에는 송전계통상의 고장을 신속하게 검출하여 자동으로 해당 계통 선로를 차단시키는 다기종 복수의 디지털 보호 계전기 및 각 전력계통상의 고장전후의 필요한 데이터를 기록 저장하는 다기종 복수의 고장기록장치가 설치되어 있는 전력 시스템에 있어서,
다기종 복수의 상기 디지털 보호 계전기와 상기 고장 기록장치로부터 전력계통 상태에 관한 각종의 정보 데이터를 취득, 관리 및 저장하고,
상위로 단일 모뎀을 매개로 하는 단일 통신망을 통해 상기 취득된 데이터를 원격 전송하는 데이터 수집/전송장치; 및
상기 전송된 데이터를 수신하고, 그 수신된 데이터에 상응하는 해당 소프트웨어 프로그램을 실행시켜 상기 수신된 데이터를 분석하고 표시하며, 상기 데이터 수집/전송장치와 상호 통신하는 퍼스컴 장치를 포함하여 구성된 것을 특징으로 하는 전력계통의 상태 정보 수집 및 데이터 전송 시스템.

청구항 2.

제 1 항에 있어서,
상기 데이터 수집/전송장치는, 상기 복수개의 디지털 보호계전기와 고장기록장치에 각각 대응하는 통신 접속방식으로 각각 직렬 통신 접속된 복수개의 직렬 통신 단말 접속부; 상기 각 직렬 통신 단말 접속부와의 주제어부 간에 데이터를 접속시키는 데이터 버스부; 및 상기 데이터 버스부를 통해서 직렬통신 단말접속부와 통신 데이터를 주고 받고, 상기 직렬 통신 단말 접속부를 제어하여 상기 디지털 보호 계전기와 상기 고장 기록장치로부터 데이터를 취득하게 하고, 상기 취득한 데이터를 저장수단에 저장시킴과 아울러 상위 퍼스컴 장치로 원격 통신하기 위해서 모뎀을 구동하는 원격 통신접속부를 제어하는 주제어부를 포함하여 구성된 것을 특징으로 하는 전력계통의 상태정보 수집 및 데이터 전송 시스템.

청구항 3.

제 2 항에 있어서,
상기 직렬 통신 단말 접속부는,
상기 주 제어부의 명령에 따라서 상기 데이터 BUS부로부터 받는 병렬 데이터를 직렬로 변환하고, 이에 대한 역방향 변환도 수행하는 직렬단말제어부;
복수의 채널을 가지고서 통신채널을 선택하는 통신 채널 선택부;
상기 주제어부에 입력되는 상기 각종의 정보 데이터를 저장하는 데이터 저장부; 및
상기 디지털 보호계전기 및 고장기록장치로부터 취득한 병렬 데이터 신호를 시리얼로 변환하여 상기 퍼스컴 장치로 원격 전송하고, 상기 퍼스컴 장치로부터 원격 전송된 시리얼 데이터를 모뎀을 통해서 전송받아서 병렬 데이터 신호로 변환하여 상기 주 제어부에 제공하는 원격 통신접속부; 및
전력관리센터에 있는 스카다(SCADA)에 데이터를 송신하기 위한 스카다 통신접속부를 포함하여 구성된 것을 특징으로 하는 전력계통의 상태정보 수집 및 데이터 전송 시스템.

청구항 4.

제 3 항에 있어서,
상기 데이터 수집/전송장치는, 상기 각 디지털 보호계전기와 고장기록장치로부터 제공되는 디지털 데이터를 수신하는 디지털 데이터 수신부;

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및
상기 수신된 디지털 데이터에 의거하여 표시 및 경보를 수행하는 표시/경보부를 더 포함하여 구성된 것을 특징으로 하는 전력계통의 상태 정보 수집 및 데이터 전송 시스템.

청구항 5.
제 4 항에 있어서,
상기 주 제어부는 상기 디지털 데이터 수신부에 수신된 디지털 데이터에 의거하여 상기 통신채널 선택부의 통신채널 선택을 제어하는 것을 특징으로 하는 전력계통의 상태 정보 수집 및 데이터 전송 시스템.

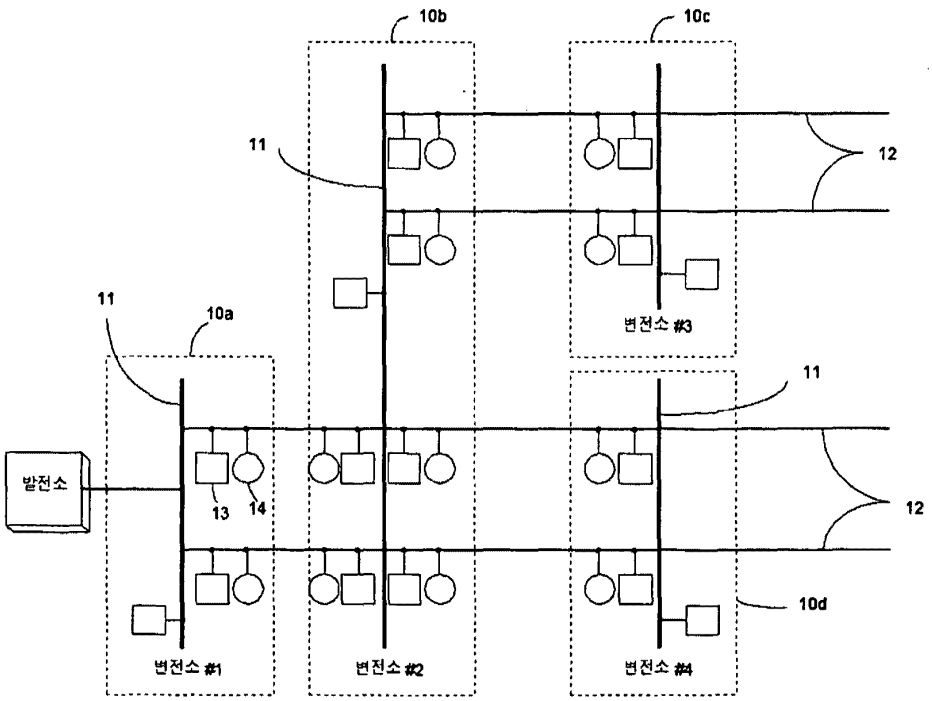
청구항 6.
제 2 항에 있어서,
상기 데이터 수집/전송장치는, 상기 주 제어부와 외부의 제어기기간의 직렬 데이터 통신을 위한 통신 접속부를 더 포함하여 구성된 것을 특징으로 하는 전력계통의 상태 정보 수집 및 데이터 전송 시스템.

청구항 7.
제 6 항에 있어서,
상기 주 제어부는 상기 외부 제어기기로부터 입력되는 명령 데이터에 의거하여 상기 통신채널 선택부의 통신채널 선택을 제어하는 것을 특징으로 하는 전력계통의 상태 정보 수집 및 데이터 전송 시스템.

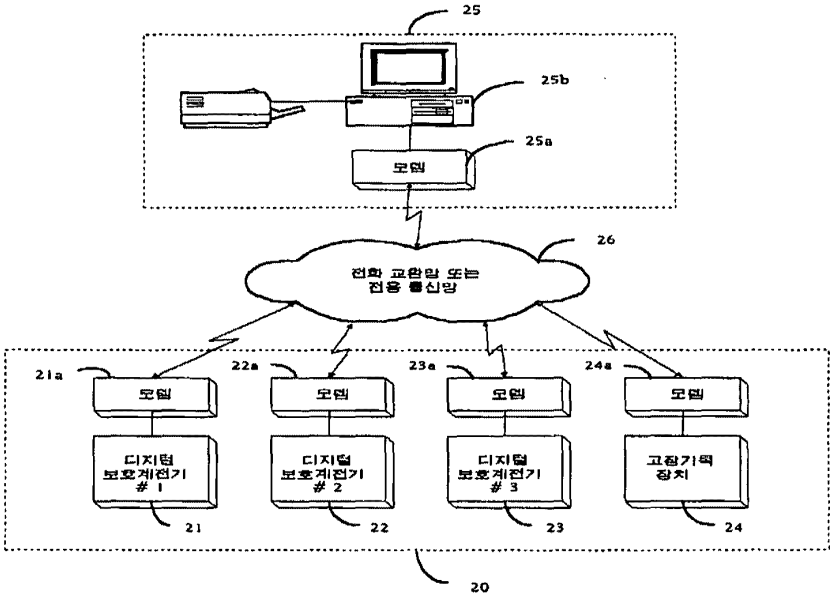
청구항 8.
제 2 항 또는 제 5 항에 있어서,
상기 주 제어부는 상기 퍼스컴 장치 또는 상기 외부의 제어기기로부터의 요구에 따라 각 해당 변전소에 설치된 모든 디지털 보호계전기와 고장기록장치의 목록을 제공하고, 상기 퍼스컴 장치 또는 상기 외부의 제어기기로부터 상기 제공된 목록중 하나를 선택하는 선택 신호가 전송되면, 상기 전송된 선택 신호에 의거하여 상기 통신채널 선택부의 통신채널 선택을 제어하는 것을 특징으로 하는 전력계통의 상태 정보 수집 및 데이터 전송 시스템.

도면

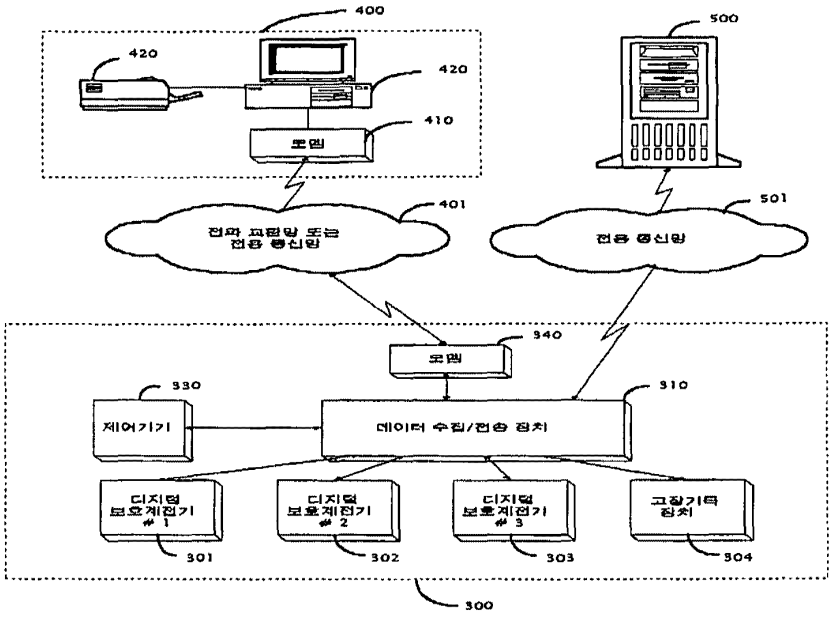
도면 1



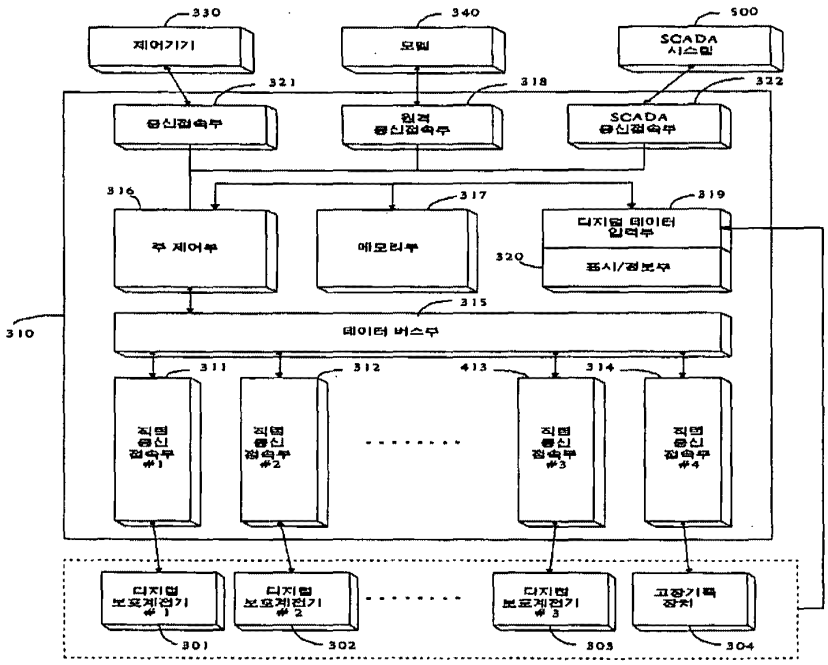
도면 2


25
25b
25a
모뎀
26
전화 교환망 또는
전용 통신망
21a
22a
23a
24a
모뎀
모뎀
모뎀
모뎀
디지털
보호계전기
1
디지털
보호계전기
2
디지털
보호계전기
3
고장기록
장치
21
22
23
24
20

도면 3

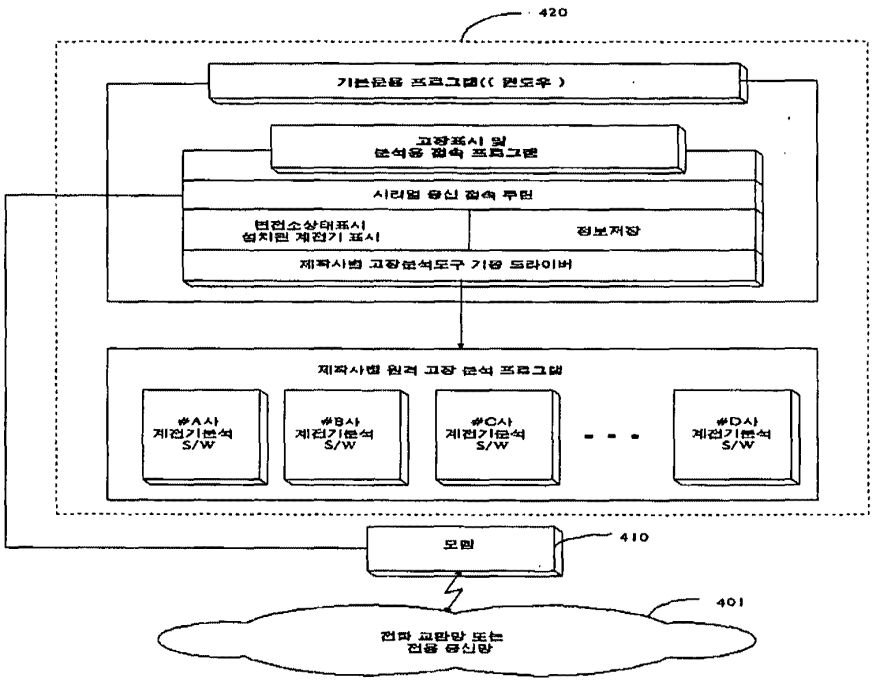

400
420
420
410
모뎀
500
401
전화 교환망 또는
전용 통신망
501
전용 통신망
940
모뎀
930
제어기기
910
데이터 수집/전송 장치
디지털
보호계전기
#1
디지털
보호계전기
#2
디지털
보호계전기
#3
고장기록
장치
301
302
303
304
300

도면 4

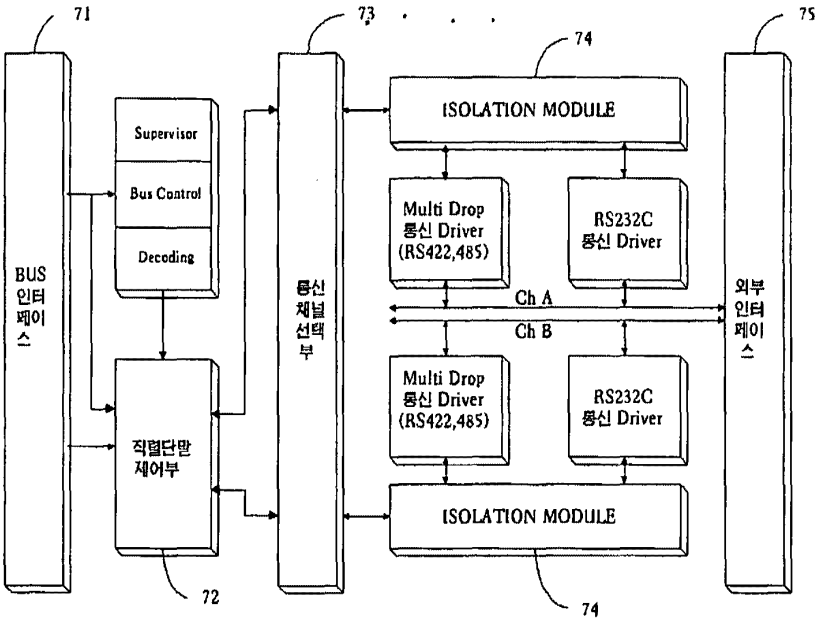


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도면 5


420
기본운용 프로그램((윈도우))
고장표시 및
분석용 접속 프로그램
시리얼 통신 접속 루틴
변전소상태표시
설치된 계전기 표시
정보저장
제작사별 고장분석도구 기능 드라이버
제작사별 원격 고장 분석 프로그램
#A사
계전기분석
S/W
#B사
계전기분석
S/W
#C사
계전기분석
S/W
#D사
계전기분석
S/W
모뎀
410
401
전화 교환망 또는
전용 통신망

도면 6


71
73
74
75
BUS 인터페이스
Supervisor
Bus Control
Decoding
직렬단말 제어부
72
통신 채널 선택부
ISOLATION MODULE
Multi Drop 통신 Driver (RS422,485)
RS232C 통신 Driver
Ch A
Ch B
Multi Drop 통신 Driver (RS422,485)
RS232C 통신 Driver
ISOLATION MODULE
74
외부 인터페이스

PATENT ABSTRACTS OF JAPAN

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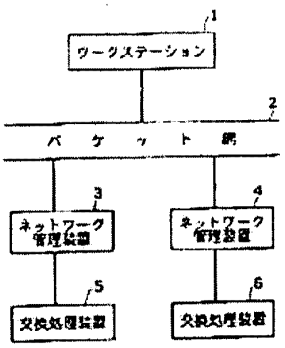
(51)Int.Cl. H04L 12/24
H04L 12/26

(21)Application number : 02-076381
(22)Date of filing : 26.03.1990

(71)Applicant : NEC CORP
(72)Inventor : KOBAYASHI TAKESHI

(54) UNITARY MONITORING METHOD FOR NETWORK

(57)Abstract:
PURPOSE: To monitor plural network controllers by one work station by connecting one of the plural network controllers with the work station while changing a logical path.
CONSTITUTION: The work station 1 controls the network controller 3 through a packet network 2. When an alarm is received from an exchange processor 5, the controller 3 transmits this alarm through the packet network 2 to the station 1. On the other hand, when controlling the network controller 4 from the station 1, it is executed while cutting the logical path with the controller 3 and setting the logical path with the controller 4 from the station 1. Even in the case of the station 1, when the alarm is received, it is displayed.



⑲日本国特許庁(JP)　⑪特許出願公開

⑫公開特許公報(A)　平3-274939

⑤1Int.Cl.[5]　識別記号　庁内整理番号　⑬公開　平成3年(1991)12月5日

H 04 L 12/24
12/26

8732-5K　H 04 L 11/08

審査請求　未請求　請求項の数 2　(全4頁)

⑤4発明の名称　ネットワークの一元監視方法

⑳特　願　平2-76381
㉒出　願　平2(1990)3月26日

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⑦1出願人　日本電気株式会社　東京都港区芝5丁目7番1号
⑦4代理人　弁理士　渡辺　喜平

明　細　書

1．発明の名称

ネットワークの一元監視方法

2．特許請求の範囲

(1) 複数の交換処理装置を各々管理する複数のネットワーク管理装置と、これらネットワーク管理装置のうちの一のネットワーク管理装置と一台のワークステーションとをパケット網を介し論理パスを設定して接続するネットワークの監視方法であって、前記論理パスを変更して前記ワークステーションと前記パケット網に接続された前記一のネットワーク管理装置以外のネットワーク管理装置とを接続し、各々のネットワーク管理装置からのアラームを前記一台のワークステーションで受信し表示することを特徴とするネットワークの一元監視方法。

(2) 複数のネットワーク管理装置からのアラームを、論理パスを設定した一のネットワーク管理装置を介して一台のワークステーションで受信し表示することを特徴とした請求項1記載のネットワークの一元監視方法。

3．発明の詳細な説明

[産業上の利用分野]

本発明は、複数の交換処理装置を各々管理する複数のネットワーク管理装置と、ネットワーク管理装置のワークステーションをパケット網を介して接続したネットワークシステムの監視方法に関し、特にネットワークの監視を一元的に行うようにしたネットワークの一元監視方法に関する。

[従来の技術]

従来、交換処理装置を管理するネットワーク管理装置と、前記ネットワーク管理装置のワークステーションをパケット網を介して接続したネットワークシステムにおいては、各ネットワークにおける各ネットワーク管理装置毎にワークステーションが設けられていた。

そして、この場合、各ネットワーク管理装置と各ワークステーションの間の論理パスが設定されたままであった。したがって、ネットワークの監

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視も、一のネットワーク管理装置に対してそれぞれ専用のワークステーションを用意して行っていた。

［解決すべき課題］

上述のネットワーク管理装置とワークステーションをパケット網を介して接続する従来の方法では、前記ネットワーク管理装置と前記ワークステーションの間の論理パスを設定したままであったので、ネットワーク管理装置の数だけワークステーションを接続しなければならないとともに、オペレータは、複数のワークステーションが、各ネットワーク管理装置から受信し表示するアラームをそれぞれ監視しなければならないという問題があった。

本発明は上述した問題点にかんがみてなされたものであり、ネットワーク管理装置が複数あっても、ワークステーションは一台だけでよく、しかも一台のワークステーションを監視すれば複数のネットワーク管理装置の監視を行えるネットワークの一元監視方法の提供を目的とする。

［課題の解決手段］

上記目的を達成するために本発明のネットワークの一元監視方法は、複数の交換処理装置を各々管理する複数のネットワーク管理装置と、これらネットワーク管理装置のうちの一のネットワーク管理装置と一台のワークステーションとをパケット網を介し論理パスを設定して接続するネットワークの監視方式であって、前記論理パスを変更して前記ワークステーションと前記パケット網に接続された前記一のネットワーク管理装置以外のネットワーク管理装置とを接続し、各々のネットワーク管理装置からのアラームを前記一台のワークステーションで受信し表示するようにしてある。

［作用］

上記構成からなるネットワークの一元監視方法によれば、論理パスを変更して、複数あるネットワーク管理装置のうちの一のネットワーク管理装置と、ワークステーションとを接続するようにしているので、一台のワークステーションで複数のネットワーク管理装置の監視を行える。

また、論理パスを設定した一のネットワーク管理装置を介してすべてのネットワーク管理装置からのアラームが一台のワークステーションで受信，表示されるので、一台のワークステーションを監視すればネットワーク全体の監視を行うことができる。

［実施例］

以下、本発明の一実施例について図面を参照して説明する。

第１図は、本発明のネットワークの一元監視方法を実施するための一システム例のブロック図を示す。

ネットワークシステムは、ワークステーション１と、パケット網２と、ネットワーク管理装置３，４と、交換処理装置（データ交換系）５と、交換処理装置（回線交換系）６とで構成されている。ネットワーク管理装置３および４はそれぞれ異なる交換処理装置を管理しており、ネットワーク管理装置３は交換処理装置５を管理し、ネットワーク管理装置４は交換処理装置６を管理している。

ワークステーション１は、パケット網２を介してネットワーク管理装置３あるいはネットワーク管理装置４と論理パスを設定して接続する。論理パスの設定は、標準的な端末インターフェースとして国際電信電話諮問委員会（CCITT)から勧告として示されているＸシリーズインターフェースのうちの「Ｘ・２５インターフェース」に定められた手順に従って行われる。

次に、本実施例の動作について説明する。

いま、ワークステーション１がパケット網２を介してネットワーク管理装置３と接続しているとすると、ワークステーション１はパケット網２を介してネットワーク管理装置３の制御を行う。ネットワーク管理装置３は、交換処理装置５からアラームを受信すると、パケット網２を介してワークステーション１にアラームを送信する。

また、ワークステーション１からネットワーク管理装置４の制御を行う場合は、ワークステー

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ション1からネットワーク管理装置3との論理パスを切断しネットワーク管理装置4と論理パスを設定して行う。ここで、論理パスの切断および設定は上述した「X・25インターフェース」に定められた手順に従って行われる。この場合、ネットワーク管理装置4が交換処理装置6からのアラームを受信すると、パケット網2を介してワークステーション1にアラームを送信する。

第1図に示すように、ネットワーク管理装置3と4の間にアラーム送信路を設けてある場合には、次のようにしてアラームの送信を行う。

すなわち、ワークステーション1がパケット網2を介してネットワーク管理装置3と接続している場合において、ネットワーク管理装置4が交換処理装置6からアラームを受信すると、ネットワーク管理装置4はネットワーク管理装置3にアラームを送信する。一方、ネットワーク管理装置3は、受信したアラームをパケット網2を介してワークステーション1に送信する。

このように、ネットワーク管理装置3と4の間に、アラーム送信路を設けてある場合には、いずれのネットワーク管理装置3，4でアラームを受信しても、ネットワーク管理装置3およびパケット網2を介してワークステーション1に送信される。したがって、ワークステーション1はいずれの場合もアラームを受信すると表示を行う。

ワークステーション1とネットワーク管理装置4との間で論理パスが設定してある場合には、交換処理装置5のアラームは、ネットワーク管理装置3、ネットワーク管理装置4 、パケット網2を介してワークステーション1に送信される。

なお、本発明は上記実施例に限定されるものではなく、適宜変形実施が可能である。

例えば、ネットワークが二つである場合に限られず、三つ以上のネットワークを監視する場合も含まれる。

また、論理パスの変更（設定および切断）は、「X・25インターフェイス」に定められた手順以外によっても行うことができる。

［発明の効果］

以上説明したように本発明は、論理パスを変更することによって、ワークステーションとパケット網に接続された他のネットワーク管理装置とを接続して制御を行い、各々のネットワーク管理装置からのアラームを前記ワークステーションで受信し表示することにより、ネットワーク管理装置が複数あってもワークステーションは一台だけでよく、しかも、すべてのネットワーク管理装置からのアラームがそのワークステーションに表示されるので、オペレータは一台のワークステーションを監視すればネットワーク全体の監視を行えるという効果がある。

4．図面の簡単な説明

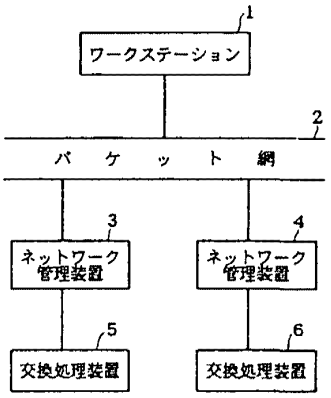
第1図は、本発明のネットワークの一元監視方法を実施するための一システム例のブロック図を示す。

1：ワークステーション
2：パケット網
3：ネットワーク管理装置
4：ネットワーク管理装置
5：交換処理装置（データ交換系）
6：交換処理装置（回線交換系）

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第1図



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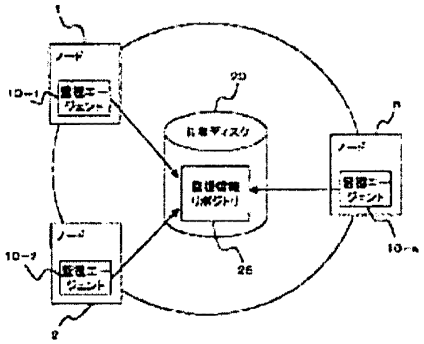
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(54) COMPUTER SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To improve resistance to fault while securing processing efficiency in a computer system constituted by plural nodes.
SOLUTION: In plural networked nodes 1, 2,..., n, monitoring agents 10-1, 10-2,..., 10-n respectively operate to monitor the operating situation of a DB application in its own node and the other nodes. In addition, information of each node is stored in a monitoring information repository 25 on a shared disk 20 mutually shared by the respective nodes. This information includes the CPU load, the free memory quantity, etc., of each memory. A monitoring agent detecting the down of application in its own node and the down of the other nodes dynamically selects an alternative node by the reference of a small CPU load, e.g. based on the information of the repository 25 and instructs taking over of processing to this.



* NOTICES *

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damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]A computer system with which network connection of the node of plurality which can execute a processing program, respectively was carried out, comprising:
A monitor means in which said each node supervises system operating status of each of each of said node.
An alternative node selecting means which chooses an alternative node when said monitor means detects an execution obstacle of said processing program in said arbitrary nodes, and a fail over means to make execution of said processing program take over to said alternative node from a node which produced said execution obstacle.

[Claim 2]A computer system, wherein said monitor means supervises processor load of each of each of said node and said alternative node selecting means chooses said alternative node in the computer system according to claim 1 based on said processor load obtained by said monitor means.
[Claim 3]A computer system, wherein said alternative node selecting means chooses a node in which said processor load is the minimum as said alternative node in the computer system according to claim 2.
[Claim 4]A computer system, wherein said monitor means supervises a memory availability of each of each of said node and said alternative node selecting means chooses said alternative node in the computer system according to claim 1 based on said memory availability obtained by said monitor means.
[Claim 5]A computer system, wherein said alternative node selecting means chooses a node in which said memory availability is the maximum as said alternative node in the computer system according to claim 2.
[Claim 6]In the computer system according to claim 1, said monitor means, A computer system, wherein it supervises each processor load and memory availability of each of said node and said alternative node selecting means

chooses said alternative node based on said processor load obtained by said monitor means, and said memory availability.

[Claim 7]In the computer system according to claim 1, said monitor means, Supervise a memory availability of each of each of said node, and said fail over means, A capacity comparison means by which said memory availability of said alternative node judges ****** enough to taking over of said processing program, and when said memory availabilities run short, A computer system having a memory quota alteration means which reduces memory space assigned to a point boot program started by preceding by said alternative node.

[Claim 8]It has the session information table which included session information between user nodes which use said point boot program and the point boot program concerned of said alternative node via said network in the computer system according to claim 7, When said fail over means makes a quota change of said memory space, Based on said session information, distinguish whether a transaction during an established session is [******] under continuation, and only a message to a transaction under continuation is passed to said point boot program, Other messages to the session concerned have a message handling means to suspend for said session information until said quota change is completed, and said memory quota alteration means, A computer system suspending execution of said point boot program and making a memory quota change when said transaction is completed.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the computer system especially whose fault tolerance and availability improved about the computer system to which two or more computers were connected.

[0002]

[Description of the Prior Art]In order to raise the availability of a computer system, it is necessary to reduce the down-time of the system by failure. Use of redundancy is mentioned as one method of aiming at this improvement in a fault tolerance. Redundancy can be applied to both hardware and software and there is specifically an example of use of multiplexing, a majority method, and an error correction/detected code. In it, it is a comparatively easy form which can be used about hardware, and the form of multiplexing of constituting from two or more computers to which one computer system of each other was connected is one of the large things of a scope.

[0003]In this multiplexing, when the individual computer (this may be hereafter called a node) which constitutes a system stops by a certain cause (down), the example which considers processing of that node as the fail over composition which another node defined beforehand succeeds is increasing.

[0004]

[Problem to be solved by the invention]In this conventional fail over composition, processing can be taken over only to the node point decided beforehand at the time of a fault occurrence (fail over is carried out). That is, in this method, even if there are many amounts (for example, a CPU load, memory quantity) required for processing taking over of computer resources (resources), The node by which fail over is carried out according to it could not be changed dynamically, but the load of the node by which fail over was carried out became high, and there was a problem that the case where it is substantially impossible for the processing speed to decrease beyond a tolerance limit, or to succeed to processing in being extreme might arise.

[0005]There is a case where he would like to carry out fail over of the DB application with high importance to the node in which database application software with low importance (it is hereafter written as DB application) is working, for example. In this case, a part of memory of the node of the fail over point. DB application with low importance occupies previously, and the DB application with high importance by which fail over is carried out can exploit only the remaining memory resources, but produces the above-mentioned inconvenience that processing is not performed efficiently and that processing speed is slow. Thus, in the conventional fail over method, there was a problem that assignment of a resource was not performed effectively, simply. The conventional fail over method of having improved this was made to once stop DB application with low importance which occupies the resource previously, and there were some which perform reallocation that a resource is preferentially given to DB application with high importance in it. In this method, a node once, namely, the existing session information (information required in order

to process the connection between a terminal and DB and a transaction) will be lost, There was a problem that the execution after the resource reallocation of the application currently performed previously became troublesome.

[0006]This invention is a computer system which raises a fault tolerance and availability by multiplexing of having been made in order to cancel the above-mentioned problem, and network connection of two or more nodes being carried out, and performing fail over between nodes. The purpose is to provide a system by which processing at the fail over point is performed efficiently.

[0007]

[Means for solving problem]This invention is characterized by a computer system by which network connection was carried out comprising the following in two or more nodes which can execute a processing program, respectively.

A monitor means in which said each node supervises system operating status of each of each of said node.

An alternative node selecting means which chooses an alternative node when said monitor means detects an execution obstacle of said processing program in said arbitrary nodes.

A fail over means to make execution of said processing program take over to said alternative node from a node which produced said execution obstacle.

[0008]In a computer system concerning other this inventions, said monitor means supervises processor load of each of each of said node, and said alternative node selecting means chooses said alternative node based on said processor load obtained by said monitor means. As for a suitable mode of this invention, said alternative node selecting means chooses a node in which said processor load is the minimum as said alternative node.

[0009]In the computer system concerning another this invention, said monitor means supervises the memory availability of each of each of said node, and said alternative node selecting means chooses said alternative node based on said memory availability obtained by said monitor means. As for the suitable mode of this invention, said alternative node selecting means chooses the node in which said memory availability is the maximum as said alternative node.

[0010]Said monitor means supervises each processor load and memory availability of each of said node, and other suitable modes of this invention choose said alternative node based on said processor load from which said alternative node selecting means was acquired by said monitor means, and said memory availability.

[0011]In the computer system concerning another this invention, A capacity comparison means by which said monitor means supervises the memory availability of each of each of said node, and, as for said fail over means, said memory availability of said alternative node judges ****** enough to taking over of said processing program, When said memory availabilities run short, it has a memory quota alteration means which reduces the memory space assigned to the point boot program started by preceding by said alternative node.

[0012]Have a computer system concerning this invention of further others, and a session information table included session information between user nodes which use said point boot program and the point boot program concerned of said alternative node via said network said fail over means, When making a quota change of said memory space, based on said session information, distinguish whether a transaction during an established session is [******] under continuation, and only a message to a transaction under continuation is passed to said point boot program, Other messages to the session concerned have a message handling means to suspend for said session information until said quota change is completed, and when said transaction is completed, said memory quota alteration means, Execution of said point boot program is suspended and a memory quota change is made.

[0013]

[Mode for carrying out the invention][Embodiment 1] An embodiment of the invention is hereafter described with reference to Drawings.

[0014]Two or more nodes (the node 1, the node 2, --, the node n) are mutually connected via a network, and a computer system concerning this invention is constituted. Drawing 1 is a mimetic diagram for explaining composition of this system. In each node, the module called a surveillance agent operates, respectively. This surveillance agent comprises software performed with a central processing unit (Central Processing Unit:CPU) of each node, for example, and is always made into a run state by each node. And system operating status of DB application of a node (other nodes are called) to which network connection of [other than a node (a self-node is called) in which the surveillance agent operates autonomously and it operates and a self-node] was carried out, It has a function which supervises CPU resources, a memory resource, etc. periodically or at any time while sampling. This surveillance agent 10 checks information on each node using the existing function which distinguishes whether an operating system (OS) and DB of a node have started, A monitored result of 10-n is written in each surveillance agent 10-1,10-2, --, the shared disk 20 connected with each node via a network. Specifically, a monitored result is recorded on the monitoring information repository 25 provided on this shared disk 20.

[0015]Drawing 2 is a mimetic diagram showing logical organization of an example of information stored in the monitoring information repository 25. In this figure, it is an item of a lowest level of a tree structure that a value is actually acquired as data, and the other item is a mere name which summarizes that lower level. As shown in this figure, information for every node is stored in the monitoring information repository 25 as "node information." Each "node information" contains data, such as a node name, the last sampling time, surveillance agent information, locked agent information, a sampling period, a sampling-data retention period, a node state, and standard opening memory quantity.

[0016]Each "node information" contains further data summarized by the name "DB information" and "resources information." DB information comprises a "DB" entry of only a number according to a kind of DB system used in each node, and each "DB" entry is constituted including data, such as DB name, an execution priority, sampling time, DB state, and starting information.

[0017]"Resources information" comprises a "resource data" entry and an each "resource data" entry is constituted including data, such as sampling time, a CPU operating ratio, and empty memory quantity. A "resource data" entry is included by the sampling frequency which should save the result which becomes settled according to a sampling retention period in "resources information." That is, the data set which constitutes the "resource data" at the time of the sampling whenever a sampling is performed in "resources information" is added, and the "resource data" entry which passed over the sampling retention period set beforehand on the other hand is deleted.

[0018]Hereafter, each data in the monitoring information repository 25 is explained. A "node name" is a name for identifying a node, and the "last sampling time" is the date by which the information about the node concerned was sampled at the end, and the information showing time. "Surveillance agent information" is setup information for the identifier (name) of the surveillance agent who operates by a node, and message switching with another surveillance agent to be made to be made. "Locked agent information" expresses the identifier of the surveillance agent who is checking the node concerned, and a value "NULL" is set up when not all the surveillance agent is also check Naka about the node concerned.

[0019]A "sampling period" is an interval which confirms whether DB application which a surveillance agent extracted all the DB information and resources information in a self-node, and was registered into the monitoring information repository 25 is downed. A retention period of a history of the past of resources information is specified as a "sampling-data retention period."

[0020]A "node state" is data showing a state of the present node, and can define four kinds "a down" ""during a stop and operation"", and "in fail over work" as the state, for example.

[0021]Here, it is in a state which shows that a node is not working "during a stop." Timing on which "under a stop" is recorded is immediately after being carried out as part of stop processing, or completing fail over work of all the DB applications under a "down" state of a node, when OS is stopped normally (it does not ask a success of the work concerned, or un-succeeding).

[0022]"During operation", it is in a state which shows that a node is working. Timing on which "in operation" is recorded is the stage which a state ended "during fail over work" as its own starting initial processing by a surveillance agent of a self-node.

[0023]"A down" expresses the state where a node has stopped at present, although a node was in a state "under operation" in the past. Timing on which "a down" is recorded is a case where a stop of the node concerned is detected by surveillance agent of other nodes, in spite of recording "in operation" on a monitoring information repository as a state of the node concerned.

[0024]"During fail over work", it is in the state where fail over is actually performed in the node concerned. The timing on which "under fail over work" is recorded is a time of the surveillance agent of the node concerned receiving directions of DB fail over from the surveillance agent of other nodes, and when fail over work is completed, a state returns "during operation."

[0025]Next, the empty memory quantity immediately after starting is recorded on "standard opening memory quantity."

[0026]"DB name" contained in "DB information" entry is an identifier which specifies DB system compatible with the entry concerned as a meaning. "Sampling time" expresses the date and time when the information on the concerned "DB information" entry was sampled. "Starting information" is information required in order to start DB applications, such as a script file name the order of the real way for starting the DB application corresponding to the DB system concerned was described to be, and the amount of standard memories at the time of employment.

[0027]"DB state" is data showing the state of DB system compatible with the entry concerned, and can define three kinds, "a down" ""during a stop and operation"", as the state, for example.

[0028]Here, the state where DB application has stopped is shown "during a stop." The timing on which "under a stop" is recorded is a time of being carried out as part of stop processing, or a stop of DB application being detected by the surveillance agent of a self-node as its own starting initial processing, when DB application is stopped normally.

[0029]"During operation", DB application is in the state which shows operating normally. The timing on which "in operation" is recorded is a time of the surveillance agent of the node in which the DB application concerned operates detecting that the DB application concerned is operating in the state of an except "during operation" in the state of the DB application concerned.

[0030]"A down" expresses the state where it has stopped at present, although DB application was in the state "under operation" in the past. In spite of, as for the timing on which "a down" is recorded, having recorded "in operation" on the monitoring information repository as a state of the DB application concerned, when a stop of DB application is detected by the surveillance agent of a self-node, Or it is a case where the state of the node concerned is recorded by the surveillance agent of other nodes as "a down."

[0031]An "execution priority" is a priority of DB system and can be expressed by a numerical value. For example, it can be defined as a priority being high, so that a numerical value is large.

[0032]The "sampling time" contained in "resources information" entry expresses the date and time when the information on the concerned "resources information" entry was sampled.

[0033]A "CPU operating ratio" expresses the operating ratio of CPU in the time of a sampling being performed.

[0034]"Empty memory quantity" expresses the empty memory quantity in the sampled time.

[0035]Drawing 3 - 7 are the flow charts explaining a surveillance agent's operation, and especially drawing 3 is a flow chart explaining the initial processing about a surveillance agent's DB application condition monitoring. First, before the surveillance agent 10 is started, the node state in the monitoring information repository 25 is set up "during a stop." If each node is started and the surveillance agent 10 is started, the surveillance agent 10 will set up the state of a self-node "during operation" (S50). Next, based on DB information entered by the node information about the self-node of the monitoring information repository 25, the loop which comprises Step S60 explained below for each [which is entered] DB system of every - 75 is repeated. In the

processing included in this loop, the state of DB is first taken out from the monitoring information repository 25 (S60). And it is judged whether the value of a taken-out DB state "is working" (S65), and DB state is updated with the value according to the decided result (S70, S75). In this initial processing, since a "down" state is not produced, when it is judged with it not being "under operation" at Step S65, an initial value "under a stop" is maintained in Step S75. In Step S80, if Steps S60-S75 are carried out about all the DB systems and there is a mere DB system which is not judged and carried out, processing will be returned to Step S60 and processing same about the DB system will be performed. On the other hand, when it is judged that processing was performed about all the DB systems in Step S80, the initial processing shown in drawing 3 is ended, and the monitoring process performed the whole node is started.

[0036]Drawing 4 is a flow chart explaining the outline of the monitoring process in each node, and drawing 5 is a flow chart showing more processing within DB situation check processing S125 to the self-node provided in the monitoring process concerned in details. In the terminal A indicated to be drawing 3 and drawing 4 to a figure, it is connected mutually. If processing is passed to the monitoring process shown in drawing 4 from the initial processing shown in drawing 3, while a node will work henceforth, S100 which constitutes a monitoring process - 145 are started and repeated with a constant interval.

[0037]The timer processing S100 is formed in order to start a monitoring process with a constant interval, and DB reboot processing S105 which continues based on the processing concerned having detected progress of predetermined time is performed if needed. This DB reboot processing S105 is performed when notice that a self-node was chosen as a reboot place (fail over point) of downed DB application is received, and it reboots that downed DB application in a self-node.

[0038]Next, time is acquired (S110) and it is searched for whether there are some which exceeded a sampling retention period among resources information within self-node information stored in the monitoring information repository 25 based on the time, A thing beyond the retention period concerned is deleted from the monitoring information repository 25 (S115).

[0039]Thus, after arranging unnecessary data in the monitoring information repository 25 first, a surveillance agent starts a check of a self-node. On the occasion of the check start, a surveillance agent registers an own surveillance agent identifier into locked agent information of self-node information (S120). Thereby also during check processing execution to a self-node, exclusive control of the check from a surveillance agent of a node is carried out.

[0040]The check processing to a self-node includes the check of the situation of DB application, and the check of the resource load situation of a self-node. Among these, the check processing S125 to the DB application of a self-node is explained in more detail using drawing 5. This check is repeated about all the DB systems entered by the self-node information of the monitoring information repository 25 (S200). When DB state is first taken out from the monitoring information repository 25, it is judged whether the value of the DB state concerned "is working" (S205) and a state "is not working", [be / it] It ends and shifts from the check about the DB

application concerned to the check to the DB application which is not checked [which remains] (S230). On the other hand, in Step S205, it is investigated to DB system DB condition data stored on the monitoring information repository 25 "is working" whether the actual state of the DB system is "normal operation" or it is "a stop" (S210). Conventional technology can be used for distinction of this actual state.

[0041]When the actual state where it was acquired at Step S210 in spite of having been "under operation" on the monitoring information repository 25 (S205) is "a stop" (S215), Predetermined processing (S225) corresponding to [get it blocked, and "it is downed" is judged (S220), and] a DB application down from which DB application produced an execution obstacle is performed.

[0042]In processing at the time of this DB application down. A suitable node (alternative node) to carry out alternative execution of the DB application which produced an execution obstacle is chosen, Processing for rebooting the downed DB application concerned in the alternative node, and making processing succeed is performed to a surveillance agent who is operating by the alternative node. That is, a surveillance agent has a function as a monitor means which supervises an executed situation of DB application in a self-node, an alternative node selecting means which chooses an alternative node, and a fail over means to make downed execution of DB application take over to an alternative node. Directions of processing taking over emitted to an alternative node selected here are detected and performed at Step S105 in the alternative node concerned.

[0043]Now, when it was not "a stop", i.e., it becomes clear in the conditional-judgment step S215 that it is actually "under operation" on the other hand, Since it is in agreement with information on the monitoring information repository 25 and is normal, it ends and shifts from a check about the DB application concerned to a check to DB application which is not checked [which remains] (S230). In Step S230, when it is judged that a check about all the DB applications was completed, the check processing S125 to a self-node is ended.

[0044]After the check processing S125 is completed, a surveillance agent checks resources information about a self-node next (S130). in this processing, resources information data is acquired from OS and it stores in the monitoring information repository 25 -- having (S130) -- the last sampling time about a self-node in the monitoring information repository 25 is updated in that sampling time (S135).

[0045]After check processing to Step S125 - a self-node of 135 is completed, a surveillance agent registers "NULL" into locked agent information of self-node information, and cancels exclusive control (S140).

[0046]Although the above processing is processing which a surveillance agent performs to a self-node, a surveillance agent performs not only a self-node but surveillance to other nodes and fail over processing at the time of an obstacle (S145). This is called all the node processings. Drawing 6 and 7 are the flow charts explaining all the node processings. These node processings of all the are divided and expressed to drawing 6 and two of 7 for convenience, and both figures are connected in a terminal (specifically terminal B and terminal C) of identical codes of both figures. This processing chooses a node of others [agent / of a certain node / surveillance] one by one,

Surveillance of system operating status and fail over processing at the time of a fault occurrence are performed about a selected node, and processing inserted at Step S300 and Step S445 is constituted as loop processing repeated to each node.

[0047]Step S305 - 330 The surveillance agent of a certain node. It is the treatment corresponding to the case where it is downed while the surveillance agent of other nodes had changed into the locked position the node (a node to be examined is called hereafter) which (an inspection execution agent is called hereafter) chose as a checked object. Since the locked agent information of a node to be examined is distinguished (S305), and it is satisfactory when it is "NULL", An inspection execution agent registers the identifier of an own node into the locked agent information of a node to be examined, changes a node to be examined into a locked position (S335), and starts the check to a node to be examined.

[0048]On the other hand, in Step S305, when the identifier of other nodes is registered into the locked agent information of the node to be examined, it is investigated with the surveillance agent of the other nodes concerned whether communication is possible (S310). Supposing it can communicate, the surveillance agent of the other nodes concerned will understand that the node to be examined is a check, and the check to the other nodes concerned will not be performed. On the contrary, in Step S310, when it becomes clear for it to be unable to communicate, the surveillance agent of the other nodes concerned is understood to have been downed with the node to be examined locked.Then, an inspection execution agent finds out the node locked by the surveillance agent of the other nodes concerned based on the node information of the monitoring information repository 25 by making into a retrieval object not only the node to be examined that is trying to conduct the present inspection but all the nodes, and cancels the lock. Loop processing for all the nodes is specifically performed (S315, S330), It is judged whether the locked agent information of the node is an identifier of the other nodes concerned (S320), When a decided result is "Yes", the locked agent information is reset to "NULL" (S325), and when it is "No", processing in which it does not reset is performed. After an appropriate time, an inspection execution agent registers the identifier of an own node into the locked agent information of the node to be examined which is trying to conduct an inspection now, changes a node to be examined into a locked position (S335), and starts the check to a node to be examined.

[0049]An inspection execution agent checks a node state of a node to be examined in the monitoring information repository 25 first (S400). When ""under operation or fail over work"" is set as this node state, it is investigated further whether the node to be examined is actually operating (S405). Incidentally, this judgment can be performed using conventional technology. When it becomes clear that a node to be examined has stopped in practice against information set as a node state of the monitoring information repository 25 as a result of this judgment, An inspection execution agent judges with a node to be examined being downed, and changes the node state concerned of the monitoring information repository 25 into "a down" (S410). And an inspection execution agent performs loop processing for all the DB information registered into the monitoring information repository 25 about a node to be examined judged that it is downed

(S415, S430). In this loop processing, it is investigated whether "in operation" is set as DB state in the DB information concerned (S420), and when a judgment is "Yes", DB state is changed into "a down" (S425).

[0050]After an appropriate time, an inspection execution agent performs predetermined processing (S435) corresponding to a node down to DB application currently performed on a node to be examined judged that it was downed. A suitable node (alternative node) to carry out alternative execution of the DB application currently performed on the down node concerned in processing at the time of this node down is chosen, Processing for rebooting the DB application concerned in the alternative node, and making processing succeed is performed to a surveillance agent who is operating by the alternative node. Namely, a monitor means in which an inspection execution agent supervises system operating status of a node to be examined which are other nodes, It has a function as an alternative node selecting means which chooses an alternative node, and a fail over means to make execution of DB application it became impossible to perform by node down take over to an alternative node. Directions of processing taking over emitted to an alternative node selected here are detected and performed at Step S105 in the alternative node concerned. After the processing S435 at the time of a node down is completed, an inspection execution agent changes locked agent information of a node to be examined into "NULL", cancels a lock (S440), and shifts to processing to a new node to be examined (S445). If processing is completed to all the nodes, all the node processings S145 will be ended, and it returns to a loop shown in drawing 4 (S450).

[0051]In Step S400, when a node state "is stopping", it is satisfactory, that is, since an execution obstacle of DB application is not produced, a lock is canceled promptly (S440). When a node state is already set as "a down", it means that a surveillance agent of other nodes already performed an inspection to the node concerned to be examined, detected "a down", and carried out processing S435 at the time of a node down. Therefore, an inspection execution agent who is conducting the present inspection also in this case cancels a lock promptly, without performing measures against a down of a node anew (S440).

[0052]As mentioned above, when execution of DB application in a certain node becomes difficult according to this system, a thing suitable as a node which succeeds the execution is dynamically chosen from two or more nodes by which network connection was carried out.

[0053][Embodiment 2] A 2nd embodiment of this invention is described below based on the above-mentioned Embodiment 1. The feature of this embodiment is in processing equivalent to the processing S225 at the time of a DB application down in Embodiment 1, and the processing S435 at the time of a node down, Hereafter, weight is placed in a point of difference with this Embodiment 1, it explains, and explanation is fundamentally abbreviated to Embodiment 1 about the same processing. The same mark is given to the same component as Embodiment 1, and **** of a description is planned.

[0054]In this embodiment, the big feature is at the point that selection of the alternative node in the processing at the time of these DB application down and the processing at the time of a node

down is performed based on the CPU load of the node chosen as an alternative node.

[0055]The surveillance agent 10 on each node of this system is operating for every sampling period asynchronously mutually. For the surveillance agent 10, a certain DB application in a self-node is downed, Or detection of that other existing whole node is downed will perform processing at the time of the DB application down equivalent to Step S225 of Embodiment 1, or S435, and processing at the time of a node down.

[0056]Drawing 8 is a flow chart showing the processing at the time of the DB application down in this embodiment. Although the node itself is working in this processing, DB application is processing carried out when being downed is detected, and is performed following Step S120 of drawing 4.

[0057]The surveillance agent 10 will perform loop processing of the following contents aimed at all the nodes registered into the monitoring information repository 25, if the thing of a down state is detected to the DB application of a self-node (S500, S525). 1 time of the loop of this loop processing is processing corresponding to one node, and it is first judged based on the node information of the monitoring information repository 25 whether the state of that node is ""either"" operation or fail over work (S505). When a decided result is "Yes", an average CPU operating ratio is computed based on the resources information in the monitoring information repository 25 about the node concerned (S510). Incidentally, this average operating ratio is calculated using all the resources information in two or more sampling timing of the node concerned saved at the monitoring information repository 25, for example.

[0058]Next, it is judged whether the node concerned "is fail over working" by the surveillance agent of other nodes other than the present inspection execution agent (S515), and a conversion CPU operating ratio is calculated based on the result. A conversion CPU operating ratio is searched for by multiplying the average CPU operating ratio calculated at Step S510 by the conversion rate alpha. When judged with under fail over work at Step S510, alpha is made into one or more constants (for example, 10), this can take advantaging, and a conversion CPU operating ratio is searched for (S520). On the other hand, when judged with it not fail over being [be / it] under work at Step S515, the average CPU operating ratio which alpha is set to 1, namely, was searched for at Step S510 is made into a conversion CPU operating ratio as it is. If this conversion CPU operating ratio is determined, the surveillance agent 10 will end the loop processing about the node concerned, and will shift to the loop processing of the following node.

[0059]Since processing of DB application cannot be taken over to the node concerned when the decided result in Step S505 is "a down" "during a stop", it removes from the candidate of an alternative node and moves to the loop over the following node. For example, having removed from the candidate of the alternative node can form the flag for expressing it, etc., and, thereby, it can be identified. Since a conversion CPU operating ratio chooses an alternative node on the basis of a small thing so that it may mention later, it can also constitute from this system by setting a very big value as the conversion CPU operating ratio of a node so that it may identify that the node concerned is outside an alternative node candidate.

[0060]If the surveillance agent 10 defines the propriety and the conversion CPU operating ratio as an alternative node candidate of each node of the system by which network connection was carried out by the above-mentioned loop processing, A node with the smallest conversion CPU operating ratio is chosen as an alternative node among alternative node candidates, It points to the reboot of the DB application downed by transmitting as a message the node name (namely, self-node name) and DB name of a down state by which the down of DB application was checked to the alternative node concerned (S530), and returns to Step S130 of drawing 4.

[0061]Multiplying by one or more alpha incidentally, when a node state is fail over working, It is for aiming at processing distribution, as it controls that a request of new fail over work is already performed to the node under fail over work and a request is performed to the node which is not doing fail over work if possible.

[0062]Drawing 9 is a flow chart showing the processing at the time of the node down in this embodiment. It is the processing carried out when the surveillance agent 10 of a certain node detects that the whole other nodes are downed, and this processing is performed following Step S430 of drawing 7.

[0063]The surveillance agent 10 performs loop processing of the following contents aimed at all the nodes registered into the monitoring information repository 25 (S600, S650). It is judged based on the node information of the monitoring information repository 25 whether 1 time of the loop of this loop processing is processing corresponding to one node, and the state of that node is "a down" (S605). Since execution error processing, such as a reboot, is unnecessary when a decided result is "No", it shifts to the loop processing about the following node. On the other hand, when a decided result is "Yes", Steps S610-S635 are processed. Processing of these steps S610-S635 is processing for defining the propriety and the conversion CPU operating ratio as an alternative node candidate, and since it is the same as that of processing of Steps S500-S525 explained above, it omits explanation.

[0064]If the conversion CPU operating ratio of each node is determined, the surveillance agent 10 will choose a node with the smallest conversion CPU operating ratio as an alternative node among alternative node candidates, The node name (in this case, unlike the processing at the time of a DB application down, it becomes the other node names) and DB name of a down state by which the down of DB application was checked are transmitted as a message to the alternative node concerned (S640). The state in the monitoring information repository 25 of the node judged to be a down is changed "during a stop" (S645), and it shifts to the loop processing about the following node. Thus, the loops S600-S650 of the processing at the time of a node down are carried out for all the nodes.

[0065]Drawing 10 is a flow chart explaining the DB application reboot processing by the node which received Step S530 and the message transmitted by S640. This reboot processing is equivalent to Step S105 of drawing 4.

[0066]The surveillance agent 10 operates with a constant interval, and each node investigates whether the message from one of the surveillance agents 10 exists (S700). If a message does not

exist, it shifts to the inspection processing after Step S110 shown in drawing 4, but when a message exists, after performing DB application reboot processing described below, it shifts to inspection processing.

[0067]In reboot processing, the node name and DB name as which the execution obstacle of DB application was detected are acquired from a message (S705). And "under fail over work" is set as the information on a node at the time of the monitoring information repository 25 (S710), DB starting information corresponding to DB name acquired from the monitoring information repository 25 at Step S705 is discovered, and DB application is started based on the information (S715). While moving DB information entries about the node name and DB name which were acquired at Step S705 to DB information on a self-node (S720), the state of the DB information concerned is changed "during operation" (S725). And as it already stated after performing this reboot processing, it shifts to inspection processing.

[0068]Drawing 11 is a mimetic diagram explaining an example of operation of the surveillance agent 10 at the time of execution failure detection of DB application mentioned above. As for that the node 1 is downed and its result, it is detected by inspection processing according [that DB application "DB#1" currently performed by the node 1 is in a down state] to the surveillance agent 10 (inspection execution agent) of the node 2 in an example shown in this figure. With reference to a CPU operating ratio in node information of each node of the monitoring information repository 25, an inspection execution agent computes a conversion CPU operating ratio, and chooses as an alternative node the node 3 which has the minimum. And it directs to succeed processing of DB#1 currently performed by the node 1 to the surveillance agent 10 of the node 3. The surveillance agent 10 of the node 3 who received these directions performs that reboot based on starting information about DB#1 in the monitoring information repository 25, etc.

[0069]According to this system, based on system operating status of CPU, for example, the past, processing taking over of downed DB application is performed to a node whose CPU load is not comparatively severe.

[0070]Although a conversion CPU operating ratio in consideration of load of a node which is already fail over working chose a node used as the minimum as an alternative node in an above-mentioned example, it is good also as an average CPU operating ratio choosing a node which takes the minimum, without performing such consideration. These CPU operating ratio can not necessarily choose based on a CPU load having a predetermined margin smallest, and a CPU operating ratio can choose arbitrary things in this case among nodes as for which below a predetermined threshold value becomes, for example.

[0071]In an above-mentioned example, although a conversion CPU operating ratio or an average CPU operating ratio was searched for based on an average in the whole sampling-data retention period, based on an average of resources information acquired by the some times newest sampling, an alternative node can also be chosen, for example.

[0072]Statistical information other than an average about a CPU operating ratio registered into resources information can be searched for, and an alternative node can also be determined in

consideration of it. For example, in consideration of a time change of a CPU operating ratio presumed from distribution of a CPU operating ratio, etc., it is stabilized average value is not only small, but, and what has a small CPU operating ratio may be chosen as an alternative node.

[0073][Embodiment 3] A 3rd embodiment of this invention is described with reference to figures. Embodiment 2 used the CPU operating ratio registered into the monitoring information repository 25, and chose the alternative node based on processor load. On the other hand, this embodiment uses the empty memory quantity registered into the monitoring information repository 25, and it differs from Embodiment 2 in that an alternative node is chosen based on it. About the same contents as each above-mentioned embodiment, explanation is omitted hereafter, and weight is placed in a point of difference with them, and it explains. The same mark is given to the same component as each above-mentioned embodiment, and **** of a description is planned.

[0074]Drawing 12 is a flow chart explaining characteristic processing of this embodiment. This processing replaces the processing steps S500-S530 of drawing 8, and the loop processing steps S610-S640 of drawing 9.

[0075]Namely, the thing for which the surveillance agent 10 on each node of this system operated for every sampling period asynchronously mutually, and a certain DB application in a self-node is downed, Or if it detects that other existing whole node is downed, will perform processing at the time of the DB application down equivalent to Step S225 of Embodiment 1, or S435, and processing at the time of a node down, but. These processings in this embodiment are expressed with drawing 8 which had the part replaced by the flow of drawing 12, and the flow of 9.

[0076]The surveillance agent 10 of each node acquires the standard opening memory quantity of each node from the monitoring information repository 25. Standard opening memory quantity is the amount of empty real storages immediately after starting of each node, and expresses the empty memory quantity in the state where only software indispensable to node operation of OS etc. exists on a memory fundamentally, and other applications do not exist on a memory yet. Each surveillance agent 10 measures the standard opening memory quantity of these each node, and asks for the maximum M_{max}. This processing is constituted so that it may carry out for example, during processing of Step S50 shown in drawing 3.

[0077]Next, the process flow of drawing 12 is explained. When the surveillance agent 10 detects the thing of a down state to the DB application of a self-node, And when it is detected that other whole node is downed, loop processing of the following contents aimed at all the nodes registered into the monitoring information repository 25 is performed (S800, S820). 1 time of the loop of this loop processing is processing corresponding to one node, The surveillance agent 10 averages the empty memory quantity contained in the resources information about the node about all the sampling frequencies saved at the monitoring information repository 25, and asks for the degree m of memory margin defined as a value which **(ed) the average value by M_{max} (S805).

[0078]Then, the surveillance agent 10 judges whether the node concerned "is fail over working" by the surveillance agent of other nodes other than the present inspection execution agent (S810),

and the degree of conversion memory margin is calculated based on the result. Conversion memory margin degree m* is called for by multiplying the degree m of memory margin calculated at Step S805 by the conversion rate beta. When judged with under fail over work at Step S810, beta is made into or more 0 less than one constant (for example, 0.1), it multiplies by this, and conversion memory margin degree m* is called for (S815). On the other hand, when judged with it not fail over being [be / it] under work at Step S810, the degree m of memory margin which beta is set to 1, namely, was called for at Step S810 is made into conversion memory margin degree m* as it is. If this conversion memory margin degree m* is determined, the surveillance agent 10 will end the loop processing about the node concerned, and will shift to the loop processing of the following node.

[0079]If the surveillance agent 10 defines propriety as an alternative node candidate of each node of a system by which network connection was carried out, and the degree of conversion memory margin by the above-mentioned loop processing, A node with the largest degree of conversion memory margin is chosen as an alternative node among alternative node candidates, A reboot of DB application downed by transmitting as a message a node name (namely, self-node name) and DB name of a down state by which a down of DB application was checked to the alternative node concerned is directed (S825).

[0080]Multiplying by less than [0 or more] one beta incidentally, when a node state is fail over working, It is for aiming at processing distribution, as it controls that a request of new fail over work is already performed to a node under fail over work and a request is performed to a node which is not doing fail over work if possible.

[0081]According to this system, based on empty situations of a memory, for example, the past, processing taking over of downed DB application is performed to a node in which a margin of a memory is comparatively large. When a margin of a memory is large, high processing efficiency is obtained by a hit ratio of cash improving or preventing thrashing by controlling swapping.

[0082]Although the degree of conversion memory margin in consideration of the load of the node which is already fail over working chose the node used as the maximum as the alternative node in the above-mentioned example, it is good also as the simple degree of memory margin choosing the node which takes the maximum, without performing such consideration. Arbitrary things can be chosen among the nodes which the degree of these memory margin does not necessarily need to be the largest, for example, make a note, and become beyond a threshold value predetermined in the degree of margin.

[0083]In an above-mentioned example, although it asked for the degree of conversion memory margin, or the simple degree of memory margin based on the average in the whole sampling-data retention period, based on the average of the resources information acquired by the some times newest sampling, an alternative node can also be chosen, for example.

[0084]Statistical information other than the average about the empty memory quantity (or the degree of memory margin) registered into resources information can be searched for, and an alternative node can also be determined in consideration of it. For example, in consideration of a

time change of the empty memory quantity presumed from distribution of the degree of memory margin, etc., it is stabilized average value is not only large, but, and what has the large degree of memory margin may be chosen as an alternative node.

[0085][Embodiment 4] The point which is vacant as for a 4th embodiment of this invention with the CPU operating ratio registered into the monitoring information repository 25, and chooses an alternative node using both sides with memory quantity differs from Embodiment 2 only using a CPU operating ratio, or Embodiment 3 only using empty memory quantity. About the same contents as each above-mentioned embodiment, explanation is omitted hereafter, and weight is placed in a point of difference with them, and it explains. The same mark is given to the same component as each above-mentioned embodiment, and **** of a description is planned.

[0086]According to this embodiment, it is vacant with a CPU operating ratio, the parameter which "rate [of empty resources]" Uses both sides with memory quantity is computed for every node, and an alternative node is chosen based on the value. That is, although the "resources" in a computer is generally grasped with a CPU load and the independent index about each of memory use, in this embodiment, those indices are unified against one index of "the rate of empty resources" showing the rate of resources available to other processings among the resources of a certain node.

[0087]For example, the rate of empty resources is defined as follows. When a CPU operating ratio is expressed with W (0<=W<=1), rate omega of a CPU opening is expressed with (1-W). About a memory, empty memory quantity is expressed with E, and it asks for M_{max} like Embodiment 3, and these ratios (E/M_{max}) are defined as the rate epsilon of a memory opening. And it is vacant and the arithmetical average {(omega+epsilon) /2} of rate omega of these CPU opening and the rate epsilon of a memory opening is defined as the rate of resources.

[0088]The surveillance agent 10 (inspection execution agent) chooses as an alternative node the node from which the rate of empty resources defined in this way serves as the maximum.

[0089]The definition of the rate of empty resources which the meaning of this invention has in the point of it being vacant with a CPU operating ratio, and determining an alternative node in consideration of both sides with memory quantity, and was shown above is only an example. For example, it is things, such as $(omega^2+epsilon^2) / [(k_1 and omega+k_2-epsilon)/(k_1+k_2)$ and] 2, and $^{(omega-epsilon)\ 1/2}$, and it is also possible for it to be vacant and to define the rate of resources.

[0090]Thus, by being vacant with a CPU operating ratio and taking into consideration both sides with memory quantity, the reliability of evaluation of the degree of margin of the resources of a node becomes high, and an alternative node can be determined more appropriately.

[0091][Embodiment 5] The degree of the empty resources of the fail over point is calculated, and processing of the DB application downed to the generous node is made to take over in each above-mentioned embodiment. Since what an alternative node is determined dynamically and has the degree of margin in these systems is chosen, the possibility in which fail over is impossible is low at the alternative node determined by making it such. However, although resources still chose the most vacant node in addition, for carrying out fail over, the possibility that resources

(especially memory resource) are insufficient remains.

[0092]A 5th embodiment of this invention copes with this, it responds to change the memory which the DB application under present operation has gained by the node of the fail over point, accepts necessity in empty memory quantity dynamically, makes it increase, and performs fail over convenient.

[0093]About the same contents as each above-mentioned embodiment, explanation is omitted hereafter, and weight is placed in the point of difference between them and this embodiment, and it explains. The same mark is given to the same component as each above-mentioned embodiment, and **** of a description is planned.

[0094]Drawing 13 is a flow chart explaining characteristic processing of this embodiment. This processing is fundamentally added in DB reboot processing S105 of drawing 4.

[0095]Namely, when timer processing makes the surveillance agent's 10 processing start, DB reboot processing S105 is started and first in it the surveillance agent 10, If it checks having received a message which directs DB reboot, while acquiring starting information corresponding to DB name directed to it from the monitoring information repository 25, empty memory quantity of the present self-node is grasped. And the amount of standard memories (necessary opening memory quantity) used for employment of the DB system concerned which is data in starting information, and the present empty memory quantity are measured (S900). Since there is no trouble in (S900) and DB reboot when empty memory quantity is larger than the amount of standard memories, starting of DB by the same fail over processing as each above-mentioned embodiment is started (S925).

[0096]On the other hand, if DB reboot is performed as it is when empty memory quantity is smaller than the amount of standard memories, even if DB application cannot be started or it can start, trouble may be produced in employment. Therefore, in this case the surveillance agent 10, Loop processing of the following contents aimed at DB application whose priority is lower than DB application by which fail over is carried out among all the DB entries which are registered into self-node information of the monitoring information repository 25, and which are started previously is performed (S905, S920). 1 time of a loop of this loop processing is processing corresponding to one DB entry, and the surveillance agent 10 determines the new memory allotment reduced rather than the present to that DB entry (S910). And once ending the DB application concerned started previously, it reboots based on an allotment determined at Step S910 (S915). After reorganization of a memory is performed by this and processing finishes about all the target DB(s) [loop processing] entry, an opening of a complement is generated by employment of DB application for fail over on a memory. After the surveillance agent 10 is vacant at Step S900, does in this way, is vacant, when judged with memory quantity being smaller than the amount of standard memories, and he expands memory quantity, he starts DB application for fail over similarly with having carried out by each above-mentioned embodiment (S925). Incidentally, starting of DB application in this step S925 is performed with reference to a script file for starting in starting information registered into the monitoring information repository 25, etc.

[0097]The example of the concrete deciding method of the new memory allotment to the DB application of point starting is explained below. For example, the execution priority of the target DB entry can be taken into consideration in the determination of a new memory allotment. The execution priority of each DB entry is registered, and as explanation of the monitoring information repository 25 described, an execution priority is expressed with a big numerical value to the monitoring information repository 25 here, so that it is high. Here, if the numerical value showing the priority of DB entry "DB#i" is made into P_i, reduction amount R_a of a quota memory to DB entry "DB#a" will be calculated with a following formula. In this formula, L is memory quantity which starting for [DB] fail over runs short of, and is the value which deducted the present empty memory quantity from that amount of standard memories. Total "sigma" is calculated at Step S905 about all the target DB entries (namely, thing which has a priority lower than DB entry for fail over).

[0098]$R_a=L-P_a/sigmaP_i$ and the new memory allotment to DB entry "DB#a" are determined as the value which deducted R_a from the amount of standard memories at the time of the employment stored in the monitoring information repository 25 to the entry concerned.

[0099]Thus, even when it is vacant in execution of DB application for fail over and memory quantity is insufficient, fail over processing is performed much more certainly by reducing and reorganizing memory quantity assigned to other DB applications started by preceding.

[0100][Embodiment 6] In the above-mentioned Embodiment 5, empty memory quantity required for execution of DB application for fail over was secured by changing operating memory quantity of DB application started by preceding. DB application started by preceding is once ended when changing this memory assignment. This embodiment is concerned with an end of this precedence starting DB application, and an improvement of a man machine interface in the case of a reboot. Namely, in Embodiment 5 which this embodiment reduces memory usage of DB system under operation, and secures empty memory quantity required for DB system startup for fail over, It constituted so that it might not be made conscious of collateralizing the continuity of processing of DB system under operation, and DB system being suspended by end user at the time of the memory reduction concerned.

[0101]About the same contents as each above-mentioned embodiment, explanation is omitted hereafter, and weight is placed in a point of difference between them and this embodiment, and it explains. The same mark is given to the same component as each above-mentioned embodiment, and **** of a description is planned.

[0102]In a system configuration which advances processing while an end user and DB system exchange messages via a network, processing of the end user side node and each DB system action node is constituted by layered structure containing two or more functional layers.

[0103]Drawing 14 is a mimetic diagram showing an example of functional layer composition of the end user side node and DB system action node. Three layers, the end user application 1002, the terminal side message switching module 1004 for DB systems, and the network control layer 1006, are shown in the end user side node 1000 from a layer of a higher rank, On the other hand,

three layers, DB application 1012, the server side message switching module 1014 for DB systems, and the network control layer 1016, are shown in DB system action node 1010 from a layer of a higher rank. And between network control layers which are the layers of the lowest [nodes / both] is connected through the physical connection 1020. This layer composition is an example, for example, it is also possible to divide each layer still more finely. For example, the network control layer 1006-1016 will correspond to a network layer, a data link layer, and the physical layer in a TCP/IP protocol.

[0104]The message published from the end user application 1002 is passed to the network control layer 1006 via the terminal side message switching module 1004. Between the network control layer 1006 and the network control layer 1016, transfer of a signal is performed via the physical connections 1020, such as a cable. If the server side message switching module 1014 of DB system action node 1010 supervises so that the message from the network control layer 1016 can always be accepted, and arrival of a message is checked, it will pass the message to DB application 1012. On the contrary, the result output from DB application 1012, The server side message switching module 1014, the network control layer 1016, the connection 1020, the network control layer 1006, and the terminal side message switching module 1004 are followed in order, and the end user application 1002 is passed.

[0105]Now, in a system configuration as shown in drawing 14, change processing of the memory quantity to the execution process (it is hereafter called DB process) of 1 which precedes at the time of fail over and is working, or two or more DB applications 1012 is performed, and it gets. this memory change processing -- DB -- it being made to end normally and DB process at this time, It realizes by making it rerun with new memory quantity, and the server side message switching module 1014 mainly bears the function of maintenance of the session between the end user application 1002 in that case, and each DB application (DB process) 1012. Namely, the server side message switching module 1014, It sees from an end user, the session (it is a state which can exchange messages to mutual with the level of end user application and DB application) is not cut, i.e., it has a function shown as the session is connected in false.

[0106]Drawing 15 is a flow chart explaining the memory reorganization processing included characteristic processing of this embodiment. This processing constitutes the processing step fundamentally performed in the position of the memory reorganization processing S915 of drawing 13.

[0107]The surveillance agent 10 will emit DB reboot preparation demand signal to the server side message switching module, if the new memory allotment determined to DB process started by preceding in the self-node is obtained (S1100) (S1105).

[0108]The server side message switching module which received this requirement signal performs session processing (it mentions later for details) for session maintenance, and transmits a prepared signal to the surveillance agent 10 (S1110). The surveillance agent 10 performs check point processing, after receiving this prepared signal (S1115). Check point processing is processing which writes the data fragment on a memory in a disk, when the contents of the data fragment

of the database in the memory space of DB process and the data fragment actually recorded on the disk differ. After performing check point processing S1115, the surveillance agent 10 stops DB system (S1120). It depends for the stopping method on each DB system.

[0109]Next, the surveillance agent 10 performs loop processing which reads all the DB parameter files stored in the magnetic disk drive etc. for every DB process (S1125, S1140). Within this loop processing, it reads a parameter file one [at a time] from the magnetic disk drive 1130, for example. This parameter file is a file for specifying from the outside DB process starting conditions, such as memory quantity assigned to DB process, and DB system is started on condition of the versatility according to this parameter file. The method of the starting is various depending on each DB system. Now, the memory quantity information assigned to DB process is taken out from the parameter file which the surveillance agent 10 read from the magnetic disk drive 1130 (S1135).

[0110]Thus, in the stage which ended the loops S1125-S1135, the memory requirements on various starting conditions over a certain DB system are taken out. The surveillance agent 10 chooses the parameter file corresponding to the memory requirements concerned as a parameter file used for a reboot, when the new memory allotment etc. which were obtained at Step S1100 are carried out and that of a potato is found out in them. When a new memory allotment etc. are carried out and that of a potato does not exist in them, the new memory allotment is not exceeded, but the memory requirements nearest to it are chosen, and the parameter file corresponding to it is chosen as a parameter file used for a reboot (S1145).

[0111]The surveillance agent 10 reboots DB system using the selected parameter file for a reboot (S1150). And the signal started [DB] is transmitted to the server side message switching module (S1155).

[0112]The server side message switching module performs session [signal / started / DB] processing (it mentions later) according to reception (S1160). The system of this embodiment performs memory reorganization processing as mentioned above.

[0113]Next, the session processing in the server side message switching module is explained. The server side message switching module has the session information table which stored the group of information, including "session ID", "transaction ID", "terminal information", and "a message chain", for every session.

[0114]Here, "session ID" is an identifier assigned to a meaning for every session. This is assigned by DB process and session ID is notified to the server side message switching module from DB process.

[0115]"Transaction ID" is an identification number for managing a transaction, this is assigned by DB process, and when a transaction occurs, transaction ID is notified to the server side message switching module from DB process. In a certain session, a "transaction" means the period until a "definite" message is received by DB process from the time of this operation being performed first, when operation of change, an addition, and deletion is performed once or more to DB.

[0116]"Terminal information" is information needed in a network control layer, in order to

communicate with a terminal. Incidentally, these may differ according to what kind of networks (for example, TCP/IP etc.) are used.

[0117]"A message chain" is the structure for suspending what cannot be passed to DB process at the time among the messages which DB system action node 1010 received from the end user side node 1000. Drawing 16 is a mimetic diagram explaining the structure of a message chain. All over a session information table, the message chain pointer 1200 showing the start address of a message chain is stored. The top message entry 1202 is stored in the field which continues from the address on the memory to which the message chain pointer 1200 points, or a magnetic disk, For example, the following pointer 1204 which the substance of a message shows the start address of the next message entry at the rear again is stored in the anterior part of the message entry. Thus, when each message entry has the start address information on the message entry following it, each message entry forms a chain structure connected in order. Incidentally the server side message switching module, If processing of passing DB process about a top message is finished, the pointer 1204 to the following message entry stored in the entry of the head message will be posted to the message chain pointer 1200, and the head message entry concerned will be removed from a chain.

[0118]Three states, a "normal state", "it being a state during preparation", and "a state of preparing", of explaining below are defined as the server side message switching module.

[0119]The server side message switching module is in a state where a reboot requirement signal is not received, and a "normal state" is in a state which can carry out message switching of end user application and the DB process without restrictions.

[0120]"It is a state during preparation" receives a reboot requirement signal, it is in a state where transaction ID is registered into one or more session information, and the next restrictions are imposed on message switching of end user application and DB process.

[0121](1) Receive and twist a new session request and the transaction concerned decides a session when transaction ID is set as (2) session information, When a message arrives from end user application about a session when transaction ID is not set as (3) session information which makes message switching possible until it is ended. (When [for example,] a message used as a start of a transaction new about a session which a pre-transaction ended arrives), the message concerned is registered into a message chain and it does not transmit to DB process.

[0122]That is, during preparation, in the state, establishment of a new session and a transaction is not accepted, but, on the other hand, accepts actual processing to DB only about an existing transaction, and waits for the normal end.

[0123]A state where "a state of preparing" receives a reboot requirement signal and which does not have session information, Or it is in a state where transaction ID is registered into no session information, and the next restrictions are imposed on message switching of end user application and DB process in this case.

[0124](1) Receive and twist a new session request, and when a message reaches (2) session information from end user application, it registers the message concerned into a message chain,

and does not transmit it to DB process.

[0125]That is, a state of preparing means being in a state where DB system can be suspended and having been ready for memory reorganization processing. This state changes to a "normal state" with a signal from the surveillance agent 10 started [DB].

[0126]Drawing 17 - 20 are the flow charts for explaining processing with the server side message switching module. These figures divide one flow chart for convenience, and it means that the nodes shown with the same sign that appears in them are connected mutually. For example, processing will be passed to the node F to which drawing 18 is similarly expressed from the node A which described "F" into a circle of drawing 17.

[0127]The server side message switching module The message from DB process, If the message from the end user application through a network and the message from the surveillance agent 10 are received (S1300), it will be distinguished whether it is a message from the surveillance agent 10 (S1305). When a decided result is "Yes" next, it is judged whether the message concerned is a reboot requirement signal (S1310). A decided result is "Yes" and session information exists by the judgment which continues further (S1315), And as a result of investigating the existing session information, when transaction ID is set up, the state of the (S1320) server side message switching module is changed into a state during preparation (S1325), and it returns to Step S1300. When a decided result is "No" in Step S1315 and S1320, since the transaction under operation has not already existed, it returns to Step (S1330) S1300 by changing the state of the server side message switching module into the state of preparing.

[0128]When the message from the surveillance agent 10 is not a reboot requirement signal in Step S1310, it is judged that it is a signal started [DB]. In this case, if the message suspended for the message chain of session information exists (S1335), After transmitting the message suspended in all the session information to DB process (S1340), if a message does not exist, on the other hand, the state of the server side message switching module will be promptly changed into a normal state as it is (S1345).

[0129]When the message received at Step S1300 is a thing from DB process, it is judged whether (S1305, S1400), and it are the messages decided [transaction] (S1405). When a decided result is "Yes", the message concerned investigates the response message to which session it is, and clears transaction ID of session information to the session (S1410). As a result, when transaction ID of all the sessions is cleared (S1415), If the state of the server side message switching module is preparing (S1420), it will be changed into the state of preparing, a prepared signal will be transmitted to the surveillance agent 10 (S1425), and it will return to Step S1300. On the other hand, when there is a session which transaction ID has not decided yet, the (S1415) server side message switching module maintains the state (in preparation a normal state or a state) till then, and returns to Step S1300. Also when the state of the server side message switching module is not preparing in Step S1420 and it is specifically a normal state, the server side message switching module maintains the normal state till then, and returns to Step S1300. Since it set in Step S1420 by Step S1410 to precede and the transaction still existed, it cannot be in the state of preparing.

[0130]The message from DB process in Step S1405 Not the message decided [transaction] but (S1405), And when transaction ID is contained in the message concerned (S1430), it is a response message which shows generating of a new transaction. In this case, it is investigated a response message to which session the message concerned is, The transaction ID concerned is set as the session information corresponding to the session (S1435), the end user side node 1000 is specified based on session information, the message concerned is returned (S1440), and it returns to Step S1300. In such a case, it is not generated when the state of the server side message switching module is preparing. Because, although a new transaction is generated according to the demand from end user application, When the state of the server side message switching module is preparing, Since the message from end user application is stored in a message chain and it is not transmitted to DB process so that it may mention later, it is also because the message which notifies it does not arise that a transaction is generated.

[0131]On the other hand, in Step S1430, since it is a message according to the processing to an existing transaction when a decided result is "No", without setting transaction ID as session information, Step S1440 is processed and it returns to Step S1300.

[0132]When the message received at Step S1300 is a thing from the end user side node 1000, (S1305, S1400), and processing branch by whether the state of the server side message switching module is a normal state (S1500).

[0133]When it is a normal state, processing shown in (S1500) and drawing 19 is performed. First, when the message concerned is a new session establishment request, a message is transmitted to (S1505) and DB process (S1510). And if DB process performs processing which establishes a session (S1515) and returns the notice of session setup to the server side message switching module according to it, The server side message switching module acquires session ID from the response from the DB process, registers the new session information of initialization status (S1520), and returns to Step S1300.

[0134]On the other hand, when judged with it not being a new session establishment request at Step S1505, a message is transmitted to DB process (S1525), and it returns to Step S1300.

[0135]When it is in the state where the server side message switching module specifically prepares during preparation when judged with it not being a normal state in Step S1500, restrictions are imposed on the message switching of the end user side node 1000 and DB process which were mentioned above. When a message is a new session establishment request first (S1600), an error is returned to the end user side node 1000 (S1605), and it returns to Step S1300.

[0136]When a message is not a new session establishment request (S1600), the state of the server side message switching module branches according to a state during the state of preparing, and preparation (S1610). The message concerned is registered into the message chain of session information at the case in the state of preparing, and it returns to Step (S1615) S1300. In the case of a state, a session is specified from a message during preparation (S1620). And when transaction ID is registered into corresponding session information, a message is transmitted to DB process

(S1630), and it returns to Step S1300. When transaction ID is not registered, registration processing S1615 to a message chain is performed, and it returns to Step S1300. Drawing 21 is a state transition diagram showing the example of the change state produced at the session when transaction ID is registered into session information. In a figure, time passes from a top to the bottom and the arrow of the solid line between each state, Expressing transmission and reception of the message between the end user side node 1000, the server side message switching module, and DB process, etc., the arrow of the dotted line between a state and the state of preparing expresses the change state between these states during the normal state of the server side message switching module, and preparation.

[0137]The end user side node 1000 and DB process are performing message transmission and the result notice to it via the server side message switching module of a normal state (P1700). In this state, the server side message switching module will change in the state during preparation, if DB reboot requirement signal for fail over is received from the surveillance agent 10 (S1705). Henceforth, while the end user side node 1000 and DB process have the existing transaction, during preparation, via the server side message switching module of a state, message transmission and the result notice to it are performed, and processing is advanced (P1710). And it is reported that the transaction was decided in DB process from the end user side node 1000, If the notice of finishing [determining processing] to it is transmitted to the server side message switching module from DB process (S1720), The server side message switching module sends the prepared signal which notifies what as for the state the state of preparing was made to change (S1725) and preparation of DB reboot processing was able to carry out to the surveillance agent 10. Henceforth, the surveillance agent 10 carries out DB reboot processing (S1730), and after ending it, he transmits the signal started [DB] to the server side message switching module. From this prepared signal transmission before started [DB] signal reception, even if the server side message switching module receives the message S1735 from the end user side node 1000, it does not pass it to DB process but suspends it for a message chain. and the server side message switching module's reception of the signal started [DB] will return it to a normal state from finishing [preparation of a state] -- making (S1740) -- the message suspended for the message chain is passed to DB process (S1745). The processing to the hold message of DB process is unchanging with the thing to the message passed as it was without being suspended, and DB process notifies the processing result to the end user side node 1000 (S1750).

[0138]When suspending DB system under operation in memory reorganization processing for securing empty memory quantity required for DB system startup for fail over according to the structure of these above embodiments, For example during DB reboot, a message which a transaction under execution was normally ended and an end user emitted is suspended for a message chain, without being refused, and processing corresponding following the end back of a reboot is performed. That is, while the continuity of the contents of processing of DB process at the time of DB reboot themselves is collateralized, it can show as processed without DB system breaking off also as an interface to an end user.

[0139]

[Effect of the Invention]Since each node by which network connection was carried out chooses the alternative node to which processing of the node which supervised each operating status and produced the execution obstacle based on the monitored result is made to take over according to the computer system concerning this invention, The effect that the optimal thing according to the state of the system at that time is dynamically chosen as an alternative node is acquired.

[0140]According to the computer system concerning this invention, an alternative node is chosen based on the monitored result of the processor load of each node. For example, the node from which processor load becomes the minimum is chosen as an alternative node. The effect that the node whose processor load is not severe is chosen as an alternative node by this, load sharing within a system is planned in respect of processor load, and reservation of the speed of processing is achieved is acquired.

[0141]According to the computer system concerning this invention, an alternative node is chosen based on the monitored result of the memory availability of each node. For example, the node from which a memory availability becomes the maximum is chosen as an alternative node. The comparatively large node of the margin of a memory is chosen as an alternative node by this, Load sharing within a system is planned in respect of memory space, and the effect that high processing efficiency is obtained is acquired by the hit ratio of cash improving or preventing thrashing by controlling swapping.

[0142]According to the computer system concerning this invention, an alternative node is chosen based on the monitored result of the both sides of the processor load of each node, and a memory availability. Thereby, load sharing within a system is planned in consideration of the field of both processor load and memory space, and the effect that processing efficiency is secured is acquired.

[0143]When taking over of the processing program which produced the execution obstacle runs short of the memory availabilities of an alternative node according to the computer system concerning this invention, Since the quota memory space to the program started by preceding by the alternative node is reduced, it is effective in fail over processing being performed much more certainly.

[0144]When according to the computer system concerning this invention stopping a point boot program and making a quota change of memory space, Based on session information, it distinguishes whether the transaction during an established session is [******] under continuation, and only the message to the transaction under continuation is passed to a point boot program. Other messages to the session concerned are suspended for session information until quota change of memory space is completed, and they are usually processed after quota change at a passage. When stopping a point boot program, reducing the memory usage and securing empty memory quantity required for processing program starting for fail over by these, The effect that the interface with which he is not conscious of the continuity of the contents of processing of a point boot program being collateralized, and a point boot program being stopped by the end

user is provided is acquired.

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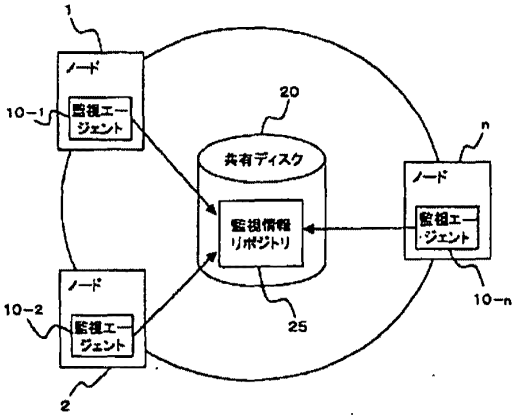
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(54)【発明の名称】　計算機システム

(57)【要約】
【課題】　複数のノードで構成された計算機システムにおいて、処理効率を確保しつつ耐故障性を向上させる。
【解決手段】　ネットワーク接続された複数のノード１，２，…，ｎではそれぞれ監視エージェント１０-1，１０-2，…，１０-nが動作し、自ノード及び他ノードでのＤＢアプリケーションの稼働状況を監視する。また、各ノードで相互に共有する共有ディスク２０上の監視情報リポジトリ２５に各ノードの情報が格納される。この情報には、各ノードのＣＰＵ負荷、空きメモリ量などが含まれる。自ノードでのアプリケーションのダウン、他ノードのダウンを検知した監視エージェントは、監視情報リポジトリ２５の情報を基に、例えばＣＰＵ負荷が少ないといった基準で動的に代替ノードを選択して、これに処理の引き継ぎを指示する。



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【特許請求の範囲】
【請求項１】　それぞれ処理プログラムを実行可能な複数のノードがネットワーク接続された計算機システムにおいて、
前記各ノードは、
前記各ノードそれぞれの稼働状況を監視する監視手段と、
前記監視手段が任意の前記ノードでの前記処理プログラムの実行障害を検知したとき、代替ノードを選択する代替ノード選択手段と、
前記実行障害を生じたノードから前記代替ノードへ前記処理プログラムの実行を引き継がせるフェールオーバ手段と、
を有することを特徴とする計算機システム。
【請求項２】　請求項１記載の計算機システムにおいて、
前記監視手段は、前記各ノードそれぞれのプロセッサ負荷を監視し、
前記代替ノード選択手段は、前記監視手段により得られた前記プロセッサ負荷に基づいて前記代替ノードを選択すること、
を特徴とする計算機システム。
【請求項３】　請求項２記載の計算機システムにおいて、
前記代替ノード選択手段は、前記プロセッサ負荷が最小であるノードを前記代替ノードとして選択すること、
を特徴とする計算機システム。
【請求項４】　請求項１記載の計算機システムにおいて、
前記監視手段は、前記各ノードそれぞれのメモリ空き容量を監視し、
前記代替ノード選択手段は、前記監視手段により得られた前記メモリ空き容量に基づいて前記代替ノードを選択すること、
を特徴とする計算機システム。
【請求項５】　請求項２記載の計算機システムにおいて、
前記代替ノード選択手段は、前記メモリ空き容量が最大であるノードを前記代替ノードとして選択すること、
を特徴とする計算機システム。
【請求項６】　請求項１記載の計算機システムにおいて、
前記監視手段は、前記各ノードそれぞれのプロセッサ負荷とメモリ空き容量とを監視し、
前記代替ノード選択手段は、前記監視手段により得られた前記プロセッサ負荷と前記メモリ空き容量とに基づいて前記代替ノードを選択すること、
を特徴とする計算機システム。
【請求項７】　請求項１記載の計算機システムにおいて、
前記監視手段は、前記各ノードそれぞれのメモリ空き容量を監視し、
前記フェールオーバ手段は、
前記代替ノードの前記メモリ空き容量が前記処理プログラムの引き継ぎに十分か否かを判断する容量比較手段と、
前記メモリ空き容量が不足するときは、前記代替ノードで先行して起動されている先起動プログラムに割り当てられるメモリ容量を縮小するメモリ割当変更手段と、
を有することを特徴とする計算機システム。
【請求項８】　請求項７記載の計算機システムにおいて、
前記代替ノードの前記先起動プログラムと当該先起動プログラムを前記ネットワークを介して利用するユーザノードとの間のセッション情報を含んだセッション情報テーブルを有し、
前記フェールオーバ手段は、前記メモリ容量の割当変更を行う際に、前記セッション情報に基づいて既設セッション中のトランザクションが継続中か否かを判別して継続中のトランザクションに対するメッセージのみ前記先起動プログラムに渡し、当該セッションに対する他のメッセージは前記割当変更が完了するまで前記セッション情報に保留するメッセージ取扱手段を有し、
前記メモリ割当変更手段は、前記トランザクションが終了したときに、前記先起動プログラムの実行を停止してメモリ割当変更を行うこと、
を特徴とする計算機システム。

【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、複数の計算機が接続された計算機システムに関し、特に耐故障性、可用性が向上した計算機システムに関する。
【０００２】
【従来の技術】計算機システムの可用性を向上させるためには、故障によるシステムのダウン時間を低減する必要がある。この耐故障性向上を図る一つの方法として冗長性の利用が挙げられる。冗長性はハードウェア、ソフトウェアの両方に適用することが可能であり、具体的には多重化、多数決方式、誤り訂正／検出符号の利用といった例がある。その中で、ハードウェアについて利用できる比較的簡単な形態であって適用範囲の広いものに、一つの計算機システムを互いに接続された複数の計算機で構成するという多重化の形態がある。
【０００３】この多重化では、システムを構成する個別の計算機（これを以下、ノードと呼ぶことがある）が何らかの原因で停止（ダウン）したとき、そのノードの処理を予め定義された別のノードが引き継ぐフェールオーバ構成とする事例が多くなってきている。
【０００４】
【発明が解決しようとする課題】この従来のフェールオ

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ーバ構成では、障害発生時に、予め決められたノード先にしか処理を引き継ぐ（フェールオーバする）ことができない。つまり、この方法では、処理引き継ぎに必要な計算機リソース（資源）量（例えばＣＰＵ負荷、メモリ量）が多くても、それに応じてフェールオーバされるノードを動的に変更できず、フェールオーバされたノードの負荷が高くなってその処理速度が許容限度以上に低減したり、極端な場合には処理を引き継ぐことが実質的に不可能である場合が生じ得るという問題があった。

【０００５】また、例えば、重要度の低いデータベースアプリケーションソフトウェア（以下、ＤＢアプリケーションと略記する）が稼働しているノードに、重要度の高いＤＢアプリケーションをフェールオーバしたい場合がある。この場合、フェールオーバ先のノードのメモリの一部は、重要度の低いＤＢアプリケーションが先に占有しており、フェールオーバされる重要度の高いＤＢアプリケーションは、残りのメモリ資源しか利用することができず、処理が効率的に行われない、処理速度が遅いといった上述の不都合を生じる。このように従来のフェールオーバ方法では、単純には、リソースの割当が効果的に行われないといった問題があった。これを改善した従来のフェールオーバ方法には、一旦、先にリソースを占有している重要度の低いＤＢアプリケーションを停止させて、重要度の高いＤＢアプリケーションに対して優先的にリソースが与えられるような再配分を行うものもあった。この方法では、一旦、ノードをシャットダウンする、すなわち既存のセッション情報（端末とＤＢ間の接続及びトランザクションを処理するために必要な情報）が失われてしまい、先に実行されていたアプリケーションのリソース再配分後の実行が面倒となるという問題があった。

【０００６】本発明は上記問題点を解消するためになされたもので、複数ノードがネットワーク接続され、ノード間でフェールオーバを行うという多重化により耐故障性、可用性を向上させる計算機システムであって、フェールオーバ先での処理が効率的に行われるシステムを提供することを目的とする。

【０００７】

【課題を解決するための手段】本発明に係る、それぞれ処理プログラムを実行可能な複数のノードがネットワーク接続された計算機システムは、前記各ノードが、前記各ノードそれぞれの稼働状況を監視する監視手段と、前記監視手段が任意の前記ノードでの前記処理プログラムの実行障害を検知したとき代替ノードを選択する代替ノード選択手段と、前記実行障害を生じたノードから前記代替ノードへ前記処理プログラムの実行を引き継がせるフェールオーバ手段とを有することを特徴とする。

【０００８】他の本発明に係る計算機システムにおいては、前記監視手段は前記各ノードそれぞれのプロセッサ負荷を監視し、前記代替ノード選択手段は前記監視手段により得られた前記プロセッサ負荷に基づいて前記代替ノードを選択することを特徴とする。本発明の好適な態様は、前記代替ノード選択手段が前記プロセッサ負荷が最小であるノードを前記代替ノードとして選択するものである。

【０００９】別の本発明に係る計算機システムにおいては、前記監視手段は前記各ノードそれぞれのメモリ空き容量を監視し、前記代替ノード選択手段は前記監視手段により得られた前記メモリ空き容量に基づいて前記代替ノードを選択することを特徴とする。本発明の好適な態様は、前記代替ノード選択手段が前記メモリ空き容量が最大であるノードを前記代替ノードとして選択するものである。

【００１０】また、本発明の他の好適な態様は、前記監視手段が前記各ノードそれぞれのプロセッサ負荷とメモリ空き容量とを監視し、前記代替ノード選択手段が前記監視手段により得られた前記プロセッサ負荷と前記メモリ空き容量とに基づいて前記代替ノードを選択するものである。

【００１１】また別の本発明に係る計算機システムにおいては、前記監視手段は前記各ノードそれぞれのメモリ空き容量を監視し、前記フェールオーバ手段は前記代替ノードの前記メモリ空き容量が前記処理プログラムの引き継ぎに十分か否かを判断する容量比較手段と、前記メモリ空き容量が不足するときは前記代替ノードで先行して起動されている先起動プログラムに割り当てられるメモリ容量を縮小するメモリ割当変更手段とを有することを特徴とする。

【００１２】さらに他の本発明に係る計算機システムは、前記代替ノードの前記先起動プログラムと当該先起動プログラムを前記ネットワークを介して利用するユーザノードとの間のセッション情報を含んだセッション情報テーブルを有し、前記フェールオーバ手段が、前記メモリ容量の割当変更を行う際に前記セッション情報に基づいて既設セッション中のトランザクションが継続中か否かを判別して継続中のトランザクションに対するメッセージのみ前記先起動プログラムに渡し、当該セッションに対する他のメッセージは前記割当変更が完了するまで前記セッション情報に保留するメッセージ取扱手段を有し、前記メモリ割当変更手段が前記トランザクションが終了したときに、前記先起動プログラムの実行を停止してメモリ割当変更を行うことを特徴とする。

【００１３】

【発明の実施の形態】［実施の形態１］以下、本発明の実施の形態について図面を参照して説明する。

【００１４】本発明に係る計算機システムは、複数のノード（ノード１、ノード２、…、ノードｎ）が互いにネットワークを介して接続されて構成される。図１は、本システムの構成を説明するための模式図である。各ノードではそれぞれ、監視エージェントと呼ぶモジュールが

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動作する。この監視エージェントは、例えば、各ノードの中央処理装置（Central Processing Unit：ＣＰＵ）で実行されるソフトウェアで構成され、各ノードで常時実行状態にされている。そして監視エージェントは自律的に動作して、それが動作するノード（自ノードと称する）と自ノード以外のネットワーク接続されたノード（他ノードと称する）のＤＢアプリケーションの稼働状況、ＣＰＵ資源、メモリ資源などを定期的に、又は随時、サンプリングしながら監視する機能を有する。この監視エージェント１０は、ノードのオペレーティングシステム（ＯＳ）やＤＢが起動しているかどうかを判別する既存の機能を用いて各ノードの情報をチェックし、それぞれの監視エージェント１０-1，１０-2，…，１０-nの監視結果は、ネットワークを介して各ノードと接続された共有ディスク２０に書き込まれる。監視結果は具体的には、この共有ディスク２０上に設けられる監視情報リポジトリ２５に記録される。

【００１５】図２は、監視情報リポジトリ２５に格納される情報の一例の論理構成を示す模式図である。なお、この図において、データとして実際に値が取得されるのは、ツリー構造の最下位レベルの項目であり、それ以外の項目はその下位レベルを総括する単なる名称である。この図に示したように、監視情報リポジトリ２５には「ノード情報」として各ノード毎の情報が格納される。各「ノード情報」は、ノード名、最終サンプリング時刻、監視エージェント情報、ロック済みエージェント情報、サンプリング間隔、サンプリングデータ保存期間、ノード状態、基準空きメモリ量といったデータを含んでいる。

【００１６】また各「ノード情報」はさらに、「ＤＢ情報」、「資源情報」という名称で総括されるデータを含んでいる。ＤＢ情報は、各ノードにて使用されるＤＢシステムの種類に応じた数だけの「ＤＢ」エントリで構成され、各「ＤＢ」エントリはＤＢ名、実行優先度、サンプリング時刻、ＤＢ状態、起動情報といったデータを含んで構成される。

【００１７】「資源情報」は、「資源データ」エントリで構成され、各「資源データ」エントリはサンプリング時刻、ＣＰＵ稼働率、空きメモリ量といったデータを含んで構成される。「資源データ」エントリは「資源情報」内に、サンプリング保存期間に応じて定まる、結果を保存すべきサンプリング回数分だけ含まれる。すなわち、「資源情報」には、サンプリングが行われる度に、そのサンプリング時における「資源データ」を構成するデータセットが追加され、一方、予め定められたサンプリング保存期間を過ぎた「資源データ」エントリは削除される。

【００１８】以下、監視情報リポジトリ２５内の各データについて説明する。「ノード名」は、ノードを識別するための名前であり、「最終サンプリング時刻」は、当該ノードについての情報が最後にサンプリングされた日付、時刻を表す情報である。「監視エージェント情報」は、ノードで動作する監視エージェントの識別子（名前）、及び別の監視エージェントとのメッセージ交換ができるようにするための設定情報である。「ロック済みエージェント情報」は、当該ノードをチェックしている監視エージェントの識別子を表し、どの監視エージェントも当該ノードをチェック中でないときは値“ＮＵＬＬ”が設定される。

【００１９】「サンプリング間隔」は、監視エージェントが自ノード内の全てのＤＢ情報及び資源情報を採取し、監視情報リポジトリ２５内に登録されたＤＢアプリケーションがダウンしているかどうかをチェックする間隔である。「サンプリングデータ保存期間」には、資源情報の過去の履歴の保存期間が指定される。

【００２０】「ノード状態」は、現在のノードの状態を表すデータであり、その状態としては、例えば“停止中”、“稼働中”、“ダウン”、“フェールオーバ作業中”の４通りを定義することができる。

【００２１】ここで、“停止中”は、ノードが稼働していないことを示す状態である。“停止中”が記録されるタイミングはＯＳが正常に停止されるときに停止処理の一環として行われるか、ノードの“ダウン”状態下での全てのＤＢアプリケーションのフェールオーバ作業が完了（当該作業の成功又は不成功は問わない）した直後である。

【００２２】“稼働中”は、ノードが稼働していることを示す状態である。“稼働中”が記録されるタイミングは、自ノードの監視エージェントによって、自分自身の起動初期処理として、又は“フェールオーバ作業中”状態が終了した段階である。

【００２３】“ダウン”は、ノードが過去に“稼働中”の状態であったが、現時点ではノードが停止している状態を表す。“ダウン”が記録されるタイミングは、監視情報リポジトリに当該ノードの状態として“稼働中”が記録されているにも拘わらず他ノードの監視エージェントによって当該ノードの停止が検出された場合である。

【００２４】“フェールオーバ作業中”は、当該ノードにてフェールオーバが実際に行われている状態である。“フェールオーバ作業中”が記録されるタイミングは当該ノードの監視エージェントが他ノードの監視エージェントからＤＢフェールオーバの指示を受け取ったときであり、フェールオーバ作業が終了した時点で状態は“稼働中”に戻る。

【００２５】次に「基準空きメモリ量」には、起動直後の空きメモリ量が記録される。

【００２６】「ＤＢ情報」エントリに含まれる「ＤＢ名」は、当該エントリに対応するＤＢシステムを一意に特定する識別子である。「サンプリング時刻」は、当該「ＤＢ情報」エントリの情報がサンプリングされた日

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付、時刻を表す。「起動情報」は当該ＤＢシステムに対応したＤＢアプリケーションを起動するための実行手順が記述されたスクリプトファイル名や、運用時の標準メモリ量など、ＤＢアプリケーションを起動するために必要な情報である。

【００２７】「ＤＢ状態」は、当該エントリに対応するＤＢシステムの状態を表すデータであり、その状態としては、例えば“停止中”、“稼働中”、“ダウン”の３通りを定義することができる。

【００２８】ここで、“停止中”は、ＤＢアプリケーションが停止している状態を示す。“停止中”が記録されるタイミングはＤＢアプリケーションが正常に停止されるときに停止処理の一環として行われるか、自ノードの監視エージェントによって、自分自身の起動初期処理としてＤＢアプリケーションの停止が検出されたときである。

【００２９】“稼働中”は、ＤＢアプリケーションが正常に動作していることを示す状態である。“稼働中”が記録されるタイミングは、当該ＤＢアプリケーションが動作するノードの監視エージェントによって、当該ＤＢアプリケーションの状態が“稼働中”以外の状態において、当該ＤＢアプリケーションが動作していることを検出したときである。

【００３０】“ダウン”は、ＤＢアプリケーションが過去に“稼働中”の状態であったが、現時点では停止している状態を表すものである。“ダウン”が記録されるタイミングは、監視情報リポジトリに当該ＤＢアプリケーションの状態として“稼働中”が記録されているにも拘わらず自ノードの監視エージェントによってＤＢアプリケーションの停止が検出されたとき、又は当該ノードの状態が他ノードの監視エージェントによって“ダウン”と記録される場合である。

【００３１】「実行優先度」は、ＤＢシステムの優先度であり、数値を以て表すことができる。例えば、数値が大きいほど優先度が高いと定義することができる。

【００３２】「資源情報」エントリに含まれる「サンプリング時刻」は、当該「資源情報」エントリの情報がサンプリングされた日付、時刻を表す。

【００３３】「ＣＰＵ稼働率」は、サンプリングが行われた時点でのＣＰＵの稼働率を表す。

【００３４】「空きメモリ量」は、サンプリングされた時刻での空きメモリ量を表す。

【００３５】図３～７は、監視エージェントの動作を説明するフロー図であり、特に図３は、監視エージェントのＤＢアプリケーション状態監視に関する初期処理を説明するフロー図である。まず、監視エージェント１０が起動される前においては、監視情報リポジトリ２５内のノード状態は“停止中”に設定される。各ノードが起動され、監視エージェント１０が起動されると、監視エージェント１０は自ノードの状態を“稼働中”に設定する（Ｓ５０）。次に、監視情報リポジトリ２５の自ノードに関するノード情報にエントリされているＤＢ情報に基づいて、エントリされている各ＤＢシステム毎に以下に説明するステップＳ６０～７５で構成されるループを繰り返す。このループに含まれる処理においては、まずＤＢの状態が監視情報リポジトリ２５から取り出される（Ｓ６０）。そして取り出したＤＢ状態の値が“稼働中”であるか否かが判定され（Ｓ６５）、その判定結果に応じた値でＤＢ状態が更新される（Ｓ７０，Ｓ７５）。なお、この初期処理においては、“ダウン”状態は生じないので、ステップＳ６５にて“稼働中”でないと判定された場合には、ステップＳ７５において、初期値“停止中”が維持される。ステップＳ８０においては、全てのＤＢシステムについてステップＳ６０～Ｓ７５が実施されたかが判断され、実施されていないＤＢシステムがあれば、処理はステップＳ６０に戻され、そのＤＢシステムについて同様の処理が行われる。一方、ステップＳ８０において全てのＤＢシステムについて処理が行われたと判断された場合には、図３に示す初期処理は終了し、各ノード毎で行われる監視処理が開始される。

【００３６】図４は、各ノードでの監視処理の概略を説明するフロー図であり、図５は当該監視処理に設けられる自ノードに対するＤＢ状況チェック処理Ｓ１２５内での処理をより詳細に示したフロー図である。図３と図４とは、図に示される端子Ａにおいて互いに接続される。図３に示す初期処理から図４に示す監視処理に処理が渡されると、以降、ノードが稼働中である間、監視処理を構成するＳ１００～１４５が例えば一定間隔で起動され繰り返される。

【００３７】タイマー処理Ｓ１００は、監視処理を一定間隔で起動するために設けられ、当該処理が所定時間の経過を検知したことに基づいて、続くＤＢ再起動処理Ｓ１０５が必要に応じて行われる。このＤＢ再起動処理Ｓ１０５は、ダウンしているＤＢアプリケーションの再起動先（フェールオーバ先）として自ノードが選択されたという通知を受けた場合に実行され、そのダウンしているＤＢアプリケーションを自ノードにおいて再起動する。

【００３８】次に時刻が取得され（Ｓ１１０）、その時刻に基づいて、監視情報リポジトリ２５内に格納されている自ノード情報内の資源情報のうちサンプリング保存期間を超えたものがあるかどうかが探索され、当該保存期間を超えたものは監視情報リポジトリ２５から削除される（Ｓ１１５）。

【００３９】このようにまず監視情報リポジトリ２５内の不要なデータを整理した後、監視エージェントは自ノードのチェックを開始する。そのチェック開始に際して、監視エージェントは自身の監視エージェント識別子を自ノード情報のロック済みエージェント情報に登録す

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る（Ｓ１２０）。これにより自ノードに対するチェック処理実行中における他ノードの監視エージェントからのチェックを排他制御する。

【００４０】自ノードに対するチェック処理はＤＢアプリケーションの状況のチェックと、自ノードのリソース負荷状況のチェックとを含んでいる。このうち自ノードのＤＢアプリケーションに対するチェック処理Ｓ１２５を図５を用いてより詳しく説明する。このチェックは、監視情報リポジトリ２５の自ノード情報にエントリされている全てのＤＢシステムについて反復される（Ｓ２００）。まずＤＢ状態が監視情報リポジトリ２５から取り出され、当該ＤＢ状態の値が“稼働中”であるか否かが判定され（Ｓ２０５）、状態が“稼働中”でない場合には、当該ＤＢアプリケーションについてのチェックを終了し、残る未チェックのＤＢアプリケーションに対するチェックに移る（Ｓ２３０）。一方、ステップＳ２０５において、監視情報リポジトリ２５上に格納されているＤＢ状態データが“稼働中”であるＤＢシステムに対しては、そのＤＢシステムの実際の状態が“正常稼働”であるか“停止”であるかが調べられる（Ｓ２１０）。この実際の状態の判別には、従来技術を用いることができる。

【００４１】監視情報リポジトリ２５上で“稼働中”であった（Ｓ２０５）にも拘わらず、ステップＳ２１０で取得された実際の状態が“停止”であった場合（Ｓ２１５）は、ＤＢアプリケーションは実行障害を生じた、つまり“ダウン”していると判断され（Ｓ２２０）、ＤＢアプリケーションダウンに対応する所定の処理（Ｓ２２５）が実行される。

【００４２】このＤＢアプリケーションダウン時の処理では、実行障害を生じたＤＢアプリケーションを代替実行させるのに適当なノード（代替ノード）が選択され、当該ダウンしたＤＢアプリケーションをその代替ノードにおいて再起動し処理を引き継がせるための処理が、その代替ノードで動作している監視エージェントに対して実行される。すなわち、監視エージェントは、自ノードでのＤＢアプリケーションの実行状況を監視する監視手段、代替ノードを選択する代替ノード選択手段、及びダウンしたＤＢアプリケーションの実行を代替ノードへ引き継がせるフェールオーバ手段としての機能を有する。なお、ここで選択された代替ノードへ発せられる処理引き継ぎの指示は、当該代替ノードにおけるステップＳ１０５で検知され、実行される。

【００４３】さて一方、条件判断ステップＳ２１５において、”停止”ではない、すなわち実際に“稼働中”であることが明らかになった場合は、監視情報リポジトリ２５上の情報と一致しており異常はないので、当該ＤＢアプリケーションについてのチェックを終了し、残る未チェックのＤＢアプリケーションに対するチェックに移る（Ｓ２３０）。なお、ステップＳ２３０において、全てのＤＢアプリケーションについてのチェックが完了したと判断された場合には、自ノードに対するチェック処理Ｓ１２５を終了する。

【００４４】チェック処理Ｓ１２５が終了すると、次に監視エージェントは、自ノードに関する資源情報のチェックを行う（Ｓ１３０）。この処理では資源情報データがＯＳから取得され、監視情報リポジトリ２５に格納される（Ｓ１３０）とともに、そのサンプリング時刻で監視情報リポジトリ２５内の自ノードに関する最終サンプリング時刻を更新する（Ｓ１３５）。

【００４５】ステップＳ１２５～１３５の自ノードに対するチェック処理が終了すると、監視エージェントは自ノード情報のロック済みエージェント情報に“ＮＵＬＬ”を登録し、排他制御を解除する（Ｓ１４０）。

【００４６】以上の処理は監視エージェントが自ノードに対して行う処理であるが、監視エージェントは自ノードだけでなく、他のノードに対する監視及び障害時のフェールオーバ処理をも行う（Ｓ１４５）。これを全ノード処理と称する。図６，７は、全ノード処理を説明するフロー図である。この全ノード処理は便宜上、図６，７の２つに分割して表しており、両図の同一符号の端子（具体的には端子Ｂ同士、及び端子Ｃ同士）において両図は接続される。この処理は、あるノードの監視エージェントが他のノードを順次選択して、選択したノードに関し稼働状況の監視、及び障害発生時のフェールオーバ処理を行うものであり、ステップＳ３００とステップＳ４４５とで挟まれる処理が、それぞれのノードに対して反復されるループ処理として構成されている。

【００４７】ステップＳ３０５～３３０は、あるノードの監視エージェント（以下、検査実行エージェントと称する）がチェック対象として選択したノード（以下、検査対象ノードと称する）を、他のノードの監視エージェントがロック状態としたままダウンした場合に対応する処置である。検査対象ノードのロック済みエージェント情報が判別され（Ｓ３０５）、それが“ＮＵＬＬ”である場合は問題がないので、検査実行エージェントは検査対象ノードのロック済みエージェント情報に、自身のノードの識別子を登録して検査対象ノードをロック状態とし（Ｓ３３５）、検査対象ノードに対するチェックを開始する。

【００４８】一方、ステップＳ３０５において、検査対象ノードのロック済みエージェント情報に、他ノードの識別子が登録されている場合は、当該他ノードの監視エージェントと通信可能かどうかが調べられる（Ｓ３１０）。もし通信可能であるならば、当該他ノードの監視エージェントがその検査対象ノードをチェックであると解して、当該他ノードに対するチェックは行わない。反対に、ステップＳ３１０において、通信不可能であることが判明した場合には、当該他ノードの監視エージェントは検査対象ノードをロックしたままダウンしたと解さ

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れる。そこで、検査実行エージェントは、現在検査を行おうとしている検査対象ノードだけでなく全ノードを検索対象として、当該他ノードの監視エージェントによりロックされているノードを監視情報リポジトリ２５のノード情報に基づいて見いだし、そのロックを解除する。具体的には、全てのノードを対象とするループ処理が行われ（Ｓ３１５，Ｓ３３０）、そのノードのロック済みエージェント情報が当該他ノードの識別子であるかどうかが判定され（Ｓ３２０）、判定結果が“Ｙｅｓ”である場合にはそのロック済みエージェント情報を“ＮＵＬＬ”にリセットし（Ｓ３２５）、“Ｎｏ”である場合にはリセットを行わないという処理が行われる。しかる後に、検査実行エージェントは現在検査を行おうとしている検査対象ノードのロック済みエージェント情報に、自身のノードの識別子を登録して検査対象ノードをロック状態とし（Ｓ３３５）、検査対象ノードに対するチェックを開始する。

【００４９】検査実行エージェントは、まず、監視情報リポジトリ２５中の検査対象ノードのノード状態をチェックする（Ｓ４００）。このノード状態に“稼働中”、又は“フェールオーバ作業中”が設定されている場合は、さらに、検査対象ノードが実際に動作しているかどうかが調べられる（Ｓ４０５）。ちなみに、この判定は従来技術を用いて行うことができる。この判定の結果、検査対象ノードが、監視情報リポジトリ２５のノード状態に設定された情報に反して、実際は停止していることが判明した場合は、検査実行エージェントは検査対象ノードがダウンしていると判定して、監視情報リポジトリ２５の当該ノード状態を“ダウン”に変更する（Ｓ４１０）。そして、検査実行エージェントは、ダウンしていると判定した検査対象ノードについて監視情報リポジトリ２５に登録されている全てのＤＢ情報を対象とするループ処理を行う（Ｓ４１５，Ｓ４３０）。このループ処理では、当該ＤＢ情報中のＤＢ状態に“稼働中”が設定されているかどうかが調べられ（Ｓ４２０）、判定が“Ｙｅｓ”である場合にはＤＢ状態を“ダウン”に変更する（Ｓ４２５）。

【００５０】しかる後、検査実行エージェントは、ダウンしたと判定した検査対象ノード上で実行されていたＤＢアプリケーションに対し、ノードダウンに対応する所定の処理（Ｓ４３５）を実行する。このノードダウン時の処理では、当該ダウンノード上で実行されていたＤＢアプリケーションを代替実行させるのに適当なノード（代替ノード）が選択され、当該ＤＢアプリケーションをその代替ノードにおいて再起動し処理を引き継がせるための処理が、その代替ノードで動作している監視エージェントに対して実行される。すなわち、検査実行エージェントは、他ノードである検査対象ノードの稼働状況を監視する監視手段、代替ノードを選択する代替ノード選択手段、及びノードダウンにより実行できなくなったＤＢアプリケーションの実行を代替ノードへ引き継がせるフェールオーバ手段としての機能を有する。なお、ここで選択された代替ノードへ発せられる処理引き継ぎの指示は、当該代替ノードにおけるステップＳ１０５で検知され、実行される。ノードダウン時の処理Ｓ４３５が終了すると、検査実行エージェントは、検査対象ノードのロック済みエージェント情報を“ＮＵＬＬ”に変更しロックを解除し（Ｓ４４０）、新たな検査対象ノードに対する処理に移る（Ｓ４４５）。もし、全てのノードに対して処理が終了したら全ノード処理Ｓ１４５を終了し、図４に示すループに復帰する（Ｓ４５０）。

【００５１】なお、ステップＳ４００において、ノード状態が“停止中”である場合は問題がない、つまりＤＢアプリケーションの実行障害は生じていないので、直ちにロックを解除する（Ｓ４４０）。また、ノード状態が既に“ダウン”に設定されている場合は、他のノードの監視エージェントが既に当該検査対象ノードに対し検査を実行して“ダウン”を検知し、ノードダウン時の処理Ｓ４３５を実施したことを意味している。よって、この場合も、現在検査を行っている検査実行エージェントは改めてノードのダウンに対する処置を行わずに直ちにロックを解除する（Ｓ４４０）。

【００５２】上述したように本システムによれば、あるノードでのＤＢアプリケーションの実行が困難となったときに、ネットワーク接続された複数のノードの中から、その実行を引き継ぐノードとして適切なものが動的に選択される。

【００５３】［実施の形態２］本発明の第２の実施形態を、上記実施の形態１をベースに以下説明する。本実施の形態の特徴は、実施の形態１におけるＤＢアプリケーションダウン時の処理Ｓ２２５及びノードダウン時の処理Ｓ４３５に相当する処理にあり、以下、この実施の形態１との相違点に重きを置いて説明し、実施の形態１と基本的に同様である処理については説明を省略する。また、実施の形態１と同様の構成要素には同一の符号を付し、記載の簡潔を図る。

【００５４】本実施の形態においては、これらＤＢアプリケーションダウン時の処理及びノードダウン時の処理における代替ノードの選択が、代替ノードとして選択されるノードのＣＰＵ負荷に基づいて行われる点に大きな特徴がある。

【００５５】本システムの各ノード上の監視エージェント１０は、互いに非同期にサンプリング間隔毎に動作している。監視エージェント１０は、自ノード内のあるＤＢアプリケーションがダウンしていること、又は他のあるノード全体がダウンしていることを検出すると、実施の形態１のステップＳ２２５又はＳ４３５に相当するＤＢアプリケーションダウン時の処理及びノードダウン時の処理を行う。

【００５６】図８は、本実施の形態におけるＤＢアプリ

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ケーションダウン時の処理を示すフロー図である。この処理は、ノード自体は稼働しているが、ＤＢアプリケーションはダウンしていることが検知された場合に実施される処理であり、図４のステップＳ１２０に続いて行われる。

【００５７】監視エージェント１０は、自ノードのＤＢアプリケーションにダウン状態のものを検知すると、監視情報リポジトリ２５に登録されている全てのノードを対象とした以下の内容のループ処理を行う（Ｓ５００，Ｓ５２５）。このループ処理の１回のループは１つのノードに対応した処理であり、まず、そのノードの状態が“稼働中”、“フェールオーバ作業中”のいずれかであるかどうかが監視情報リポジトリ２５のノード情報に基づいて判定される（Ｓ５０５）。判定結果が“Ｙｅｓ”である場合には、当該ノードに関する監視情報リポジトリ２５中の資源情報に基づいて、平均ＣＰＵ稼働率が算出される（Ｓ５１０）。ちなみに、例えばこの平均稼働率は、監視情報リポジトリ２５に保存されている当該ノードの複数サンプリングタイミングにおける資源情報の全てを用いて計算される。

【００５８】次に、当該ノードが、現在の検査実行エージェント以外の他ノードの監視エージェントにより“フェールオーバ作業中”であるか否かが判定され（Ｓ５１５）、その結果に基づいて換算ＣＰＵ稼働率が算定される。換算ＣＰＵ稼働率は、ステップＳ５１０で計算された平均ＣＰＵ稼働率に換算率αを乗じることにより求められる。ステップＳ５１０にてフェールオーバ作業中と判定された場合には、αは１以上の定数（例えば１０）とされ、これが乗じられて換算ＣＰＵ稼働率が求められる（Ｓ５２０）。一方、ステップＳ５１５にて、フェールオーバ作業中ではないと判定された場合には、αは１とされる、すなわち、ステップＳ５１０で求められた平均ＣＰＵ稼働率がそのまま換算ＣＰＵ稼働率とされる。監視エージェント１０は、この換算ＣＰＵ稼働率を決定すると、当該ノードについてのループ処理を終了し、次のノードのループ処理に移る。

【００５９】なお、ステップＳ５０５での判定結果が、“停止中”、又は“ダウン”である場合には、当該ノードにＤＢアプリケーションの処理を引き継ぐことはできないので、代替ノードの候補から外して、次のノードに対するループに移る。例えば、代替ノードの候補から外したことは、それを表すためのフラグ等を設け、それにより識別することができる。また、本システムでは後述するように換算ＣＰＵ稼働率が小さいことを基準として代替ノードを選択するので、ノードの換算ＣＰＵ稼働率に非常に大きな値を設定することにより、当該ノードが代替ノード候補外であることを識別するように構成することもできる。

【００６０】監視エージェント１０は上記ループ処理により、ネットワーク接続されたシステムの各ノードの代替ノード候補としての可否、及び換算ＣＰＵ稼働率を定めると、代替ノード候補のうち換算ＣＰＵ稼働率が最も小さいノードを代替ノードとして選択し、当該代替ノードに対し、ＤＢアプリケーションのダウンが確認されたノード名（すなわち自ノード名）とダウン状態のＤＢ名をメッセージとして送信することによりダウンしたＤＢアプリケーションの再起動を指示し（Ｓ５３０）、図４のステップＳ１３０に復帰する。

【００６１】ちなみに、ノード状態がフェールオーバ作業中である場合に１以上のαを乗じるのは、既にフェールオーバ作業中のノードへは新たなフェールオーバ作業の依頼が行われることを抑制し、なるべくフェールオーバ作業を行っていないノードへ依頼が行われるようにして処理分散を図るためである。

【００６２】図９は、本実施の形態におけるノードダウン時の処理を示すフロー図である。この処理は、あるノードの監視エージェント１０が他ノードの全体がダウンしていることを検知した場合に実施する処理であり、図７のステップＳ４３０に続いて行われる。

【００６３】監視エージェント１０は、監視情報リポジトリ２５に登録されている全てのノードを対象とした以下の内容のループ処理を行う（Ｓ６００，Ｓ６５０）。このループ処理の１回のループは１つのノードに対応した処理であり、そのノードの状態が“ダウン”であるかどうかが監視情報リポジトリ２５のノード情報に基づいて判定される（Ｓ６０５）。判定結果が“Ｎｏ”である場合には、再起動等の実行障害処理は不要であるので、次のノードについてのループ処理に移る。一方、判定結果が“Ｙｅｓ”である場合には、ステップＳ６１０～Ｓ６３５の処理を行う。このステップＳ６１０～Ｓ６３５の処理は、代替ノード候補としての可否、及び換算ＣＰＵ稼働率を定めるための処理であり、上に説明したステップＳ５００～Ｓ５２５の処理と同様であるので、説明を省略する。

【００６４】各ノードの換算ＣＰＵ稼働率が決定されると、監視エージェント１０は代替ノード候補のうち換算ＣＰＵ稼働率が最も小さいノードを代替ノードとして選択し、当該代替ノードに対し、ＤＢアプリケーションのダウンが確認されたノード名（この場合は、ＤＢアプリケーションダウン時の処理と異なり、他ノード名となる）とダウン状態のＤＢ名をメッセージとして送信する（Ｓ６４０）。さらに、ダウンと判定されたノードの監視情報リポジトリ２５での状態を“停止中”に変更し（Ｓ６４５）、次のノードについてのループ処理に移る。このようにして、ノードダウン時の処理のループＳ６００～Ｓ６５０は全てのノードを対象として実施される。

【００６５】図１０は、ステップＳ５３０，Ｓ６４０で送信されたメッセージを受信したノードでのＤＢアプリケーション再起動処理を説明するフロー図である。この

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再起動処理は、図４のステップＳ１０５に相当する。

【００６６】各ノードは、一定間隔で監視エージェント１０が動作し、いずれかの監視エージェント１０からのメッセージが存在するか否かを調べる（Ｓ７００）。メッセージが存在しなければ、図４に示すステップＳ１１０以降の検査処理に移るが、メッセージが存在した場合は、以下に述べるＤＢアプリケーション再起動処理を行った後、検査処理に移る。

【００６７】再起動処理では、メッセージからＤＢアプリケーションの実行障害が検知されたノード名とＤＢ名が取得される（Ｓ７０５）。そして、監視情報リポジトリ２５の時ノードの情報に、“フェールオーバ作業中”を設定し（Ｓ７１０）、監視情報リポジトリ２５からステップＳ７０５で取得されたＤＢ名に対応するＤＢ起動情報を探しだし、その情報に基づいてＤＢアプリケーションを起動する（Ｓ７１５）。また、ステップＳ７０５で取得されたノード名、ＤＢ名に関するＤＢ情報エントリを、自ノードのＤＢ情報に移動させるとともに（Ｓ７２０）、当該ＤＢ情報の状態を“稼働中”に変更する（Ｓ７２５）。そして、この再起動処理を行った後に既に述べたように検査処理に移る。

【００６８】図１１は、上述した、ＤＢアプリケーションの実行障害検出時の監視エージェント１０の動作の一例を説明する模式図である。この図に示す例では、ノード１がダウンしていること、そしてその結果、ノード１で実行されていたＤＢアプリケーション「ＤＢ＃１」がダウン状態であることが、ノード２の監視エージェント１０（検査実行エージェント）による検査処理により検知される。検査実行エージェントは、監視情報リポジトリ２５の各ノードのノード情報中のＣＰＵ稼働率を参照して、換算ＣＰＵ稼働率を算出し、その最小値を有するノード３を代替ノードに選択する。そして、ノード３の監視エージェント１０に対し、ノード１で実行されていたＤＢ＃１の処理を引き継ぐように指示する。この指示を受けたノード３の監視エージェント１０は、監視情報リポジトリ２５中のＤＢ＃１に関する起動情報等に基づいてその再起動を実行する。

【００６９】本システムによれば、ＣＰＵの例えば過去の稼働状況に基づいて、ＣＰＵ負荷が比較的厳しくないノードに、ダウンしたＤＢアプリケーションの処理引き継ぎが行われる。

【００７０】なお、上述の例では、既にフェールオーバ作業中であるノードの負荷を考慮した換算ＣＰＵ稼働率が最小となるノードを代替ノードに選択したが、そのような考慮を行わずに、平均ＣＰＵ稼働率が最小値をとるノードを選択することとしてもよい。また、必ずしもそれらＣＰＵ稼働率が最も小さくなくてもよく、例えばＣＰＵ負荷が所定の余裕を有することに基づいて選択を行うことができ、この場合、例えば、ＣＰＵ稼働率が所定の閾値以下となるノードのうち任意のものを選択することができる。

【００７１】また、上述の例では、サンプリングデータ保存期間全体での平均に基づいて換算ＣＰＵ稼働率、又は平均ＣＰＵ稼働率を求めたが、例えば、最新の何回かのサンプリングで得られた資源情報の平均に基づいて代替ノードを選択することもできる。

【００７２】さらに、資源情報に登録されるＣＰＵ稼働率についての平均以外の統計情報を求め、それを考慮して代替ノードを決定することもできる。例えば、ＣＰＵ稼働率の分散等から推定されるＣＰＵ稼働率の時間的な変動を考慮して、単に平均値が小さいだけでなく、安定してＣＰＵ稼働率が小さいものを代替ノードに選択してもよい。

【００７３】［実施の形態３］本発明の第３の実施形態を、図を参照して説明する。実施の形態２は、監視情報リポジトリ２５に登録されるＣＰＵ稼働率を利用し、プロセッサ負荷に基づいて代替ノードを選択した。これに対し本実施の形態は、監視情報リポジトリ２５に登録される空きメモリ量を利用し、それに基づいて代替ノードを選択する点が実施の形態２と異なる。以下、上記各実施の形態と同様の内容については説明を省略し、それらとの相違点に重きを置いて説明する。なお、上記各実施の形態と同様の構成要素には同一の符号を付し、記載の簡潔を図る。

【００７４】図１２は、本実施の形態の特徴的処理を説明するフロー図である。この処理は、図８の処理ステップＳ５００～Ｓ５３０及び図９のループ処理ステップＳ６１０～Ｓ６４０に置き換わるものである。

【００７５】すなわち、本システムの各ノード上の監視エージェント１０は互いに非同期にサンプリング間隔毎に動作し、自ノード内のあるＤＢアプリケーションがダウンしていること、又は他のあるノード全体がダウンしていることを検出すると、実施の形態１のステップＳ２２５又はＳ４３５に相当するＤＢアプリケーションダウン時の処理及びノードダウン時の処理を行うわけであるが、本実施の形態におけるこれらの処理は、図１２のフローで一部を置換された図８，９のフローで表される。

【００７６】各ノードの監視エージェント１０は、各ノードの基準空きメモリ量を監視情報リポジトリ２５から取得する。基準空きメモリ量は、各ノードの起動直後の空き実メモリ量であり、基本的にはＯＳ等のノード稼働に必須のソフトウェアのみメモリ上に存在し、他のアプリケーションがまだメモリ上に存在しない状態での空きメモリ量を表す。各監視エージェント１０は、これら各ノードの基準空きメモリ量を比較して、その最大値M_{max}を求める。この処理は、例えば、図３に示すステップＳ５０の処理中に行うように構成される。

【００７７】次に、図１２の処理フローを説明する。監視エージェント１０は、自ノードのＤＢアプリケーションにダウン状態のものを検知した場合、及び他のノード

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全体がダウンしていることを検知した場合に、監視情報リポジトリ２５に登録されている全てのノードを対象とした以下の内容のループ処理を行う（Ｓ８００，Ｓ８２０）。このループ処理の１回のループは１つのノードに対応した処理であり、監視エージェント１０はそのノードに関する資源情報に含まれる空きメモリ量を例えば監視情報リポジトリ２５に保存されている全サンプリング回数について平均し、その平均値をM_{max}で除した値として定義されるメモリ余裕度ｍを求める（Ｓ８０５）。

【００７８】続いて、監視エージェント１０は、当該ノードが、現在の検査実行エージェント以外の他ノードの監視エージェントにより“フェールオーバ作業中”であるか否かを判定し（Ｓ８１０）、その結果に基づいて換算メモリ余裕度が算定される。換算メモリ余裕度m^*は、ステップＳ８０５で計算されたメモリ余裕度ｍに換算率βを乗じることにより求められる。ステップＳ８１０にてフェールオーバ作業中と判定された場合には、βは０以上１未満の定数（例えば０．１）とされ、これを乗じて換算メモリ余裕度m^*が求められる（Ｓ８１５）。一方、ステップＳ８１０にて、フェールオーバ作業中ではないと判定された場合には、βは１とされる、すなわち、ステップＳ８１０で求められたメモリ余裕度ｍがそのまま換算メモリ余裕度m^*とされる。監視エージェント１０は、この換算メモリ余裕度m^*を決定すると、当該ノードについてのループ処理を終了し、次のノードのループ処理に移る。

【００７９】監視エージェント１０は上記ループ処理により、ネットワーク接続されたシステムの各ノードの代替ノード候補としての可否、及び換算メモリ余裕度を定めると、代替ノード候補のうち換算メモリ余裕度が最も大きいノードを代替ノードとして選択し、当該代替ノードに対し、ＤＢアプリケーションのダウンが確認されたノード名（すなわち自ノード名）とダウン状態のＤＢ名をメッセージとして送信することによりダウンしたＤＢアプリケーションの再起動を指示する（Ｓ８２５）。

【００８０】ちなみに、ノード状態がフェールオーバ作業中である場合に０以上１未満のβを乗じるのは、既にフェールオーバ作業中のノードへは新たなフェールオーバ作業の依頼が行われることを抑制し、なるべくフェールオーバ作業を行っていないノードへ依頼が行われるようにして処理分散を図るためである。

【００８１】本システムによれば、メモリの例えば過去の空き状況に基づいて、メモリの余裕が比較的大きいノードに、ダウンしたＤＢアプリケーションの処理引き継ぎが行われる。メモリの余裕が大きい場合には、スワッピングが抑制されることによりキャッシュのヒット率が向上したり、スラッシングが防止されることにより高い処理効率が得られる。

【００８２】なお、上述の例では、既にフェールオーバ作業中であるノードの負荷を考慮した換算メモリ余裕度が最大となるノードを代替ノードに選択したが、そのような考慮を行わずに、単純なメモリ余裕度が最大値をとるノードを選択することとしてもよい。また、必ずしもそれらメモリ余裕度が最も大きくなくてもよく、例えばメモリ余裕度が所定の閾値以上となるノードのうち任意のものを選択することができる。

【００８３】また、上述の例では、サンプリングデータ保存期間全体での平均に基づいて換算メモリ余裕度、又は単純なメモリ余裕度を求めたが、例えば、最新の何回かのサンプリングで得られた資源情報の平均に基づいて代替ノードを選択することもできる。

【００８４】さらに、資源情報に登録される空きメモリ量（又はメモリ余裕度）についての平均以外の統計情報を求め、それを考慮して代替ノードを決定することもできる。例えば、メモリ余裕度の分散等から推定される空きメモリ量の時間的な変動を考慮して、単に平均値が大きいだけでなく、安定してメモリ余裕度が大きいものを代替ノードに選択してもよい。

【００８５】［実施の形態４］本発明の第４の実施形態は、監視情報リポジトリ２５に登録されるＣＰＵ稼働率と空きメモリ量との双方を利用して代替ノードを選択する点が、ＣＰＵ稼働率のみ利用する実施の形態２や空きメモリ量のみ利用する実施の形態３と異なる。以下、上記各実施の形態と同様の内容については説明を省略し、それらとの相違点に重きを置いて説明する。なお、上記各実施の形態と同様の構成要素には同一の符号を付し、記載の簡潔を図る。

【００８６】本実施の形態では、ＣＰＵ稼働率と空きメモリ量との双方を用いて「空き資源率」なるパラメータをノードごとに算出し、その値に基づいて代替ノードを選択する。つまり、一般に計算機における「資源」はＣＰＵ負荷、メモリ使用のそれぞれに関する独立した指標で把握されるが、本実施の形態では、それらの指標を、あるノードの資源のうち他の処理に利用可能な資源の割合を表す「空き資源率」という一つの指標に統合する。

【００８７】例えば、空き資源率は、次のように定義される。ＣＰＵ稼働率をＷ（$0 \leqq W \leqq 1$）で表すと、ＣＰＵ空き率ωは（１－Ｗ）で表される。メモリに関しては、空きメモリ量をＥで表し、また、実施の形態３と同様にしてM_{max}を求め、これらの比（E/M_{max}）をメモリ空き率εと定義する。そして、これらＣＰＵ空き率ωとメモリ空き率εとの相加平均［$(\omega+\varepsilon)/2$］を空き資源率と定義する。

【００８８】監視エージェント１０（検査実行エージェント）は、このように定義した空き資源率が最大となるノードを代替ノードに選択する。

【００８９】本発明の趣旨は、ＣＰＵ稼働率と空きメモリ量との双方を考慮して代替ノードを決定する点にあり、上に示した空き資源率の定義は一例に過ぎない。例えば、$(k_1 \cdot \omega + k_2 \cdot \varepsilon) / (k_1 + k_2)$、$(\omega^2 +$

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ε'）／２、（$\omega \cdot \varepsilon$）$^{1/2}$といったもので空き資源率を定義することも可能である。

【００９０】このようにＣＰＵ稼働率と空きメモリ量との双方を考慮することにより、ノードの資源の余裕度の評価の信頼性が高くなり、より適切に代替ノードを決定することができる。

【００９１】［実施の形態５］上記各実施の形態では、フェールオーバ先の空き資源の度合いを計算し、余裕があるノードへダウンしたＤＢアプリケーションの処理の引き継ぎを行わせるものであった。これらの方式では、代替ノードは動的に決定され、余裕度のあるものが選択されるので、そのようにして決定された代替ノードでフェールオーバが不可能である可能性は低い。しかし、それでもなお、資源が最も空いたノードを選択したにも拘わらずフェールオーバするには資源（特にメモリ資源）が足りない可能性は残る。

【００９２】本発明の第５の実施形態は、これに対処するものであり、フェールオーバ先のノードで現在稼働中のＤＢアプリケーションが獲得しているメモリを動的に変更、すなわち空きメモリ量を必要に応じて増加させ、フェールオーバを支障なく実行するものである。

【００９３】以下、上記各実施の形態と同様の内容については説明を省略し、それらと本実施の形態との相違点に重きを置いて説明する。なお、上記各実施の形態と同様の構成要素には同一の符号を付し、記載の簡潔を図る。

【００９４】図１３は、本実施の形態の特徴的処理を説明するフロー図である。この処理は、基本的には図４のＤＢ再起動処理Ｓ１０５内に追加されるものである。

【００９５】すなわち、タイマー処理が監視エージェント１０の処理を開始させると、ＤＢ再起動処理Ｓ１０５が開始され、その中でまず、監視エージェント１０は、ＤＢ再起動を指示するメッセージを受信していることを確認すると、それに指示されたＤＢ名に対応する起動情報を監視情報リポジトリ２５から取得するとともに、現在の自ノードの空きメモリ量を把握する。そして起動情報中のデータである当該ＤＢシステムの運用に用いられる標準メモリ量（所要空きメモリ量）と、現在の空きメモリ量とを比較する（Ｓ９００）。もし、空きメモリ量が標準メモリ量より大きい場合には（Ｓ９００）、ＤＢ再起動に支障がないので、上記各実施の形態と同様のフェールオーバ処理によるＤＢの起動が開始される（Ｓ９２５）。

【００９６】一方、空きメモリ量が標準メモリ量より小さい場合には、そのままＤＢ再起動を行うと、ＤＢアプリケーションを起動できないか、起動できても運用に支障を生じる可能性がある。よって、この場合には監視エージェント１０は、監視情報リポジトリ２５の自ノード情報に登録されている先に起動されている全てのＤＢエントリのうち、フェールオーバされるＤＢアプリケーションより優先度の低いＤＢアプリケーションを対象とした以下の内容のループ処理を行う（Ｓ９０５，Ｓ９２０）。このループ処理の１回のループは１つのＤＢエントリに対応した処理であり、監視エージェント１０はそのＤＢエントリに対して、現在よりも縮小された新たなメモリ割り当て量を決定する（Ｓ９１０）。そして、当該先に起動されているＤＢアプリケーションを一旦終了した後、ステップＳ９１０で決定した割り当て量に基づいて再起動する（Ｓ９１５）。これによりメモリの再編成が行われ、ループ処理が対象とする全てのＤＢエントリについて処理が終わると、メモリ上にはフェールオーバ対象のＤＢアプリケーションの運用に必要な量の空きが生成されている。監視エージェント１０は、ステップＳ９００にて空きメモリ量が標準メモリ量より小さいと判定された場合には、このようにして空きメモリ量を拡大した後、上記各実施の形態で行ったと同様にしてフェールオーバ対象のＤＢアプリケーションを起動する（Ｓ９２５）。ちなみに、このステップＳ９２５におけるＤＢアプリケーションの起動は、監視情報リポジトリ２５に登録された起動情報中の起動のためのスクリプトファイル等を参照して実行される。

【００９７】先起動のＤＢアプリケーションに対する新たなメモリ割り当て量の具体的な決定方法の例を次に説明する。例えば、新たなメモリ割り当て量の決定においては、対象となるＤＢエントリの実行優先度を考慮することができる。監視情報リポジトリ２５には、各ＤＢエントリの実行優先度が登録されており、監視情報リポジトリ２５の説明で述べたように、ここでは、実行優先度はそれが高い程、大きな数値で表される。ここで、ＤＢエントリ「ＤＢ＃ｉ」の優先度を表す数値をP_iとすると、ＤＢエントリ「ＤＢ＃ａ」に対する割り当てメモリの縮小量R_aを次式で計算する。なお、この式の中でＬは、フェールオーバ対象ＤＢの起動に不足しているメモリ量であり、その標準メモリ量から現在の空きメモリ量を差し引いた値である。また、総和“Σ”はステップＳ９０５で対象とされる全てのＤＢエントリ（すなわち、フェールオーバ対象のＤＢエントリより優先度の低いもの）について計算される。

【００９８】$R_a = L \cdot P_a / \Sigma P_i$

そして、ＤＢエントリ「ＤＢ＃ａ」に対する新たなメモリ割り当て量は、当該エントリに対して監視情報リポジトリ２５に格納されている運用時標準メモリ量からR_aを差し引いた値に決定される。

【００９９】このように、フェールオーバ対象のＤＢアプリケーションの実行に空きメモリ量が不足している場合でも、先行して起動されている他のＤＢアプリケーションに割り当てられるメモリ量を縮小・再編成することにより、フェールオーバ処理が一層、確実に実行される。

【０１００】［実施の形態６］上記実施の形態５では、

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先行して起動されているＤＢアプリケーションの使用メモリ量を変更することにより、フェールオーバ対象のＤＢアプリケーションの実行に必要な空きメモリ量が確保された。このメモリ割り当ての変更に際し、先行して起動されているＤＢアプリケーションは一旦終了される。本実施の形態は、この先行起動ＤＢアプリケーションの終了及び再起動の際のマンマシンインターフェースの改善に関わるものである。すなわち、本実施の形態は、稼働中のＤＢシステムのメモリ使用量を縮小してフェールオーバ対象のＤＢシステム起動に必要な空きメモリ量を確保する実施の形態５において、当該メモリ縮小時に、稼働中のＤＢシステムの処理の継続性を担保し、エンドユーザにＤＢシステムが停止されることを意識させないように構成したことを特徴とするものである。

【０１０１】以下、上記各実施の形態と同様の内容については説明を省略し、それらと本実施の形態との相違点に重きを置いて説明する。なお、上記各実施の形態と同様の構成要素には同一の符号を付し、記載の簡潔を図る。

【０１０２】エンドユーザとＤＢシステムとがネットワークを介してメッセージを交換しながら処理を進めるシステム形態においては、エンドユーザ側ノードとＤＢシステム動作ノードそれぞれの処理は複数の機能レイヤを含む階層構造に構成される。

【０１０３】図１４は、エンドユーザ側ノードとＤＢシステム動作ノードとの機能レイヤ構成例を示す模式図である。エンドユーザ側ノード１０００には、上位のレイヤからエンドユーザアプリケーション１００２、ＤＢシステム用の端末側メッセージ交換モジュール１００４及びネットワーク制御層１００６の３つのレイヤが示され、一方、ＤＢシステム動作ノード１０１０には、上位のレイヤからＤＢアプリケーション１０１２、ＤＢシステム用のサーバ側メッセージ交換モジュール１０１４及びネットワーク制御層１０１６の３つのレイヤが示されている。そして、両ノードは最下位のレイヤであるネットワーク制御層間を物理的なコネクション１０２０で接続される。なお、このレイヤ構成は一例であって、例えば各レイヤをさらに細かく分けることも可能である。例えば、ネットワーク制御層１００６，１０１６は、ＴＣＰ／ＩＰプロトコルではネットワーク層、データリンク層及び物理層に対応することとなる。

【０１０４】エンドユーザアプリケーション１００２から発行されるメッセージは、端末側メッセージ交換モジュール１００４を介して、ネットワーク制御層１００６に渡される。ネットワーク制御層１００６とネットワーク制御層１０１６との間では、ケーブルなどの物理的なコネクション１０２０を介して、信号の授受が行われる。ＤＢシステム動作ノード１０１０のサーバ側メッセージ交換モジュール１０１４は、ネットワーク制御層１０１６からのメッセージを常時受け入れることができるように監視を行い、メッセージの到着を確認すると、そのメッセージをＤＢアプリケーション１０１２に渡す。逆に、ＤＢアプリケーション１０１２からの結果出力は、サーバ側メッセージ交換モジュール１０１４、ネットワーク制御層１０１６、コネクション１０２０、ネットワーク制御層１００６、端末側メッセージ交換モジュール１００４を順にたどって、エンドユーザアプリケーション１００２に渡される。

【０１０５】さて、図１４に示すようなシステム構成において、フェールオーバ時には先行して稼働されている１又は複数のＤＢアプリケーション１０１２の実行プロセス（以下、ＤＢプロセスと呼ぶ）に対するメモリ量の変更処理が行われうる。このメモリ変更処理は、ＤＢこのとき、ＤＢプロセスを正常に終了させ、新たなメモリ量で再実行させることで実現され、その際のエンドユーザアプリケーション１００２と各ＤＢアプリケーション（ＤＢプロセス）１０１２との間のセッションの維持の機能は主としてサーバ側メッセージ交換モジュール１０１４が担う。すなわち、サーバ側メッセージ交換モジュール１０１４は、エンドユーザから見て、セッション（エンドユーザアプリケーションとＤＢアプリケーションのレベルで相互にメッセージの交換が可能な状態）があたかも切断されていない、つまり擬似的にセッションがつながっているように見せる機能を有している。

【０１０６】図１５は、本実施の形態の特徴的処理を含んだメモリ再編成処理を説明するフロー図である。この処理は、基本的には図１３のメモリ再編成処理Ｓ９１５の位置において実行される処理ステップを構成する。

【０１０７】監視エージェント１０は自ノードにおいて先行して起動されているＤＢプロセスに対し決定される新メモリ割り当て量を得ると（Ｓ１１００）、サーバ側メッセージ交換モジュールに対し、ＤＢ再起動準備要求信号を発する（Ｓ１１０５）。

【０１０８】この要求信号を受信したサーバ側メッセージ交換モジュールは、セッション維持のためのセッション処理（詳細は後述する）を行い、監視エージェント１０へ準備済み信号を送信する（Ｓ１１１０）。監視エージェント１０は、この準備済み信号を受信した後、チェックポイント処理を行う（Ｓ１１１５）。チェックポイント処理は、ＤＢプロセスのメモリ空間にあるデータベースのデータ断片と実際にディスクに記録されているデータ断片の内容とが異なる場合に、メモリ上のデータ断片をディスクに書き込む処理である。チェックポイント処理Ｓ１１１５を行った後に、監視エージェント１０はＤＢシステムを停止させる（Ｓ１１２０）。なお、その停止方法は、個々のＤＢシステムに依存する。

【０１０９】次に、監視エージェント１０は、各ＤＢプロセス毎に、磁気ディスク装置等に格納されている全てのＤＢパラメータファイルを読み出すループ処理を行う（Ｓ１１２５，Ｓ１１４０）。このループ処理内では、

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磁気ディスク装置１１３０から例えば一つずつパラメータファイルを読み込む。このパラメータファイルは、ＤＢプロセスに割り当てるメモリ量等のＤＢプロセス起動条件を外部から指定するためのファイルであり、ＤＢシステムはこのパラメータファイルに応じた種々の条件で起動される。なお、その起動の仕方は個々のＤＢシステムに依存し様々である。さて、監視エージェント１０は磁気ディスク装置１１３０から読み込んだパラメータファイルからＤＢプロセスに割り当てられるメモリ量情報が取り出される（Ｓ１１３５）。

【０１１０】このようにループＳ１１２５～Ｓ１１３５を終了した段階では、あるＤＢシステムに対する種々の起動条件におけるメモリ所要量が取り出される。監視エージェント１０は、それらの中に、ステップＳ１１００で得た新メモリ割り当て量に等しいものを見いだした場合には、当該メモリ所要量に対応するパラメータファイルを、再起動に用いるパラメータファイルとして選択する。また、それらの中に、新メモリ割り当て量に等しいものが存在しない場合には、その新メモリ割り当て量を超えず、それに最も近いメモリ所要量を選択し、それに対応するパラメータファイルを、再起動に用いるパラメータファイルとして選択する（Ｓ１１４５）。

【０１１１】監視エージェント１０は選択した再起動用パラメータファイルを用いてＤＢシステムの再起動を行う（Ｓ１１５０）。そして、サーバ側メッセージ交換モジュールに対してＤＢ起動済み信号を送信する（Ｓ１１５５）。

【０１１２】サーバ側メッセージ交換モジュールはＤＢ起動済み信号を受信に応じたセッション処理（後述する）を行う（Ｓ１１６０）。以上のようにして本実施の形態のシステムはメモリ再編成処理を行う。

【０１１３】次に、サーバ側メッセージ交換モジュールにおけるセッション処理について説明する。サーバ側メッセージ交換モジュールは、「セッションＩＤ」、「トランザクションＩＤ」、「端末情報」、「メッセージチェイン」といった情報の組をセッション毎に格納したセッション情報テーブルを有している。

【０１１４】ここで、「セッションＩＤ」は、セッション毎に一意に割り当てられる識別子である。これはＤＢプロセスによって割り当てられ、サーバ側メッセージ交換モジュールは、ＤＢプロセスからセッションＩＤを通知される。

【０１１５】「トランザクションＩＤ」はトランザクションを管理するための識別番号であり、これは、ＤＢプロセスによって割り当てられ、サーバ側メッセージ交換モジュールは、トランザクションが発生した時点でＤＢプロセスからトランザクションＩＤを通知される。なお、「トランザクション」とは、あるセッションにおいて、ＤＢに対して変更、追加、削除の操作が一回以上行われる場合、この操作が最初に行われた時点から“確定”メッセージがＤＢプロセスによって受け付けられるまでをいう。

【０１１６】「端末情報」は端末と通信するためにネットワーク制御層において必要とされる情報である。ちなみに、これはどのような種類のネットワーク（例えばＴＣＰ／ＩＰ等）を使用するかに応じて異なり得る。

【０１１７】「メッセージチェイン」は、ＤＢシステム動作ノード１０１０がエンドユーザ側ノード１０００から受け取ったメッセージのうち、その時点ではＤＢプロセスに渡すことができないものを保留するための仕組みである。図１６は、メッセージチェインの構造を説明する模式図である。セッション情報テーブル中には、メッセージチェインの先頭アドレスを表すメッセージチェインポインタ１２００が格納される。メッセージチェインポインタ１２００が指し示すメモリ上、又は磁気ディスク上のアドレスから連続する領域に先頭のメッセージエントリ１２０２が格納され、例えば、そのメッセージエントリの前部にはメッセージの実体が、また後部には次のメッセージエントリの先頭アドレスを示す次のポインタ１２０４が格納される。このように各メッセージエントリがそれに続くメッセージエントリの開始アドレス情報を有することにより各メッセージエントリは順に接続された鎖状の構造を形成する。ちなみに、サーバ側メッセージ交換モジュールは、先頭のメッセージについてＤＢプロセスに渡す等の処理を済ますと、その先頭メッセージのエントリに格納された次メッセージエントリへのポインタ１２０４をメッセージチェインポインタ１２００に転記して、当該先頭メッセージエントリをチェインから外す。

【０１１８】サーバ側メッセージ交換モジュールには、以下に説明する「通常状態」、「準備中状態」、「準備済み状態」の３つの状態が定義される。

【０１１９】「通常状態」は、サーバ側メッセージ交換モジュールが再起動要求信号を受け取っていない状態で、エンドユーザアプリケーションとＤＢプロセスとが制約なしにメッセージ交換できる状態である。

【０１２０】「準備中状態」は、再起動要求信号を受信し、一つ以上のセッション情報にトランザクションＩＤが登録されている状態であり、エンドユーザアプリケーションとＤＢプロセスとのメッセージ交換には次の制約が課される。

【０１２１】（１）新規のセッション要求は受け付けない、（２）セッション情報にトランザクションＩＤが設定されているセッションは当該トランザクションが確定、終了されるまでメッセージ交換を可能とする、（３）セッション情報にトランザクションＩＤが設定されていないセッションについてエンドユーザアプリケーションからメッセージが届いたとき（例えば、前トランザクションが終了したセッションについて新たなトランザクションの開始となるメッセージが届いたとき）は、

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当該メッセージをメッセージチェインに登録しＤＢプロセスに伝達しない。

【０１２２】すなわち、準備中状態では、新たなセッション、トランザクションの開設は認めず、その一方で現存のトランザクションについてのみＤＢに対する実際の処理を認め、その正常な終了を待つわけである。

【０１２３】「準備済み状態」は、再起動要求信号を受信し、セッション情報が全く無い状態、または全てのセッション情報にトランザクションＩＤが登録されていない状態であり、この場合には、エンドユーザアプリケーションとＤＢプロセスとのメッセージ交換には次の制約が課される。

【０１２４】（１）新規のセッション要求は受け付けない、（２）セッション情報にエンドユーザアプリケーションからメッセージが届いたときは、当該メッセージをメッセージチェインに登録しＤＢプロセスに伝達しない。

【０１２５】すなわち、準備済み状態は、ＤＢシステムを停止できる状態であり、メモリ再編成処理のための準備ができたという意味である。この状態は、監視エージェント１０からのＤＢ起動済み信号によって「通常状態」へ遷移する。

【０１２６】図１７～２０は、サーバ側メッセージ交換モジュールでの処理を説明するためのフロー図である。これらの図は、便宜上一つのフロー図を分割したものであり、それらに現れる同一記号で示されるノード同士は互いに接続されることを意味する。例えば、図１７の円内に“Ｆ”を記したノードＡから、図１８の同様に表されるノードＦへ処理が渡されることになる。

【０１２７】サーバ側メッセージ交換モジュールは、ＤＢプロセスからのメッセージ、ネットワークを介したエンドユーザアプリケーションからのメッセージ、監視エージェント１０からのメッセージを受け取ると（Ｓ１３００）、それが監視エージェント１０からのメッセージであるか否かを判別する（Ｓ１３０５）。判定結果が“Ｙｅｓ”である場合には、次に、当該メッセージが再起動要求信号であるかどうかが判定される（Ｓ１３１０）。判定結果が“Ｙｅｓ”であり、さらに続く判定によりセッション情報が存在し（Ｓ１３１５）、かつ既存セッション情報を調査した結果、トランザクションＩＤが設定されている場合には（Ｓ１３２０）、サーバ側メッセージ交換モジュールの状態を準備中状態とし（Ｓ１３２５）、ステップＳ１３００に戻る。ステップＳ１３１５、Ｓ１３２０において判定結果が“Ｎｏ”である場合には、稼働中のトランザクションは既に存在していないので、サーバ側メッセージ交換モジュールの状態を準備済み状態として（Ｓ１３３０）ステップＳ１３００に戻る。

【０１２８】ステップＳ１３１０において監視エージェント１０からのメッセージが再起動要求信号でない場合は、ＤＢ起動済み信号であると判断される。この場合には、セッション情報のメッセージチェインに保留されているメッセージが存在するならば（Ｓ１３３５）、全てのセッション情報において保留されているメッセージをＤＢプロセスに送信してから（Ｓ１３４０）、一方、メッセージが存在しないならばそのまま直ちに、サーバ側メッセージ交換モジュールの状態を通常状態に変更する（Ｓ１３４５）。

【０１２９】また、ステップＳ１３００で受け取ったメッセージがＤＢプロセスからのものである場合には（Ｓ１３０５，Ｓ１４００）、それがトランザクション確定済みメッセージであるかどうかが判定される（Ｓ１４０５）。判定結果が“Ｙｅｓ”である場合には、当該メッセージがどのセッションに対する返答メッセージかを調べ、そのセッションに対するセッション情報のトランザクションｉＤをクリアする（Ｓ１４１０）。その結果、全てのセッションのトランザクションＩＤがクリアされた場合（Ｓ１４１５）、サーバ側メッセージ交換モジュールの状態が準備中であれば（Ｓ１４２０）、それを準備済み状態に変更し、監視エージェント１０に準備済み信号を送信して（Ｓ１４２５）、ステップＳ１３００に戻る。一方、まだトランザクションＩＤが確定していないセッションがある場合は（Ｓ１４１５）、サーバ側メッセージ交換モジュールはそれまでの状態（通常状態又は準備中状態）を維持しステップＳ１３００に戻る。また、ステップＳ１４２０においてサーバ側メッセージ交換モジュールの状態が準備中でない場合、具体的には通常状態である場合にも、サーバ側メッセージ交換モジュールはそれまでの通常状態を維持して、ステップＳ１３００に戻る。なお、ステップＳ１４２０では、先行するステップＳ１４１０までにおいてまだトランザクションが存在したので準備済み状態ではあり得ない。

【０１３０】ステップＳ１４０５において、ＤＢプロセスからのメッセージがトランザクション確定済みメッセージではなく（Ｓ１４０５）、かつ当該メッセージ中にトランザクションＩＤが含まれている場合（Ｓ１４３０）には、新たなトランザクションの発生を示す返答メッセージである。この場合には、当該メッセージがどのセッションに対する返答メッセージであるかを調べ、そのセッションに対応するセッション情報に当該トランザクションＩＤを設定し（Ｓ１４３５）、セッション情報に基づいてエンドユーザ側ノード１０００を特定し当該メッセージを返し（Ｓ１４４０）、ステップＳ１３００に戻る。なお、サーバ側メッセージ交換モジュールの状態が準備中である場合には、このような場合は生じない。なぜなら、新たなトランザクションはエンドユーザアプリケーションからの要求に応じて発生するものであるが、サーバ側メッセージ交換モジュールの状態が準備中である場合には、後述するようにエンドユーザアプリケーションからのメッセージはメッセージチェインに格

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納されＤＢプロセスには伝達されないので、トランザクションが発生されることも、それを通知するメッセージが生じることもないからである。

【０１３１】一方、ステップＳ１４３０において、判定結果が“Ｎｏ”である場合には、現存するトランザクションに対する処理に応じたメッセージであるので、セッション情報にトランザクションＩＤを設定せずに、ステップＳ１４４０の処理を行って、ステップＳ１３００に戻る。

【０１３２】また、ステップＳ１３００で受け取ったメッセージがエンドユーザ側ノード１０００からのものである場合には（Ｓ１３０５，Ｓ１４００）、処理はサーバ側メッセージ交換モジュールの状態が通常状態であるか否かで分岐する（Ｓ１５００）。

【０１３３】通常状態である場合には（Ｓ１５００）、図１９に示す処理が行われる。まず、当該メッセージが新規セッション確立要求である場合には（Ｓ１５０５）、ＤＢプロセスにメッセージを送信する（Ｓ１５１０）。そして、それに応じてＤＢプロセスがセッションを確立する処理を行い（Ｓ１５１５）、セッション確立通知をサーバ側メッセージ交換モジュールに返すと、サーバ側メッセージ交換モジュールはそのＤＢプロセスからの応答からセッションＩＤを取得し、初期化状態の新規のセッション情報を登録し（Ｓ１５２０）、ステップＳ１３００に戻る。

【０１３４】一方、ステップＳ１５０５にて、新規セッション確立要求ではないと判定された場合には、ＤＢプロセスにメッセージを送信し（Ｓ１５２５）、ステップＳ１３００に戻る。

【０１３５】ステップＳ１５００において通常状態ではないと判定された場合、具体的にはサーバ側メッセージ交換モジュールが準備中又は準備済みの状態である場合には、上述したようなエンドユーザ側ノード１０００とＤＢプロセスとのメッセージ交換には制約が課せられる。まずメッセージが新規セッション確立要求である場合（Ｓ１６００）には、エンドユーザ側ノード１０００にエラーが返され（Ｓ１６０５）、ステップＳ１３００に戻る。

【０１３６】メッセージが新規セッション確立要求でない場合（Ｓ１６００）には、サーバ側メッセージ交換モジュールの状態が準備済み状態か、準備中状態かに応じて分岐する（Ｓ１６１０）。準備済み状態の場合には、セッション情報のメッセージチェインに当該メッセージを登録して（Ｓ１６１５）ステップＳ１３００に戻る。準備中状態の場合には、メッセージからセッションを特定する（Ｓ１６２０）。そして、対応するセッション情報にトランザクションＩＤが登録されている場合には、ＤＢプロセスにメッセージを伝達し（Ｓ１６３０）、ステップＳ１３００に戻る。トランザクションＩＤが登録されていない場合には、メッセージチェインへの登録処理Ｓ１６１５を行い、ステップＳ１３００に復帰する。

図２１は、セッション情報にトランザクションＩＤが登録されているセッションに生じる状態遷移の例を示す状態遷移図である。図に於いて、時間は上から下に経過し、各状態間の実線の矢印は、エンドユーザ側ノード１０００、サーバ側メッセージ交換モジュール及びＤＢプロセス間のメッセージ等の送受信を表し、サーバ側メッセージ交換モジュールの通常状態、準備中状態、及び準備済み状態間の点線の矢印はそれら状態間の状態遷移を表す。

【０１３７】エンドユーザ側ノード１０００とＤＢプロセスとは、通常状態のサーバ側メッセージ交換モジュールを介してメッセージ送信、それに対する結果通知を行っている（Ｐ１７００）。この状態でサーバ側メッセージ交換モジュールは、監視エージェント１０からフェールオーバのためのＤＢ再起動要求信号を受信すると、準備中状態に遷移する（Ｓ１７０５）。以降、エンドユーザ側ノード１０００とＤＢプロセスとは、既存のトランザクションがあるうちは、準備中状態のサーバ側メッセージ交換モジュールを介して、メッセージ送信、それに対する結果通知を行って処理を進める（Ｐ１７１０）。そして、エンドユーザ側ノード１０００からＤＢプロセスにトランザクションが確定したことが通知され、それに対する確定処理済みの通知がＤＢプロセスからサーバ側メッセージ交換モジュールに送信されると（Ｓ１７２０）、サーバ側メッセージ交換モジュールは状態を準備済み状態に遷移させ（Ｓ１７２５）、監視エージェント１０に対し、ＤＢ再起動処理の準備ができたことを通知する準備済み信号を発信する。以降、監視エージェント１０はＤＢ再起動処理を実施し（Ｓ１７３０）、それを終了するとサーバ側メッセージ交換モジュールに対しＤＢ起動済み信号を送信する。サーバ側メッセージ交換モジュールは、この準備済み信号送信からＤＢ起動済み信号受信までの間、エンドユーザ側ノード１０００からメッセージＳ１７３５を受信しても、それをＤＢプロセスに渡さずメッセージチェインに保留する。そしてサーバ側メッセージ交換モジュールは、ＤＢ起動済み信号を受信すると、状態を準備済みから通常状態に復帰させる（Ｓ１７４０）とともに、メッセージチェインに保留されていたメッセージをＤＢプロセスに渡す（Ｓ１７４５）。ＤＢプロセスの保留メッセージに対する処理は、保留されずにそのまま渡されたメッセージに対するものと変わりなく、ＤＢプロセスはその処理結果をエンドユーザ側ノード１０００に通知する（Ｓ１７５０）。

【０１３８】以上のような本実施の形態の仕組みによれば、フェールオーバ対象のＤＢシステム起動に必要な空きメモリ量を確保するためのメモリ再編成処理において稼働中のＤＢシステムを停止する場合に、実行中のトランザクションは正常に終了され、またエンドユーザが発したメッセージは拒否されることなく、例えばＤＢ再起

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動中においてもメッセージチェインに保留され、再起動終了後に引き続いて対応する処理が行われる。つまり、ＤＢ再起動時におけるＤＢプロセスの処理内容自体の継続性が担保されるとともに、エンドユーザに対するインターフェースとしても、ＤＢシステムが途切れることなく処理を行っているように見せることができる。

【０１３９】

【発明の効果】本発明に係る計算機システムによれば、ネットワーク接続された各ノードがそれぞれの稼働状態を監視し、その監視結果に基づいて実行障害を生じたノードの処理を引き継がせる代替ノードを選択するので、代替ノードとしてそのときのシステムの状態に応じた最適なものが動的に選択されるという効果が得られる。

【０１４０】また本発明に係る計算機システムによれば、各ノードのプロセッサ負荷の監視結果に基づいて代替ノードが選択される。例えばプロセッサ負荷が最小になるノードが代替ノードに選択される。これにより、プロセッサ負荷が厳しくないノードが代替ノードに選択され、プロセッサ負荷の面でシステム内での負荷分散が図られ、処理の速度の確保が図られるという効果が得られる。

【０１４１】また本発明に係る計算機システムによれば、各ノードのメモリ空き容量の監視結果に基づいて代替ノードが選択される。例えばメモリ空き容量が最大になるノードが代替ノードに選択される。これにより、メモリの余裕の比較的大きいノードが代替ノードに選択され、メモリ容量の面でシステム内での負荷分散が図られ、スワッピングが抑制されることによりキャッシュのヒット率が向上したり、スラッシングが防止されることにより高い処理効率が得られるといった効果が得られる。

【０１４２】また本発明に係る計算機システムによれば、各ノードのプロセッサ負荷とメモリ空き容量との双方の監視結果に基づいて代替ノードが選択される。これにより、プロセッサ負荷及びメモリ容量の両方の面を考慮してシステム内での負荷分散が図られ、処理効率が確保されるという効果が得られる。

【０１４３】また本発明に係る計算機システムによれば、代替ノードのメモリ空き容量が実行障害を生じた処理プログラムの引き継ぎに不足している場合には、代替ノードで先行して起動されているプログラムへの割り当てメモリ容量が縮小されるので、フェールオーバ処理が一層、確実に実行されるという効果がある。

【０１４４】また本発明に係る計算機システムによれば、先起動プログラムを停止してメモリ容量の割当変更を行う際に、セッション情報に基づいて既設セッション中のトランザクションが継続中か否かを判別して継続中のトランザクションに対するメッセージのみが先起動プログラムに渡される。また当該セッションに対する他のメッセージはメモリ容量の割当変更が完了するまでセッション情報に保留され、割当変更後に通常通りに処理される。これらにより、先起動プログラムを停止し、そのメモリ使用量を縮小してフェールオーバ対象の処理プログラム起動に必要な空きメモリ量を確保する場合に、先起動プログラムの処理内容の継続性が担保され、またエンドユーザには先起動プログラムが停止されることが意識されないインターフェースが提供されるという効果が得られる。

【図面の簡単な説明】

【図１】　本発明の実施の形態に係る計算機システムの構成を説明するための模式図である。

【図２】　本発明の実施の形態に係る監視情報リポジトリに格納される情報の一例の論理構成を示す模式図である。

【図３】　本発明の実施の形態に係る監視エージェントのＤＢアプリケーション状態監視に関する初期処理を説明するフロー図である。

【図４】　本発明の実施の形態に係る監視エージェントの監視処理の概略を説明するフロー図である。

【図５】　本発明の実施の形態に係る監視エージェントによる自ノードに対するＤＢ状況チェック処理Ｓ１２５を説明するフロー図である。

【図６】　本発明の実施の形態に係る監視エージェントによる全ノード処理を説明するフロー図である。

【図７】　本発明の実施の形態に係る監視エージェントによる全ノード処理を説明するフロー図である。

【図８】　実施の形態２に係る監視エージェントによるＤＢアプリケーションダウン時の処理を示すフロー図である。

【図９】　実施の形態２に係る監視エージェントによるノードダウン時の処理を示すフロー図である。

【図１０】　実施の形態２に係る監視エージェントにおけるフェールオーバ指示に応じて行われるＤＢアプリケーション再起動処理を説明するフロー図である。

【図１１】　実施の形態２に係る監視エージェントによるＤＢアプリケーションの実行障害検出時の動作の一例を説明する模式図である。

【図１２】　実施の形態３に係る監視エージェントの代替ノード選択方法を説明するフロー図である。

【図１３】　実施の形態５に係る監視エージェントによる、メモリ再編成を含んだフェールオーバ処理を説明するフロー図である。

【図１４】　実施の形態６に係る計算機システムにおけるエンドユーザ側ノードとＤＢシステム動作ノードとの機能レイヤ構成例を示す模式図である。

【図１５】　実施の形態６に係る監視エージェントによるメモリ再編成処理を説明するフロー図である。

【図１６】　実施の形態６に係るメッセージチェインの構造を説明する模式図である。

【図１７】　実施の形態６に係るサーバ側メッセージ交

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換モジュールでの処理を説明するためのフロー図である。

【図１８】　実施の形態６に係るサーバ側メッセージ交換モジュールでの処理を説明するためのフロー図である。

【図１９】　実施の形態６に係るサーバ側メッセージ交換モジュールでの処理を説明するためのフロー図である。

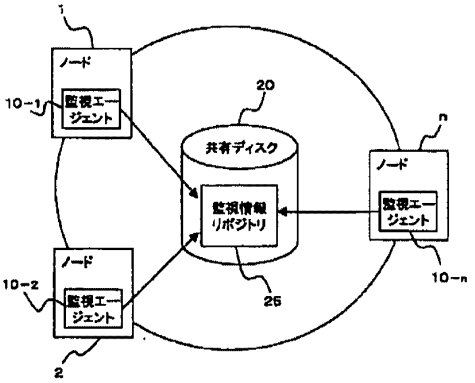
【図２０】　実施の形態６に係るサーバ側メッセージ交換モジュールでの処理を説明するためのフロー図である。

【図２１】　実施の形態６における、セッション情報にトランザクションＩＤが登録されているセッションに生じる状態遷移の例を示す状態遷移図である。

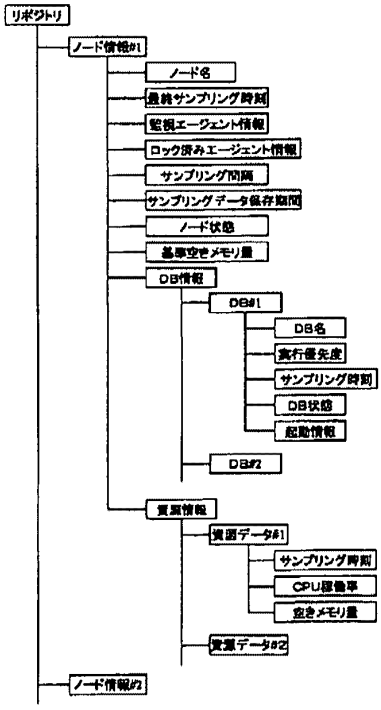
【符号の説明】

１，２，３　ノード、１０　監視エージェント、２０　共有ディスク、２５監視情報リポジトリ、１０００　エンドユーザ側ノード、１００２　エンドユーザアプリケーション、１００４　端末側メッセージ交換モジュール、１００６ネットワーク制御層、１０１０　ＤＢシステム動作ノード、１０１２　ＤＢアプリケーション、１０１４　サーバ側メッセージ交換モジュール、１０１６　ネットワーク制御層、１０２０　コネクション。

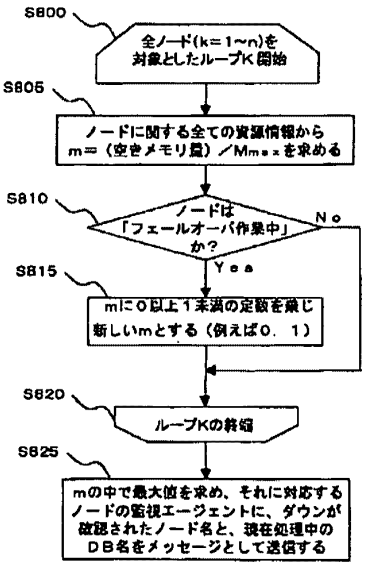
【図１】



【図２】

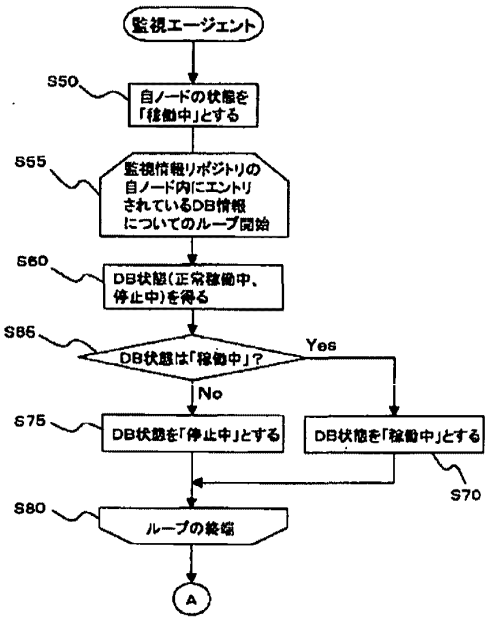


【図１２】

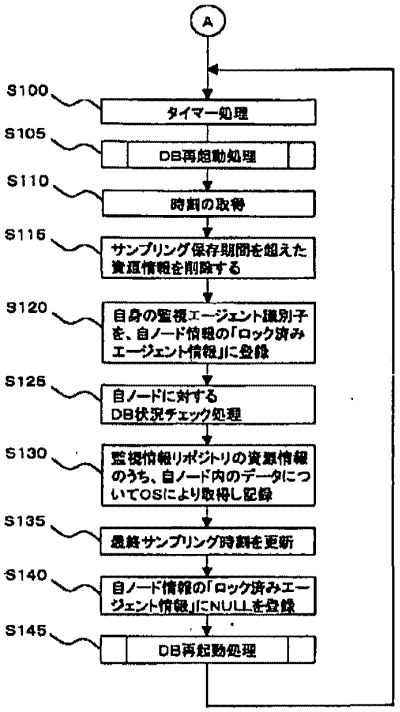


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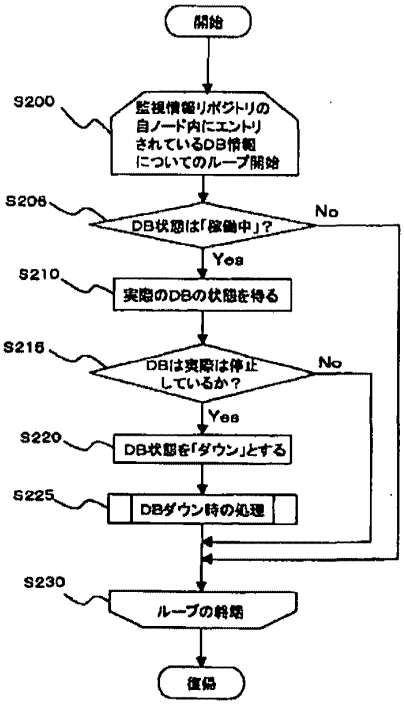
【図３】



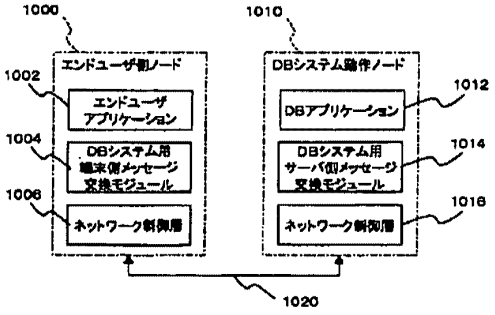
【図４】



【図５】

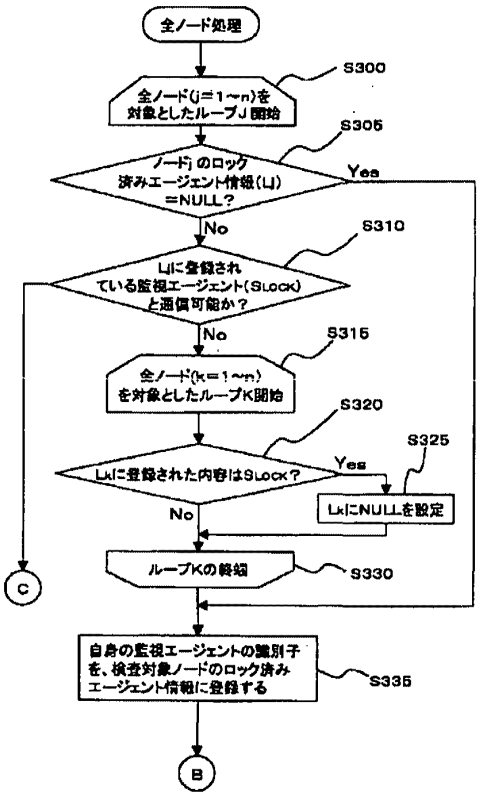


【図１４】

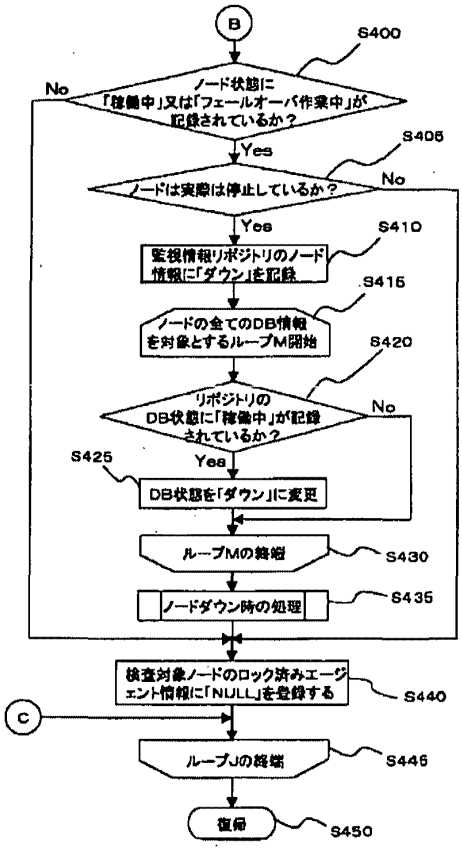


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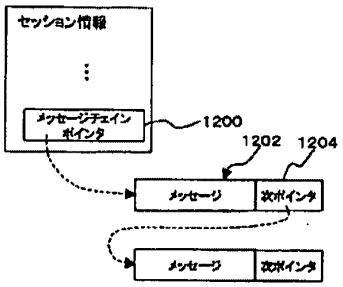
【図６】



【図７】

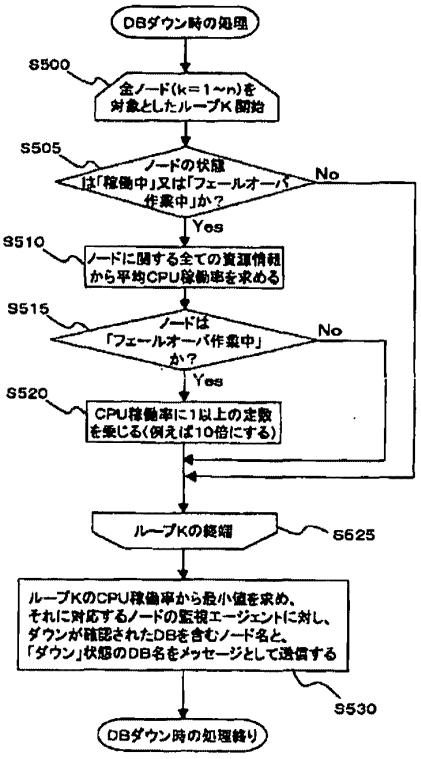


【図１６】

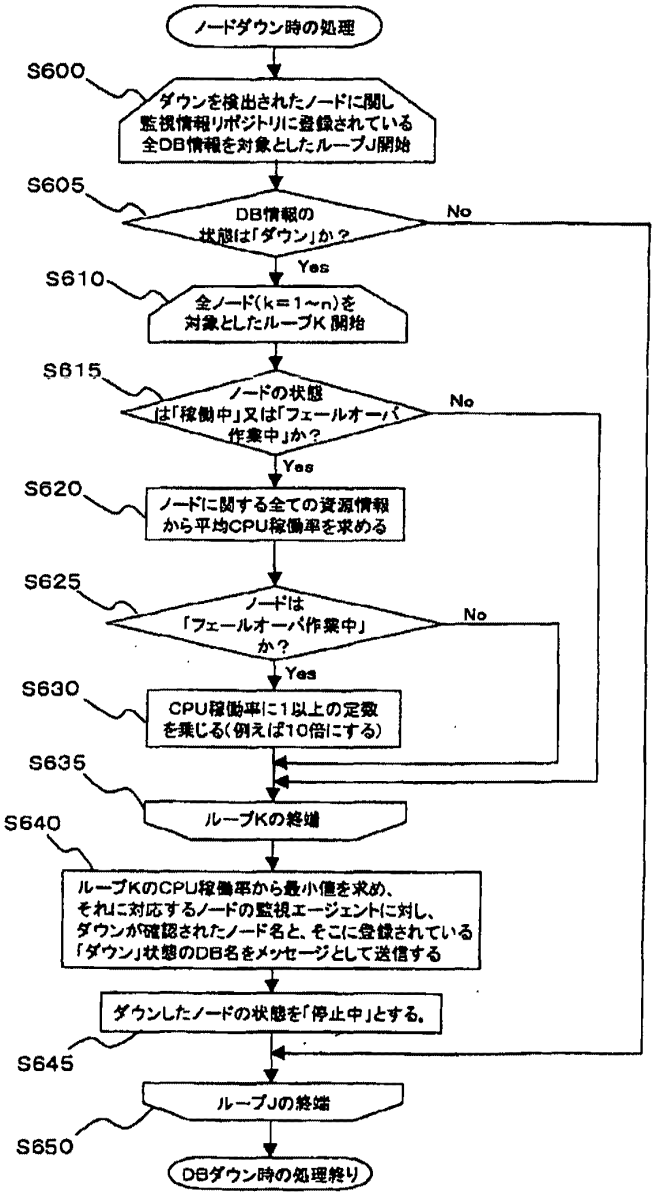


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【図８】

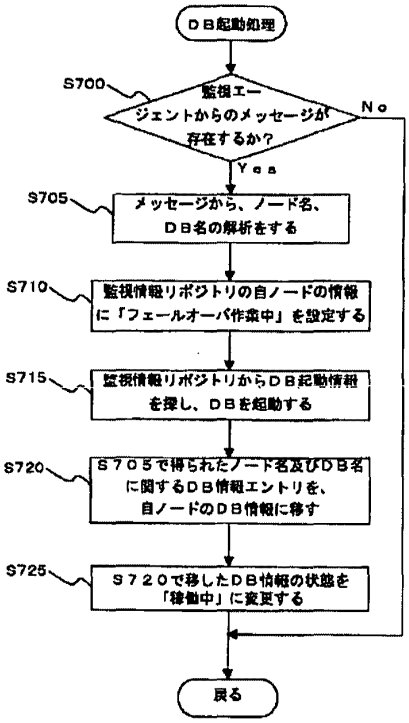


【図９】

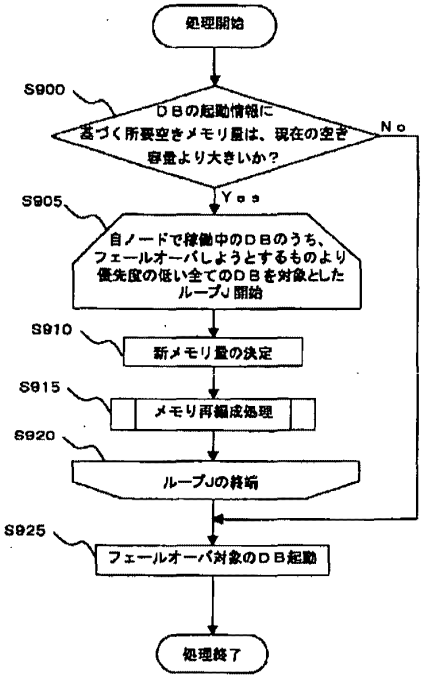


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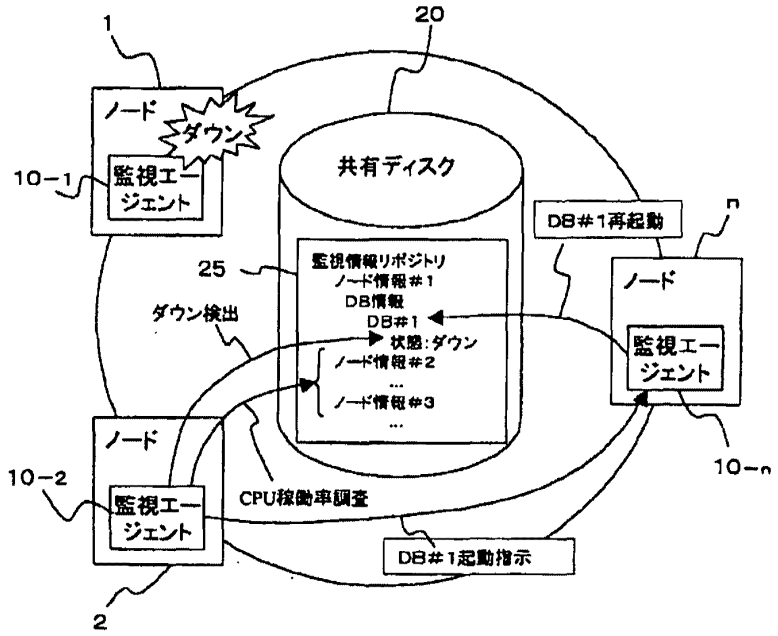
【図１０】



【図１３】

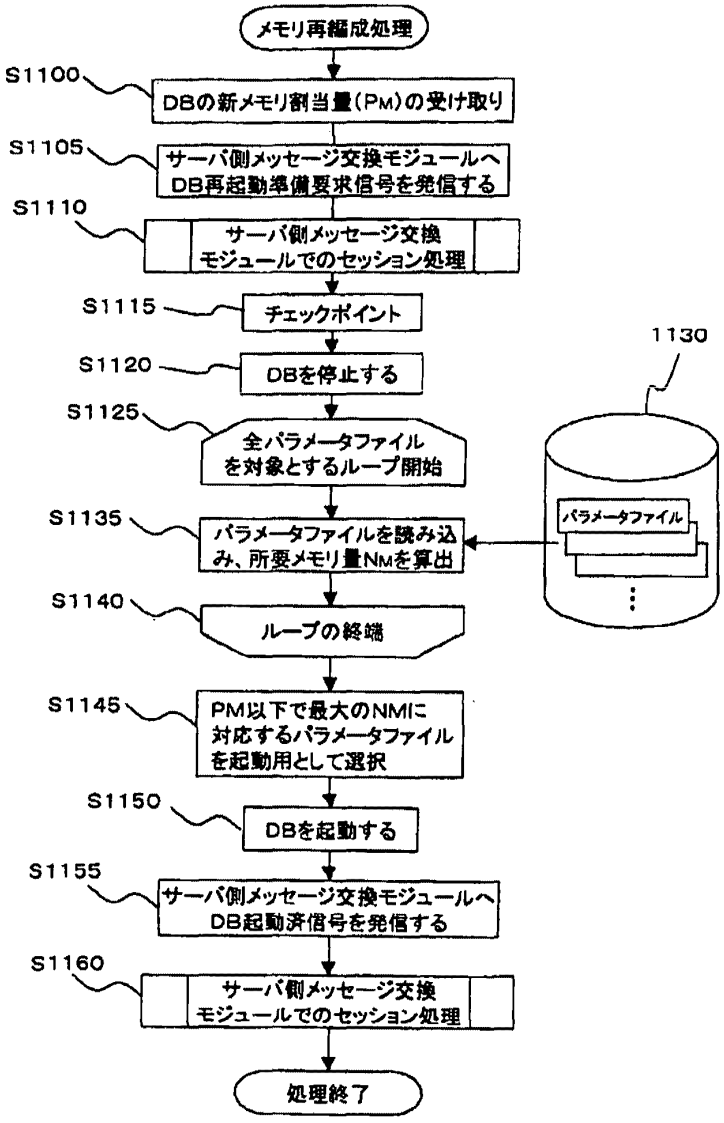


【図１１】



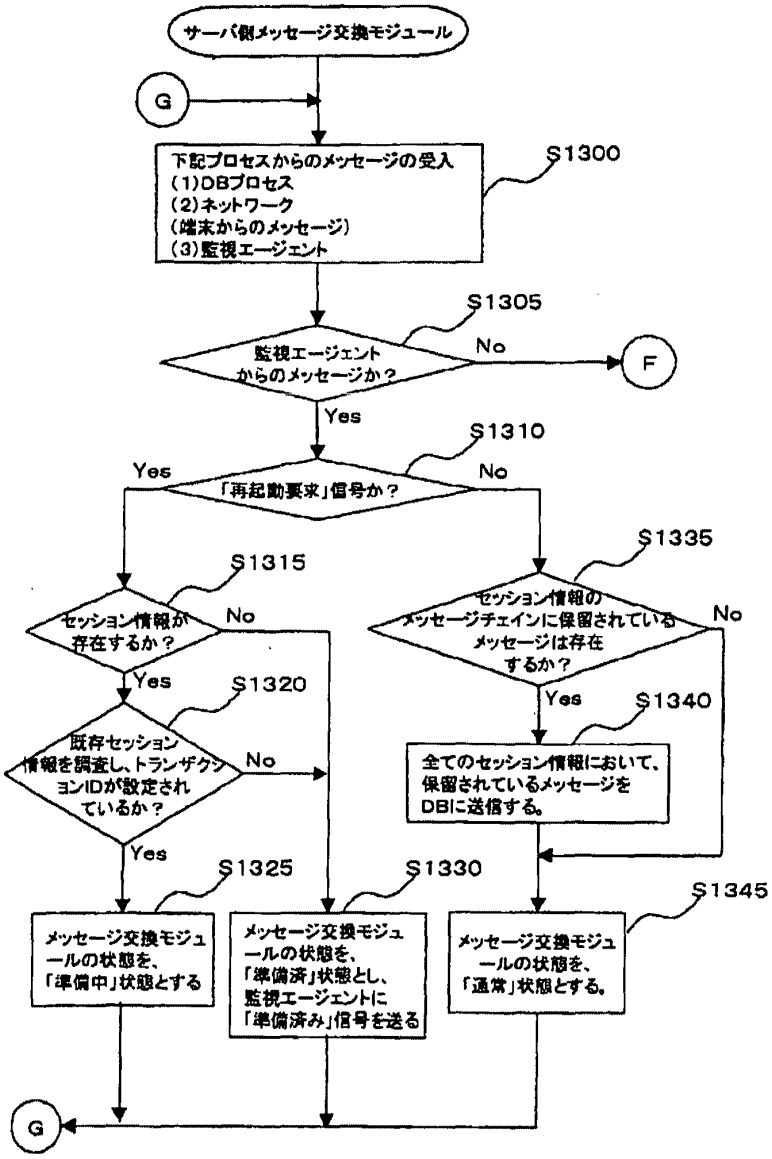
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【図１５】



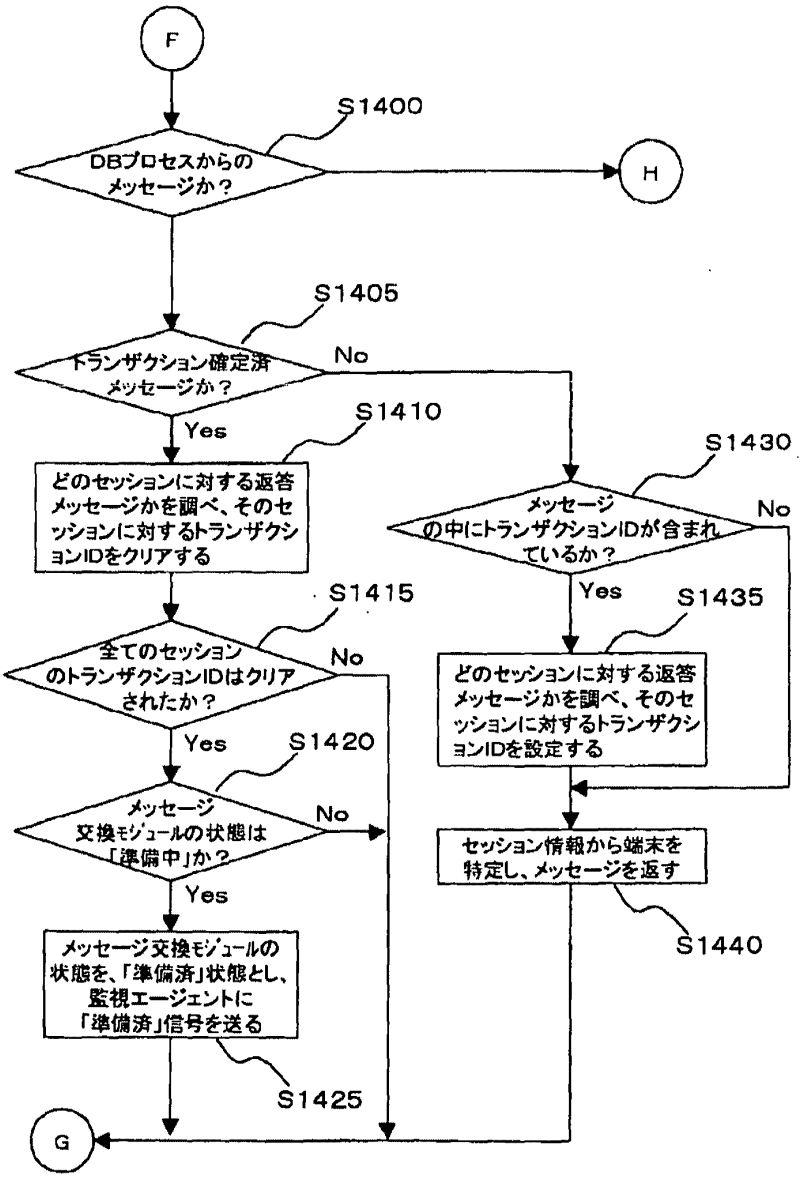
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【図１７】



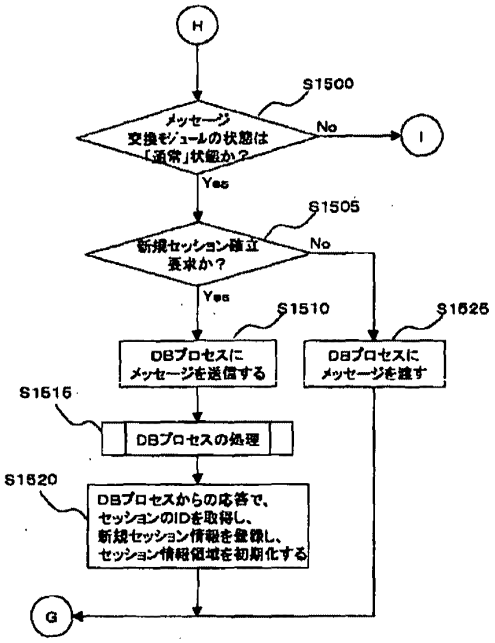
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【図１８】



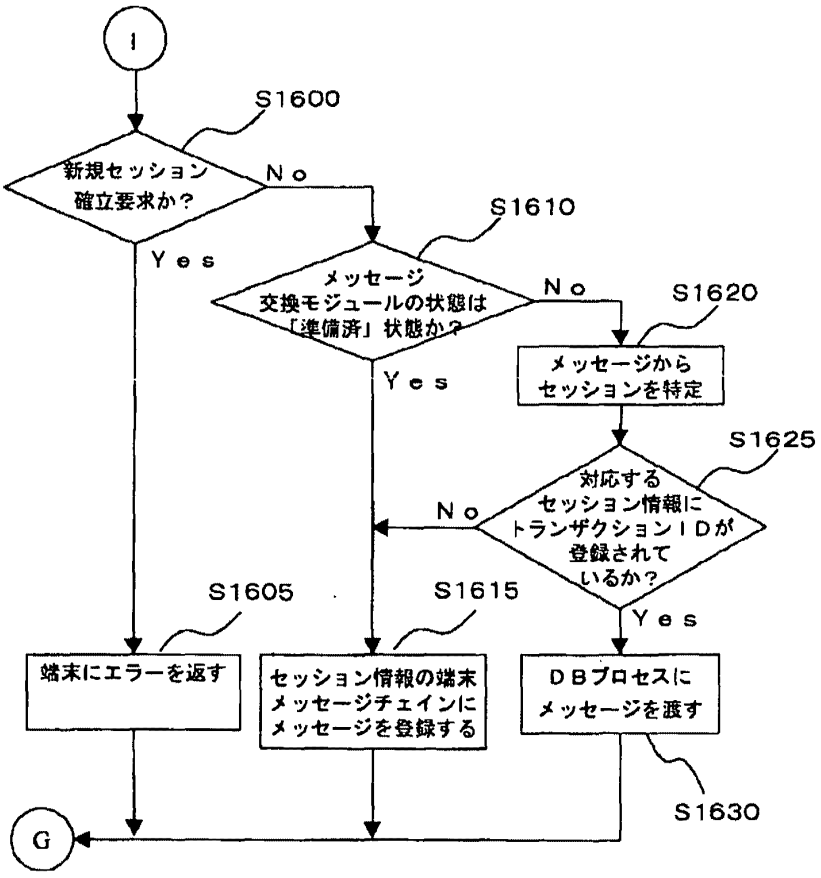
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【図１９】



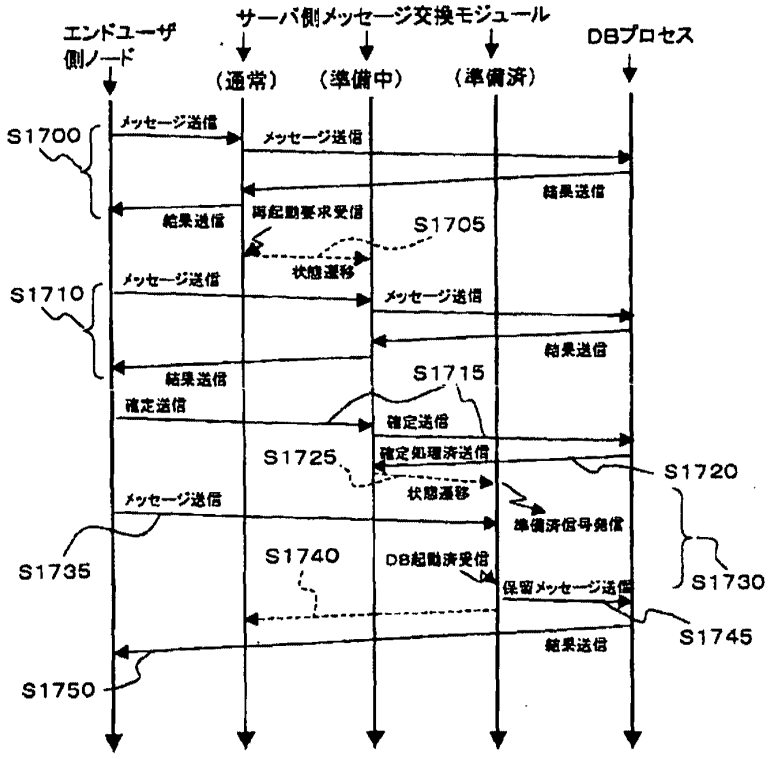
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【図２０】



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【図２１】



【手続補正書】
【提出日】平成１１年８月１７日（１９９９．８．１７）
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】特許請求の範囲
【補正方法】変更
【補正内容】
【特許請求の範囲】
【請求項１】　それぞれ処理プログラムを実行可能な複数のノードがネットワーク接続された計算機システムにおいて、
前記各ノードは、
前記各ノードそれぞれの稼働状況を監視する監視手段と、
前記監視手段が任意の前記ノードでの前記処理プログラムの実行障害を検知したとき、代替ノードを選択する代替ノード選択手段と、
前記実行障害を生じたノードから前記代替ノードへ前記処理プログラムの実行を引き継がせるフェールオーバ手段と、
を有し、
前記監視手段は、前記各ノードそれぞれのプロセッサ負荷を監視し、
前記代替ノード選択手段は、前記監視手段により得られた前記プロセッサ負荷に基づいて前記代替ノードを選択すること、
を特徴とする計算機システム。
【請求項２】　請求項１記載の計算機システムにおいて、
前記代替ノード選択手段は、前記プロセッサ負荷が最小であるノードを前記代替ノードとして選択すること、
を特徴とする計算機システム。
【請求項３】　それぞれ処理プログラムを実行可能な複数のノードがネットワーク接続された計算機システムにおいて、
前記各ノードは、
前記各ノードそれぞれの稼働状況を監視する監視手段と、
前記監視手段が任意の前記ノードでの前記処理プログラムの実行障害を検知したとき、代替ノードを選択する代

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替ノード選択手段と、
前記実行障害を生じたノードから前記代替ノードへ前記処理プログラムの実行を引き継がせるフェールオーバ手段と、
を有し、
前記監視手段は、前記各ノードそれぞれのメモリ空き容量を監視し、
前記代替ノード選択手段は、前記監視手段により得られた前記メモリ空き容量に基づいて前記代替ノードを選択すること、
を特徴とする計算機システム。
【請求項４】　請求項３記載の計算機システムにおいて、
前記代替ノード選択手段は、前記メモリ空き容量が最大であるノードを前記代替ノードとして選択すること、
を特徴とする計算機システム。
【請求項５】　それぞれ処理プログラムを実行可能な複数のノードがネットワーク接続された計算機システムにおいて、
前記各ノードは、
前記各ノードそれぞれの稼働状況を監視する監視手段と、
前記監視手段が任意の前記ノードでの前記処理プログラムの実行障害を検知したとき、代替ノードを選択する代替ノード選択手段と、
前記実行障害を生じたノードから前記代替ノードへ前記処理プログラムの実行を引き継がせるフェールオーバ手段と、
を有し、
前記監視手段は、前記各ノードそれぞれのプロセッサ負荷とメモリ空き容量とを監視し、
前記代替ノード選択手段は、前記監視手段により得られた前記プロセッサ負荷と前記メモリ空き容量とに基づいて前記代替ノードを選択すること、
を特徴とする計算機システム。
【請求項６】　それぞれ処理プログラムを実行可能な複数のノードがネットワーク接続された計算機システムにおいて、
前記各ノードは、
前記各ノードそれぞれの稼働状況を監視する監視手段と、
前記監視手段が任意の前記ノードでの前記処理プログラムの実行障害を検知したとき、代替ノードを選択する代替ノード選択手段と、
前記実行障害を生じたノードから前記代替ノードへ前記処理プログラムの実行を引き継がせるフェールオーバ手段と、
を有し、
前記監視手段は、前記各ノードそれぞれのメモリ空き容量を監視し、
前記フェールオーバ手段は、
前記代替ノードの前記メモリ空き容量が前記処理プログラムの引き継ぎに十分か否かを判断する容量比較手段と、
前記メモリ空き容量が不足するときは、前記代替ノードで先行して起動されている先起動プログラムに割り当てられるメモリ容量を縮小するメモリ割当変更手段と、
を有することを特徴とする計算機システム。
【請求項７】　請求項６記載の計算機システムにおいて、
前記代替ノードの前記先起動プログラムと当該先起動プログラムを前記ネットワークを介して利用するユーザノードとの間のセッション情報を含んだセッション情報テーブルを有し、
前記フェールオーバ手段は、前記メモリ容量の割当変更を行う際に、前記セッション情報に基づいて既設セッション中のトランザクションが継続中か否かを判別して継続中のトランザクションに対するメッセージのみ前記先起動プログラムに渡し、当該セッションに対する他のメッセージは前記割当変更が完了するまで前記セッション情報に保留するメッセージ取扱手段を有し、
前記メモリ割当変更手段は、前記トランザクションが終了したときに、前記先起動プログラムの実行を停止してメモリ割当変更を行うこと、
を特徴とする計算機システム。
【手続補正２】
【補正対象書類名】明細書
【補正対象項目名】０００７
【補正方法】変更
【補正内容】
【０００７】
【課題を解決するための手段】本発明に係る、それぞれ処理プログラムを実行可能な複数のノードがネットワーク接続された計算機システムは、前記各ノードが、前記各ノードそれぞれの稼働状況を監視する監視手段と、前記監視手段が任意の前記ノードでの前記処理プログラムの実行障害を検知したとき代替ノードを選択する代替ノード選択手段と、前記実行障害を生じたノードから前記代替ノードへ前記処理プログラムの実行を引き継がせるフェールオーバ手段とを有し、前記監視手段は、前記各ノードそれぞれのプロセッサ負荷を監視し、前記代替ノード選択手段は、前記監視手段により得られた前記プロセッサ負荷に基づいて前記代替ノードを選択することを特徴とする。
【手続補正３】
【補正対象書類名】明細書
【補正対象項目名】０００８
【補正方法】変更
【補正内容】
【０００８】本発明の好適な態様は、前記代替ノード選

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AMAZON.COM, INC.

択手段が前記プロセッサ負荷が最小であるノードを前記代替ノードとして選択するものである。

【手続補正４】
【補正対象書類名】明細書
【補正対象項目名】０００９
【補正方法】変更
【補正内容】
【０００９】別の本発明に係る計算機システムにおいては、前記各ノードが、前記各ノードそれぞれの稼働状況を監視する監視手段と、前記監視手段が任意の前記ノードでの前記処理プログラムの実行障害を検知したとき代替ノードを選択する代替ノード選択手段と、前記実行障害を生じたノードから前記代替ノードへ前記処理プログラムの実行を引き継がせるフェールオーバ手段とを有し、前記監視手段は前記各ノードそれぞれのメモリ空き容量を監視し、前記代替ノード選択手段は前記監視手段により得られた前記メモリ空き容量に基づいて前記代替ノードを選択することを特徴とする。本発明の好適な態様は、前記代替ノード選択手段が前記メモリ空き容量が最大であるノードを前記代替ノードとして選択するものである。

【手続補正５】
【補正対象書類名】明細書
【補正対象項目名】００１１
【補正方法】変更
【補正内容】
【００１１】また別の本発明に係る計算機システムにおいては、前記各ノードが、前記各ノードそれぞれの稼働状況を監視する監視手段と、前記監視手段が任意の前記ノードでの前記処理プログラムの実行障害を検知したとき代替ノードを選択する代替ノード選択手段と、前記実行障害を生じたノードから前記代替ノードへ前記処理プログラムの実行を引き継がせるフェールオーバ手段とを有し、前記監視手段は前記各ノードそれぞれのメモリ空き容量を監視し、前記フェールオーバ手段は前記代替ノードの前記メモリ空き容量が前記処理プログラムの引き継ぎに十分か否かを判断する容量比較手段と、前記メモリ空き容量が不足するときは前記代替ノードで先行して起動されている先起動プログラムに割り当てられるメモリ容量を縮小するメモリ割当変更手段とを有することを特徴とする。

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JUN 0 1 2011
IAP15
PATENT & TRADEMARK OFFICE

S&H Form: PTO/SB/30 (04/11)

REQUEST FOR CONTINUED EXAMINATION (RCE) TRANSMITTAL

(INCLUDING FILING FEE AND/OR PETITION FOR EXTENSION OF TIME FEE)

Subsection (b) of 35 U.S.C. §132, effective May 29, 2000 provides for continued examination of a utility or plant application filed on or after June 8, 1995. See The American Inventors Protection Act of 1999 (AIPA)

To: **Commissioner for Patents** **Box RCE** **PO Box 1450** **Alexandria, VA 22313-1450**	Attorney Docket No.:2044.1022

First Named Inventor	Se-Won OH, et al.		
Application No.	12/439,421	Group Art Unit	2612
Filing Date	February 27, 2009	Examiner	Tai T. Nguyen
CPA Filing Date		Confirmation No	3680
Title of Invention	USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME		

This is a Request for Continued Examination (RCE) under 37 C.F.R. §1.114 of the above-identified application.

1.

Submission required under 37 C.F.R. §1.114 (Box a or b must be completed)

a. ☐ Previously submitted
   i. ☐ Consider the amendment(s)/reply under 37 C.F.R. § 1.116 previously filed on ____ (Any unentered amendment(s) referred to above will be entered).
   ii. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on __
   iii. ☐ Other

b. ☒ Enclosed
   i. ☐ Amendment/Reply
   ii. ☐ Affidavit(s)/Declaration(s)
   iii. ☒ Information Disclosure Statement (IDS)
   iv. ☐ Other

2.

Miscellaneous

a. ☐ Suspension of action on the above-identified application is requested under 37 C.F.R. §103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 C.F.R. §1.17(i) required).

b. ☐ Other

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06/02/2011 SMOHAMME 00000083 193935 12439421
01 FC:1801 810.00 DA

		BASIC FEE			$ 810.00
Since an Official Action set an original due date of __, petition is hereby made for an extension of time to cover the date this RCE is filed, for which the requisite fee is enclosed (1 month ($130)); (2 months ($490)); (3 months ($1,110)); (4 months ($1,730)); (5 months ($2,350):					
Claims As Amended	Claims Remaining After Amendment	Highest Number Previously Paid For	Number Extra	Rate	
Total Claims	12	- 20 =	0	X $52.00 =	$ 0.00
Independent Claims	3	- 3 =	0	X $220.00 =	$ 0.00
Suspension Fee ($130.00)					
Total of above Calculations =					$ 810.00
Reduction by 50% for filing by small entity (Note 37 C.F.R. 1.9, 1.27, 1.28).					
TOTAL FEES DUE =					$ 810.00

4. ☐ Small entity status:
   a. ☐ Verified Statement Claiming Small Entity Status.
   b. ☐ A Verified Statement Claiming Small Entity Status was previously filed and such status is still proper and desired.
   c. ☐ is no longer claimed.
5. ☐ Other:

6. METHOD OF PAYMENT

☐ A check in the amount of $ $810.00 is enclosed.
☐ EFS-Web Authorization for "TOTAL FEES DUE" to Credit Card.
☒ Charge "TOTAL FEES DUE" to Deposit Account No. 19-3935. (A duplicate copy of this form is enclosed.)

7. GENERAL AUTHORIZATION

☒ The Commissioner is hereby authorized to credit any overpayment or charge any additional fees under 37 C.F.R. 1.16 (filing fees) or 37 C.F.R. 1.17 (processing fees) during the prosecution of this application and of any related application(s) claiming benefit hereof pursuant to 35 U.S.C. §120 to maintain pendency hereof and of any such related application to:
Deposit Account No. 19-3935.

8. CORRESPONDENCE ADDRESS

STAAS & HALSEY LLP

21171
PATENT TRADEMARK OFFICE

9. SIGNATURE OF ATTORNEY OR AGENT REQUIRED

NAME	J. Randall Beckers	REGISTRATION NO.	30,358
SIGNATURE		DATE	6/1/11

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Attorney Docket No. 2044.1022

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:

Se-Won OH, et al.

Application No.: 12/439,421 Group Art Unit: 2612

Confirmation No. 3680

Filed: February 27, 2009 Examiner: Tai T. Nguyen

For: USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Sir:

In accordance with the duty of disclosure provisions of 37 CFR § 1.56, there is hereby provided certain information which the Examiner may consider material to the examination of the subject U.S. patent application. It is requested that the Examiner make this information of record if it is deemed material to the examination of the subject application.

1. Enclosures accompanying this Information Disclosure Statement are:

- 1a. ☒ Form PTO-1449.
- 1b. ☒ Copy(ies) of IDS citation(s), except for U.S. Patents and U.S. Patent Application publications.
- 1c. ☐ English language copy of a communication(s) from a foreign Patent Office or a PCT International Search Report.
- 1d. ☒ English language translation (complete, Abstract or relevant portion(s)) attached to non-English language publications as indicated on the attached Form PTO-1449.
- 1e. ☐ Explanation (ATTACHMENT 1(e), hereto).
- 1f. ☐ List of Copending Applications (ATTACHMENT 1(f), hereto).
- 1g. ☐ List of Additional Submitted Documents (ATTACHMENT 1(g), hereto).

2. ☒ This Information Disclosure Statement is filed under 37 CFR § 1.97(b):

(*Check either Item 2a or 2b or 2c or 2d*)

- 2a. ☐ Within three months of the filing date of a national application;
- 2b. ☐ Within three months of the date of entry of the national stage as set forth in § 1.491 in an international application.

2c. ☐ Before the mailing of a first Office Action on the merits; or
2d. ☒ Before the mailing of a first Office Action after the filing of a Request for Continued Examination under § 1.114.

3. ☐ This Information Disclosure Statement is filed under 37 CFR § 1.97(c) after the period specified in paragraph 2 above but before the mailing date of any of a Final Office Action under § 1.113, a Notice of Allowance under § 1.311 or an action that otherwise closes prosecution in the application, AND

(*Check either Item 3a or 3b; Item 3b to be checked if any reference known for more than 3 months*)

3a. ☐ The § 1.97(e) Statement in Item 5 below is applicable; OR
3b. ☐ The $180.00 fee set forth in 37 CFR § 1.17(p) is:
- ☐ enclosed.
- ☐ to be charged to Credit Card via EFS-Web.
- ☐ to be charged to Deposit Account No. 19-3935.

4. ☐ This Information Disclosure Statement is filed under 37 CFR § 1.97(d) after the period specified in paragraph 3 above, but on or before payment of the Issue Fee, AND

4a. ☐ The § 1.97(e) Statement in Item 5 below is applicable; AND
4b. ☐ The $180.00 fee set forth in 37 CFR § 1.17(p) is:
- ☐ enclosed.
- ☐ to be charged to Credit Card via EFS-Web.
- ☐ to be charged to Deposit Account No. 19-3935.

5. ☐ Statement under § 1.97(e) (*applicable if Item 3a or Item 4a is checked*)

(*Check either Item 5a or 5b*)

5a. ☐ In accordance with 37 CFR § 1.97(e)(1), it is stated that each item of information contained in this Information Disclosure Statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Information Disclosure Statement.

5b. ☐ In accordance with 37 CFR § 1.97(e)(2), it is stated that no item of information contained in this Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in this Information Disclosure Statement was known by any individual designated in § 1.56(c) more than three months prior to the filing of this Information Disclosure Statement.

6. ☐ This is a continuation/divisional/continuation-in-part application under 37 CFR § 1.53(b).

(*Check appropriate Items 6a and/or 6b*)

6a. ☐ Copies of the publications listed on the attached Form PTO-1449 which were previously cited in prior application Serial No. __, filed on __, and which is relied on for an earlier effective filing date for the subject

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application under 35 U.S.C. § 120, have been omitted pursuant to 37 CFR § 1.98(d).

6b. ☐ Copies of the publications listed on the attached Form PTO-1449 which were not previously cited in prior application Serial No. __, filed on __, and which is relied on for an earlier effective filing date for the subject application under 35 U.S.C. § 120, are provided herewith.

7. ☐ This is a Request for Continued Examination under 37 CFR § 1.114.

(*Check either Item 7a or 7b*)

7a. ☐ The Issue Fee has not been paid.

7b. ☐ A Petition to Withdraw from issue under 37 CFR § 1.313(c) is filed concurrently herewith or has been granted. A Request for Continued Examination under 37 CFR § 1.114, after payment of the Issue Fee, is proper in accordance with 37 CFR § 1.114(a), respectively.

8. ☐ This is a Supplemental Information Disclosure Statement.

(*Check either Item 8a or 8b*)

8a. ☐ This Supplemental Information Disclosure Statement under 37 CFR § 1.97(f) supplements the Information Disclosure Statement filed on __.

8b. ☐ This Supplemental Information Disclosure Statement is timely filed within one (1) month of the Notice under 37 CFR §§ 1.97 and 1.98, mailed __.

9. ☐ In accordance with 37 CFR § 1.98, a concise explanation of what is presently understood to be the relevance of non-English language publication(s) is:

(*Check appropriate Items 9a, 9b, and/or 9c*)

9a. ☐ satisfied for non-English language publication(s) cited on the enclosed "English language version of the search report or action which indicates the degree of relevance found by the foreign office". (See MPEP § 609, Minimum Requirements for an Information Disclosure Statement, Part A(3): Concise Explanation of Relevance, 8th Ed., Rev. 2)

9b. ☐ set forth in the application.

9c. ☐ enclosed as Attachment 1(e), hereto.

10. No admission is made that the information cited in this Statement is, or is considered to be, material to patentability nor a representation that a search has been made (other than search report(s) from a counterpart foreign application or a PCT International Search Report, if submitted herewith). 37 CFR §§ 1.97(g) and (h).

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11. The Commissioner is authorized to credit any overpayment or charge any additional fee required under 37 CFR § 1.17 for this Information Disclosure Statement to Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

Dated: 6/1/11

By: _____
J. Randall Beckers
Registration No. 30,358

1201 New York Ave., N.W., 7th Floor
Washington, D.C. 20005
Telephone: (202) 434-1500
Facsimile: (202) 434-1501

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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

21171 7590 06/21/2011

STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

EXAMINER
NGUYEN, TAI T

ART UNIT	PAPER NUMBER
2612	

DATE MAILED: 06/21/2011

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/439,421	02/27/2009	Se-Won Oh	2044.1022	3680

TITLE OF INVENTION: USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	09/21/2011

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 02/11)

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

21171 7590 06/21/2011
STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/439,421	02/27/2009	Se-Won Oh	2044.1022	3680

TITLE OF INVENTION: USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	09/21/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, TAI T	2612	340-521000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): (**Please first reapply any previously paid issue fee shown above**)
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
- ❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/439,421	02/27/2009	Se-Won Oh	2044.1022	3680

21171 7590 06/21/2011

STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

EXAMINER	
NGUYEN, TAI T	

ART UNIT	PAPER NUMBER
2612	

DATE MAILED: 06/21/2011

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 297 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 297 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 02/11)

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No.	Applicant(s)	
	12/439,421	OH ET AL.	
	Examiner	Art Unit	
	TAI T. NGUYEN	2612	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *RCE filed on June 01, 2011*.

2. ☒ The allowed claim(s) is/are *1-12*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
      1. ☒ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 06/01/2011
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/TAI T NGUYEN/
Primary Examiner, Art Unit 2612

DETAILED ACTION

Allowable Subject Matter

1. Claims 1-12 are allowed.

2. The following is an examiner's statement of reasons for allowance: The prior art of record does not teach or suggest, in the claimed combination, a system for providing an information service based on heterogeneous sensor networks, comprising:

a Ubiquitous Sensor Network (USN) middleware for extracting object and environment information by cleaning, classifying and integrating a message received from a sensor network data transmitter, generating conditional events, context aware information, and knowledge contents from the extracted object and environment information, and providing the information service to an application program, the application program providing a user with information related to environment where the sensor network is installed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

3. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Webb et al. (US 2008/0267101) and Kim et al. (US 7,825,791).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tai T. Nguyen whose telephone number is (571) 272-2961. The examiner can normally be reached on Monday-Friday from 7:30am-5:00pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Razavi can be reached on (571) 272-7664. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tai T. Nguyen/
Primary Examiner, Art Unit 2612

June 16, 2011

Notice of References Cited	Application/Control No. 12/439,421	Applicant(s)/Patent Under Reexamination OH ET AL.	
	Examiner TAI T. NGUYEN	Art Unit 2612	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2008/0267101	10-2008	Webb et al.	370/310
*	B	US-7,825,791	11-2010	Kim et al.	340/500
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12439421	OH ET AL.
	Examiner	**Art Unit**
	Tai T Nguyen	2612

ORIGINAL		INTERNATIONAL CLASSIFICATION	
CLASS	SUBCLASS	CLAIMED	NON-CLAIMED
340	521	G 0 8 B 19 / 00 (2006.01.01)	

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
340	523	524	534	539.26	540
340	541	286.02			
709	218	223	224	201	206

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1														
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														
	11														
	12														

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
/TAI T NGUYEN/ Primary Examiner.Art Unit 2612	06/16/2011	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12439421	OH ET AL.
	Examiner	Art Unit
	Tai T Nguyen	2612

SEARCHED			
Class	Subclass	Date	Examiner
340	521, 523, 524, 534, 539.26, 540, 541, 286.02	6/16/2011	TN
709	218, 223, 224, 201, 206	6/16/2011	TN

SEARCH NOTES		
Search Notes	Date	Examiner
EAST SEARCH AND INVENTOR SEARCH	6/16/2011	TN

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
SAME AS ABOVE	SAME AS ABOVE	6/16/2011	TN

	/Tai T Nguyen/ Primary Examiner.Art Unit 2612

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	17741	(environmental fire smoke) near4 (monitor$3)	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/06/16 19:02
L2	26992	(environmental fire smoke) near4 (sensor detector)	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/06/16 19:02
L3	4533	1 and 2	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/06/16 19:02
L4	4	3 and (USN (ubiquitous near4 middleware))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/06/16 19:03
L5	16	2 and (USN (ubiquitous near4 middleware))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/06/16 19:06
L6	11	5 and (clean$3 extract $3 classif$4 integrat $3)	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/06/16 19:06
L7	0	6 and (provid$3 near4 (notificat$3 indicat$3 alarm alert $3 display$3))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/06/16 19:07
L8	5	6 and ((provid$3 generat$3 issu$3 signal$4) near4 (notificat$3 indicat$3 alarm alert$3 display $3))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/06/16 19:08
L9	53	2 and (USN (ubiquitous near4 network))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/06/16 19:10

L10	27	9 and ((clean$3 extract$3 classif$4 integrat$3) near4 (signal information data))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/06/16 19:10
L11	18	10 and ((provid$3 generat$3 issu$3 signal$4) near4 (notificat$3 indicat$3 alarm alert$3 display $3))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/06/16 19:11
L12	26	10 and ((provid$3 generat$3 issu$3 signal$4) near4 (notificat$3 information indicat$3 alarm alert$3 display $3))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/06/16 19:11
L13	1	12 and ((service management) near4 (center personnel person central))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2011/06/16 19:13

6/16/2011 7:14:07 PM
C:\ Documents and Settings\ TNguyen35\ My Documents\ EAST\ Workspaces\ Default EAST Workspace 1600x1200.wsp

OIPE JUN 01 2011 IAP15 PATENT & TRADEMARK OFFICE

FORM PTO-1449 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY DOCKET NO.	APPLICATION NO.
INFORMATION DISCLOSURE STATEMENT	2044.1022	12/439,421
	FIRST NAMED INVENTOR	
	Se-Won OH, et al.	
(Use several sheets if necessary)	FILING DATE	GROUP ART UNIT
	February 27, 2009	2612

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NO.	DATE	NAME	CLASS	SUB-CLASS	FILING DATE
	AA	2006/0149905 (corresponds to Ref. AG)	07/2006	Park et al.			
	AB						
	AC						
	AD						
	AE						
	AF						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NO.	DATE	COUNTRY	TRANSLATION YES	TRANSLATION NO	English ABSTRACT
	AG	10-2006-0068518	06/2006	Korea			X
	AH	10-2001-0020018	03/2001	Korea	X		X
	AI	03-274939	12/1991	Japan			X
	AJ	2000-047894	02/2000	Japan	X		X
	AK						
	AL						

OTHER REFERENCES **(Including Author, Title, Date, Pertinent Pages, Etc.)**

			TRANSLATION YES	TRANSLATION NO
	AM			

EXAMINER	DATE CONSIDERED
/Tai Nguyen/	06/16/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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Revised April, 2011

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /TN/

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
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Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

21171 7590 06/21/2011
STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

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I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/439,421	02/27/2009	Se-Won Oh	2044.1022	3680

TITLE OF INVENTION: USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	09/21/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, TAI T	2612	340-521000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 **STAAS & HALSEY LLP**
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: **ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE**

(B) RESIDENCE: (CITY and STATE OR COUNTRY): **DAEJEON, REPUBLIC OF KOREA**

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

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☐ A check is enclosed.
☒ Payment by credit card. ~~Form PTO-2038 is attached.==~~
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 19-3935 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

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Authorized Signature _____ Date Sept 15, 2011

Typed or printed name ~~SANG CHUL KWON.~~ J. Randall Beckers Registration No. ~~63,153~~ 30,358

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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Electronic Patent Application Fee Transmittal

Application Number:	12439421
Filing Date:	27-Feb-2009
Title of Invention:	USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME
First Named Inventor/Applicant Name:	Se-Won Oh
Filer:	Randall J. Beckers/Kelly Elam
Attorney Docket Number:	2044.1022

Filed as Small Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl issue fee	2501	1	755	755
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1055**

Electronic Acknowledgement Receipt

EFS ID:	10958513
Application Number:	12439421
International Application Number:	
Confirmation Number:	3680
Title of Invention:	USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME
First Named Inventor/Applicant Name:	Se-Won Oh
Customer Number:	21171
Filer:	Randall J. Beckers/Kelly Elam
Filer Authorized By:	Randall J. Beckers
Attorney Docket Number:	2044.1022
Receipt Date:	15-SEP-2011
Filing Date:	27-FEB-2009
Time Stamp:	15:58:23
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1055
RAM confirmation Number	2841
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Issue Fee Payment (PTO-85B)	3977732-FeesTransmittal.PDF	180590 01a855a805b9ba17b07fd1efa359edfe14e46b74	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32051 1183a9dc4189a2cc425d9d1b76f6a7b618c169e1	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	212641		

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/439,421	10/18/2011	8040232	2044.1022	3680

21171 7590 09/28/2011

STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 297 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Se-Won Oh, Daejon, KOREA, REPUBLIC OF;
Yong-Joon Lee, Daejon, KOREA, REPUBLIC OF;
Jong-Hyun Park, Daejon, KOREA, REPUBLIC OF;

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
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NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	12/439,421
Filing Date	02/27/2009
First Named Inventor	Se-Won Oh
Title	USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME
Art Unit	2612
Examiner Name	TAI T NGUYEN
Attorney Docket Number	BP23-273US1

SIGNATURE of Applicant or Patent Practitioner

Signature	/Choong Won Cho/	Date (Optional)	
Name	Choong Won Cho	Registration Number	79,713
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
Approved for use through 03/31/2021. OMB 0651-0035
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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 178942

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

KAIFI, LLC

☐ Inventor or Joint Inventor (title not required below)

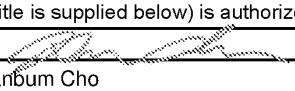
☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature		Date (Optional)	December 11, 2023
Name	Hanbum Cho		
Title	CEO		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: KAIFI, LLC

Application No./Patent No.: 12/439,421 Filed/Issue Date: 02/27/2009

Titled: USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

KAIFI, LLC, a corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: OH, SE-WON ET AL. To: ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE

   The document was recorded in the United States Patent and Trademark Office at
   Reel 022431, Frame 0832, or for which a copy thereof is attached.

2. From: ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE To: KAIFI, LLC

   The document was recorded in the United States Patent and Trademark Office at
   Reel 065842, Frame 0235, or for which a copy thereof is attached.

This collectionof information is required by 37CFR 3.73(b). The informationis required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application.Confidentiality isgoverned by 35U.S.C. 122 and37 CFR 1.11and 1.14.This collection is estimated to take 12 minutes to complete, including gathering,preparing, and submitting the completed applicationform to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should besent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETEDFORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA22313-1450** .

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PTO/AIA/96 (08-12)
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STATEMENT UNDER 37 CFR 3.73(c)

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4. From: _____ To: _____

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Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Choong Won Cho/	2023-12-13
Signature	Date
Choong Won Cho	79,713
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requiresthat you begiven certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirementsof the Act, please be advised that: (1)the general authority for the collectionof this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary;and (3) the principalpurpose for whichthe informationis used by the U.S. Patent and Trademark Office is to process and/or examine your submission related toa patent application or patent. If you do not furnishthe requested information, the U.S. Patent and Trademark Officemay not be able to process and/or examine yoursubmission, which may result in termination of proceedings orabandonment of the application or expiration of the patent.

Theinformation provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need forthe information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A recordrelated to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further,a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A recordfrom this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
12/439,421	**12/14/2023 04:55:00 PM Z ET**	**2044.1022**

Title of Invention

USN MIDDLEWARE APPARATUS AND METHOD FOR GENERATING INFORMATION BASED ON DATA FROM HETEROGENEOUS SENSOR NETWORKS AND INFORMATION SERVICE PROVIDING SYSTEM USING THE SAME

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	8040232
CONFIRMATION #	3680	FILED BY	Tony Hwang
PATENT CENTER #	63621521	FILING DATE	02/27/2009
CUSTOMER #	21171	FIRST NAMED INVENTOR	Se-Won Oh
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	CHOONG WON CHO

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
BP23-273US1_POA.pdf	2	Power of Attorney	516 KB
BP23-273US1_3.73c.pdf	3	Assignee showing of ownership per 37 CFR 3.73	193 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)

BP23-273US1_POA.pdf	7EBD965E0FA11EDCBBBF0B6475DC49F6381392A4AEFBC452 E7AA95F1F61EC738BDD044D766C06C92C447DAD3AAC72606 231809A67F34E482F4DDC845E76BE1B9
BP23-273US1_3.73c.pdf	2B3EA414E21479B309CA1689E9F7AB150F46892F5981E34869 76EC42601DBB9EF19F735AD1242281E71A9191E78EA8B21207 64B4D5CF0313C1933C0A6B73CA58

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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United States Patent and Trademark Office
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/439,421	02/27/2009	Se-Won Oh	2044.1022

CONFIRMATION NO. 3680

21171
STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

POWER OF ATTORNEY NOTICE

OC000000066073105

Date Mailed: 12/21/2023

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 12/14/2023.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/tawashington/

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/439,421	02/27/2009	Se-Won Oh	2044.1022

CONFIRMATION NO. 3680

178942
BROADVIEW IP LAW, PC
6 Jenner
Suite 230
Irvine, CA 92618

POA ACCEPTANCE LETTER

OC000000066073155

Date Mailed: 12/21/2023

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 12/14/2023.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/tawashington/

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ACKNOWLEDGEMENT OF LOSS OF ENTITLEMENT TO ENTITY STATUS DISCOUNT

APPLICATION #	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET #	REQUEST ID
12/439,421	02/27/2009	Se-Won Oh	BP23-273US1	146257

The entity status change request below filed through Patent Center on 01/09/2024 has been accepted.

Certifications

APPLICANT CHANGING TO REGULAR UNDISCOUNTED FEE STATUS

Signature

I certify, in accordance with 37 CFR 1.4(d)(4), that I am one of the signatories making the entity status change.

Signature	Name	Registration #
/CHOONG WON CHO/	CHOONG WON CHO	79713