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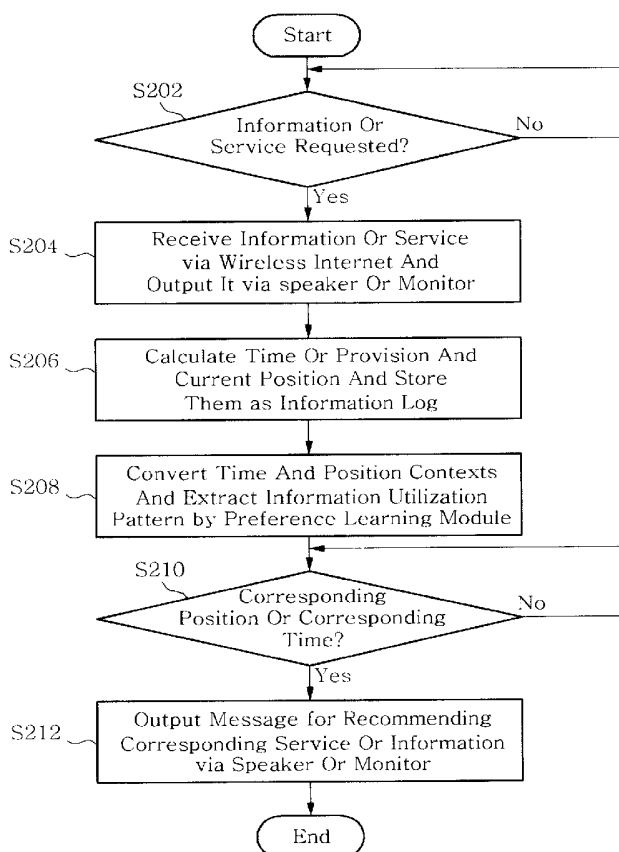
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(54) Title: METHOD AND SYSTEM FOR RECOMMENDING PREFERRED SERVICE USING MOBILE ROBOT



(57) Abstract: Disclosed is a method and a system for recommending a preferred service by using a mobile robot wherein, when a user is provided with various services or information via the mobile robot, time of provision, position of the user, reaction of the user, etc. are stored as a log, the stored log is analyzed and the user's preferred service and information are predicted, based on utilization time and position, and the predicted service and information are recommended to the user when he is in the corresponding time period or position. The mobile robot recommends suitable information or service to a user in conformity with his current position and time and efficiently copes with the user's ever-changing environments. As a result, the user is satisfied with the service from the mobile robot. This substantially improves the user convenience.

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**METHOD AND SYSTEM FOR RECOMMENDING PREFERRED SERVICE USING
MOBILE ROBOT**

Technical Field

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The present invention relates to a method and a system for recommending a preferred service by using a mobile robot. More particularly, the present invention relates to a method and a system for recommending a preferred service by using a mobile robot wherein, when a user is provided with various services or information via the mobile robot, time of provision, position of the user, reaction of the user, etc. are stored as a log, the stored log is analyzed and the user's preferred service and information are predicted, based on utilization time and position, and the predicted service and information are recommended to the user when he is in the corresponding time period or position.

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Background Art

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Recent development in science and technology has developed and commercialized mobile robots, which can do household cleaning, simple errands, etc. Specifically, the mobile robots are generally configured to automatically clean a house and transfer a simple object along a predetermined path. However, they are capable of little

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beyond simple work, despite their high price, and thus are not yet widely used for domestic purposes.

For example, Korean Utility Model Application No. 1993-2422 discloses a sensing device for a robot cleaner, which is adapted to sensing an obstacle, when the cleaner is in operation, and prevents collision between the robot cleaners, in order to avoid unnecessary power consummation and damage resulting from collision.

In addition, Korean Patent Application No. 1998-23269 discloses an apparatus and a method for recognizing the layout of a region to be cleaned, wherein a CCD camera recognizes the accurate layout of the region to be cleaned so that cleaning can be performed fast and accurately based on a traveling path, which depends on the recognized layout.

However, such conventional cleaning robots cannot cover various matters occurring in household environments, except for cleaning. As a result, users get little satisfaction from the expensive robots.

Meanwhile, robots for home automation and robots for transmitting images via the Internet (e.g. R100 manufactured by NEC) have recently been developed. They can provide users with mails or other necessary information. In addition, they can act as alarm clocks or TV remote controls. However, these services are passively provided at users' request. This means that they have no functions which can be timely used on the spot. Particularly, they cannot

provide information on weather when users are dressing up before going to work or inform user of TV programs at lunch time on a holiday. As such, conventional robots can neither efficiently cope with ever-changing environments of users
5 nor give substantial help.

Disclosure of the Invention

Therefore, the present invention has been made in view
10 of the above-mentioned problems, and it is an object of the present invention to provide a method and a system for recommending a preferred service by using a mobile robot wherein, when a user is provided with various services or information via the mobile robot, time of provision,
15 position of the user, reaction of the user, etc. are stored as a log, the stored log is analyzed and the user's preferred service and information are predicted, based on utilization time and position, and the predicted service and information are recommended to the user when he is in the
20 corresponding time period or position.

In order to accomplish this object, according to an aspect of the present invention, there is provided a preferred service recommending system by using a mobile robot equipped with a mover and adapted to predict a service
25 and information preferred by a user and recommend the predicted service and information to the user, the system

including an information log database for storing data on information or service utilized by the user and a log regarding time of utilization of the information or service and position of utilization of the information or service; a
5 preference learning module for performing position context conversion based on the user's position information and time context conversion based on information utilization time, the preference learning module extracting and learning an information utilization pattern regarding information or
10 service utilized by the user; a preference database for storing the user's preference information as data, based on the extracted information utilization pattern; and a CPU for searching preference information corresponding to a specific position or time recognized by the mobile robot and
15 recommending the searched preference information to the user.

According to another aspect of the present invention, there is provided a method for recommending a preferred service by using a mobile robot by predicting a service and information preferred by a user and recommending the
20 predicted service and information to the user, the method including a first step of receiving the user's request for service or information by the mobile robot; a second step of providing the user with service or information by the mobile robot; a third step of calculating information on time of
25 provision of the service or information and the mobile robot's position and storing the information as an

information log; a fourth step of extracting and learning the user's information utilization pattern by the preference learning module, based on the information log, as well as storing the information utilization pattern as preference information; and a fifth step of recommending the user to utilize corresponding information or service at a corresponding position or time, based on the preference information.

10 **Brief Description of the Drawings**

The foregoing and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. 1 briefly shows the construction of a preferred service recommending mobile robot according to an embodiment of the present invention; and

FIG. 2 is a flowchart showing a series of steps of a method for recommending a preferred service by using a mobile robot according to an embodiment of the present invention.

Best Mode for Carrying Out the Invention

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Hereinafter, a preferred embodiment of the present

invention will be described with reference to the accompanying drawings.

In the following description and drawings, the same reference numerals are used to designate the same or similar components, and so repetition of the description on the same or similar components will be omitted. In addition, a detailed description of known functions and configurations incorporated herein is omitted to avoid making the subject matter of the present invention unclear.

10 For better understanding of the present invention, the basic concept thereof will now be described briefly.

The type of information which a user wants to be provided with via a mobile robot depends not only on the user's individuality, but also on the user's place and time. 15 The user's current time and position have a meaning as a crucial context, which bears information on the user's conditions.

The mobile robot according to the present invention has a user interface, which is used to provide a user with information, and a timer, which is used to measure the time of provision of information. The mobile robot incorporates a navigation function. That is, it positions itself while wandering inside a house and obtains information on the place in which information is provided. The mobile robot 20 stores the context information, which has been obtained in this manner, as a log and extracts the user's information 25

utilization pattern based on the log. Therefore, when requested to provide the user with a piece of information, the mobile robots recommends information associated with the time and place.

5 FIG. 1 briefly shows the construction of a preferred service recommending mobile robot according to an embodiment of the present invention.

 The preferred service recommending mobile robot 100 according to the present invention includes an information
10 log database 102; a preference learning module 104; a preference database 106; a navigation module 108; a timer 110; a speaker 112; a sound card 114; a camera 116; a wireless communication module 118; a driver card 120; a motor driver 122; a motor 124; an encoder 126; a DSP
15 (Digital Signal Processor) 123; an illuminometer sensor 130; an infrared sensor 132; a supersonic sensor 134; a touch pad 136; a VGA card 138; a monitor 140; and a CPU 150.

 Hereinafter, the preferred service recommending mobile robot according to the present invention will be referred to
20 as "PSRM robot" in short.

 As the operating environment of the PSRM robot 100 according to the present invention, Windows 98 Second Edition, Personal Web Server, or PHP4 Zend Optimizer may be used.

25 The PSRM robot 100 provides information or a service by using HTTP (Hyper Text Transfer Protocol), which is most

widely used on the Internet, which is based on TCP/IP Internet Protocol, via the wireless communication module 118, which may be a wireless LAN card or CDMA.

When the user requests information or a service via the touch pad 136, the PSRM robot 100 receives the corresponding information or service from wireless Internet via the wireless communication module 118 and outputs or displays it via the speaker 112 or the monitor 140, which acts as an input/output means for providing information.

10 The PSRM robot 100 is informed of the time of provision of information or service from the timer 110 and the current position from the navigation module 108. The information is stored on the information log database 102. Particularly, the information log database 102 stores data on information or service utilized by the user, data on time of utilization of information or service, and data on position of utilization of information or service.

The positioning of the PSRM robot 100 is based on the analysis of the difference between a predetermined position and the current position, path setup, and video data of a specific region by the CPU 150. More particularly, the CPU 150 controls the navigation module 108 and compares images (photographed by the camera 116) of a region, in which the PSRM robot 100 is currently located, with previously stored images, in order to recognize a specific position (e.g. bedroom, living room, or kitchen).

25

The preference learning module 104 converts the user's information utilization log, which is stored in the information log database 102, into meaningful information, extracts an information utilization pattern, and stores it
5 on the preference database 106. Specifically, the preference learning module 104 performs position context conversion based on the user's position information and time context conversion based on the information utilization time, in order to extract an information utilization pattern
10 regarding the information utilized by the user.

As used herein, the position context conversion refers to classification of a user position log, which has been physically expressed in a two-dimensional space and stored, in conformity with a meaningful unit for pattern extraction
15 (e.g. indoor region, usage). The time context conversion refers to classification of a time log, which has been stored according to date, hour, minute, and second, in conformity with time period, the user's daily life, day, and the like, which are meaningful for pattern extraction. The
20 converted position and time contexts are learned by the preference learning module 104 and stored on the preference database 106 as data.

The preference database 106 stores the user's preference information as data, based on the extracted
25 information utilization pattern.

The navigation module 108 physically expresses the

user's position in a two-dimensional space and compares images of the currently located region with images corresponding to previously stored positions, in order to grasp the current position. The navigation module 108 may
5 receive positional information from a GPS (Global Positioning System) satellite to recognize the current position.

The timer 110 measures time and informs the CPU 150 of time at which information or a service is utilized.

10 When the user utilizes information or a service via wireless Internet, the CPU 150 calculates the time of utilization from the timer 112 and the position of utilization from the navigation module 108. The CPU 150 extracts and learns an information utilization pattern by
15 using the preference learning module 104, based on the calculated position and time. The CPU 150 recommends the user to utilize corresponding information or service at a corresponding position or time by outputting voice recommendations via the speaker 112 or displaying
20 recommendation images on the monitor 124.

The CPU 150 controls the movement of the PSRM robot 100.

For the movement control, the CPU 150 uses a fuzzy algorithm of an expert system so that it can perform sensory
25 actions just like a human, as well as a GA algorithm for compensating for human errors of the expert system by means

of learning abilities so that it can gradually remove improper solutions (values) until the closest solution is found.

5 The CPU 150 calculates the amount of increased traveling distance by using the navigation module 108 and gives corresponding commands to the DSP 128. The driver card 120 creates a trajectory corresponding to the amount of travel. The trajectory is divided by a sampling time value and is subjected to signal amplification by the motor driver 10 122, in order to operate the motor 124.

While the motor 124 is under operation, information is transmitted to the DSP 128 via the encoder 126. The DSP 128 transmits information on current position to the CPU 150. The number of revolutions of the motor 124 is checked by the 15 encoder 126. Based on the revolution of the motor 124, traveling distance, velocity, and acceleration are calculated so that information on position, velocity, and acceleration is fed back to the DSP 128. The position data, which has been fed back to the DSP 128, is compared with 20 currently inputted data, in order to obtain deviation from the target value and create a position traveling trajectory. Then, the data is converted into a value for traveling along the trajectory. Current is supplied to the driver card 120 for such direction conversion.

25 The ultrasonic sensor 134 is used to measure the distance and recognize passers-by. The ultrasonic

information is used for distance adjustment so as to conform to images processed by the camera 116, in order to recognize the contour of objects and recognize the surroundings.

5 The infrared sensor 132 senses passers-by while cooperating with the ultrasonic sensor 134. The illuminometer sensor 130 detects the luminance of surroundings and acts as an auxiliary device for image processing of the camera 116.

10 The operation of the PSRM robot 100, which has the above-mentioned construction, will now be described.

FIG. 2 is a flowchart showing a series of steps of a method for recommending a preferred service by using the mobile robot according to an embodiment of the present invention.

15 A user requests information or a service from the PSRM robot 100 via wireless Internet by using the touch pad 136 (S202).

The CPU 150 of the PSRM robot 100 receives the service or information request from the user via the wireless communication module 118 and outputs voice via the speaker 112 or displays images on the monitor 140 (S204).
20

The CPU 150 obtains the time of provision of service or information from the timer 112, as well as the current position of the PSRM robot 100 from the navigation module 108, and stores that information on the information log database 102 as an information log (S206).
25

The CPU 150 performs position context conversion and time context conversion by using the preference learning module 104, based on the information log, and extracts the user's information utilization pattern, in order to learn
5 what type of information the user tends to utilize in what time period and position (S208). After the time context conversion, the time information is classified into morning, afternoon, evening, night, etc. according to the time period; before and after going to work, before and after a
10 meal, before and after sleep, etc. according to the user's behavior; and day, holiday, anniversary, etc. according to date. After the position context conversion, the position information is classified into bedroom, living room, kitchen, etc. according to the location inside a house and near a TV
15 and wardrobe according to usage.

After learning the user's information utilization pattern, the CPU 150 stores it on the preference database 106 as preference information.

While wandering in a house, the PSRM robot 100
20 searches a position or time corresponding to the preference information (S210).

When the current position or time corresponds to the user's preference information, the CPU 150 creates a message for recommending a corresponding service or information,
25 based on the preference information stored on the preference database 106, and outputs voice recommendations via the

speaker 112 or displays recommendation images on the monitor
140 (S212).

Therefore, the user can be provided with a desired
service or information from the PSRM robot 100 at a specific
5 place in a corresponding time period.

As mentioned above, the present invention provides a
method and a system for recommending a preferred service by
using a mobile robot wherein, when a user is provided with
various services or information via the mobile robot, time
10 of provision, position of the user, reaction of the user,
etc. are stored as a log, the stored log is analyzed and the
user's preferred service and information are predicted,
based on utilization time and position, and the predicted
service and information are recommended to the user when he
15 is in the corresponding time or position.

While this invention has been described in connection
with what is presently considered to be the most practical
and preferred embodiment, it is to be understood that the
invention is not limited to the disclosed embodiment and the
20 drawings, but, on the contrary, it is intended to cover
various modifications and variations within the spirit and
scope of the appended claims.

Industrial Applicability

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As can be seen from the foregoing, according to the

present invention provides, the mobile robot recommends suitable information or service to a user in conformity with his current position and time and efficiently copes with the user's ever-changing environments. As a result, the user is
5 satisfied with the service from the mobile robot. This substantially improves the user convenience.

Claims

1. A preferred service recommending system by using a mobile robot equipped with a mover and adapted to predict a service and information preferred by a user and to recommend the predicted service and information to the user, the system comprising:

an information log database for storing data on information or service utilized by the user and a log regarding time of utilization of the information or service and position of utilization of the information or service;

a preference learning module for performing position context conversion based on the user's position information and time context conversion based on information utilization time, the preference learning module extracting and learning an information utilization pattern regarding information or service utilized by the user;

a preference database for storing the user's preference information as data, based on extracted information utilization pattern; and

a CPU for searching preference information corresponding to a specific position or time recognized by the mobile robot and recommending searched preference information to the user.

2. The preferred service recommending system by using a

mobile robot as claimed in claim 1, further comprising:

a timer for measuring time and providing information on time of utilization of information or service and

a navigation module for comparing images of a
5 currently located region, the images being photographed by a camera, with previously stored images and calculating position information.

3. The preferred service recommending system by using a
10 mobile robot as claimed in claim 1, wherein, during the position context conversion, a user position log, the user position log having been physically expressed in a two-dimensional space and stored, is classified in conformity with region or usage, the region or usage being a meaningful
15 unit for pattern extraction.

4. The preferred service recommending system by using a mobile robot as claimed in claim 1, wherein, during the time context conversion, a time log, the time log having been
20 stored according to date, hour, minute, and second, is classified in conformity with time period, the user's behavior, and day meaningful for pattern extraction.

5. The preferred service recommending system by using a
25 mobile robot as claimed in claim 1, further comprising:

a wireless communication module for receiving data on

information or service via wireless Internet and providing the user with the data;

an input means for receiving input of the user's request for information or service; and

5 an output means for recommending the user to utilize corresponding information or service at a corresponding position or time based on the information utilization pattern.

10 6. A method for recommending a preferred service by using a mobile robot by predicting a service and information preferred by a user and recommending the predicted service and information to the user, the method comprising:

a first step of receiving the user's request for
15 service or information by the mobile robot;

a second step of providing the user with service or information by the mobile robot;

a third step of calculating information on time of provision of the service or information and the mobile
20 robot's position and storing the information as an information log;

a fourth step of extracting and learning the user's information utilization pattern by the preference learning module, based on the information log, as well as storing the
25 information utilization pattern as preference information; and

a fifth step of recommending the user to utilize corresponding information or service at a corresponding position or time, based on the preference information.

5 7. The method for recommending a preferred service by using a mobile robot as claimed in claim 6, wherein, in the first and second steps, the service or information is requested and provided by using wireless Internet or CDMA communication.

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8. The method for recommending a preferred service by using a mobile robot as claimed in claim 6, wherein, in the fourth step, the information utilization pattern is obtained by performing position context conversion based on the user's position information and time context conversion based on information utilization time.

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9. The method for recommending a preferred service by using a mobile robot as claimed in claim 8, wherein, during the position context conversion, a user position log, the user position log having been physically expressed in a two-dimensional space and stored, is classified in conformity with region or usage, the region or usage being a meaningful unit for pattern extraction.

25

10. The method for recommending a preferred service by

using a mobile robot as claimed in claim 8, wherein, during
the time context conversion, a time log, the time log having
been stored according to date, hour, minute, and second, is
classified in conformity with time period, the user's
5 behavior, and day meaningful for pattern extraction.

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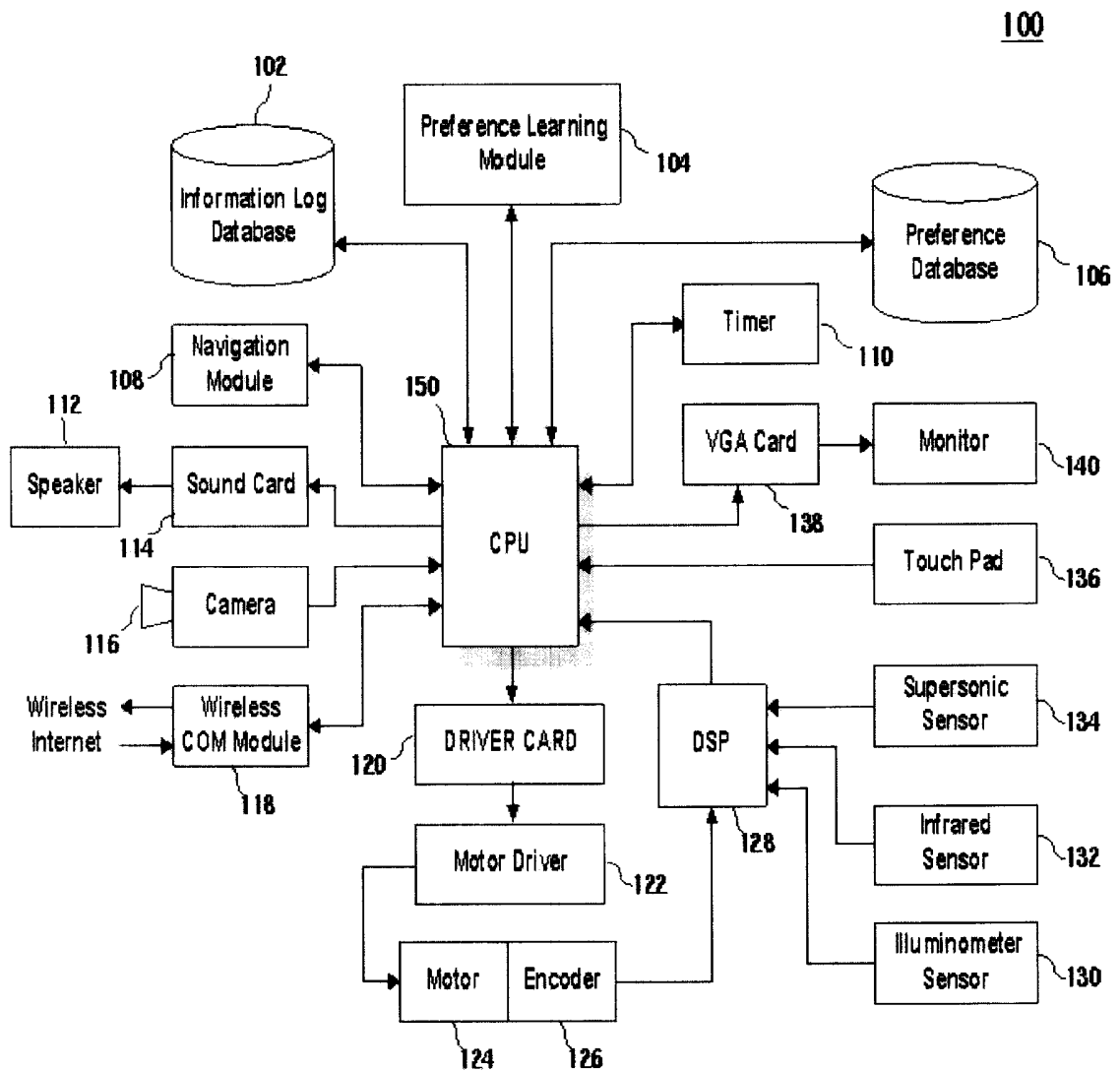


FIG. 1

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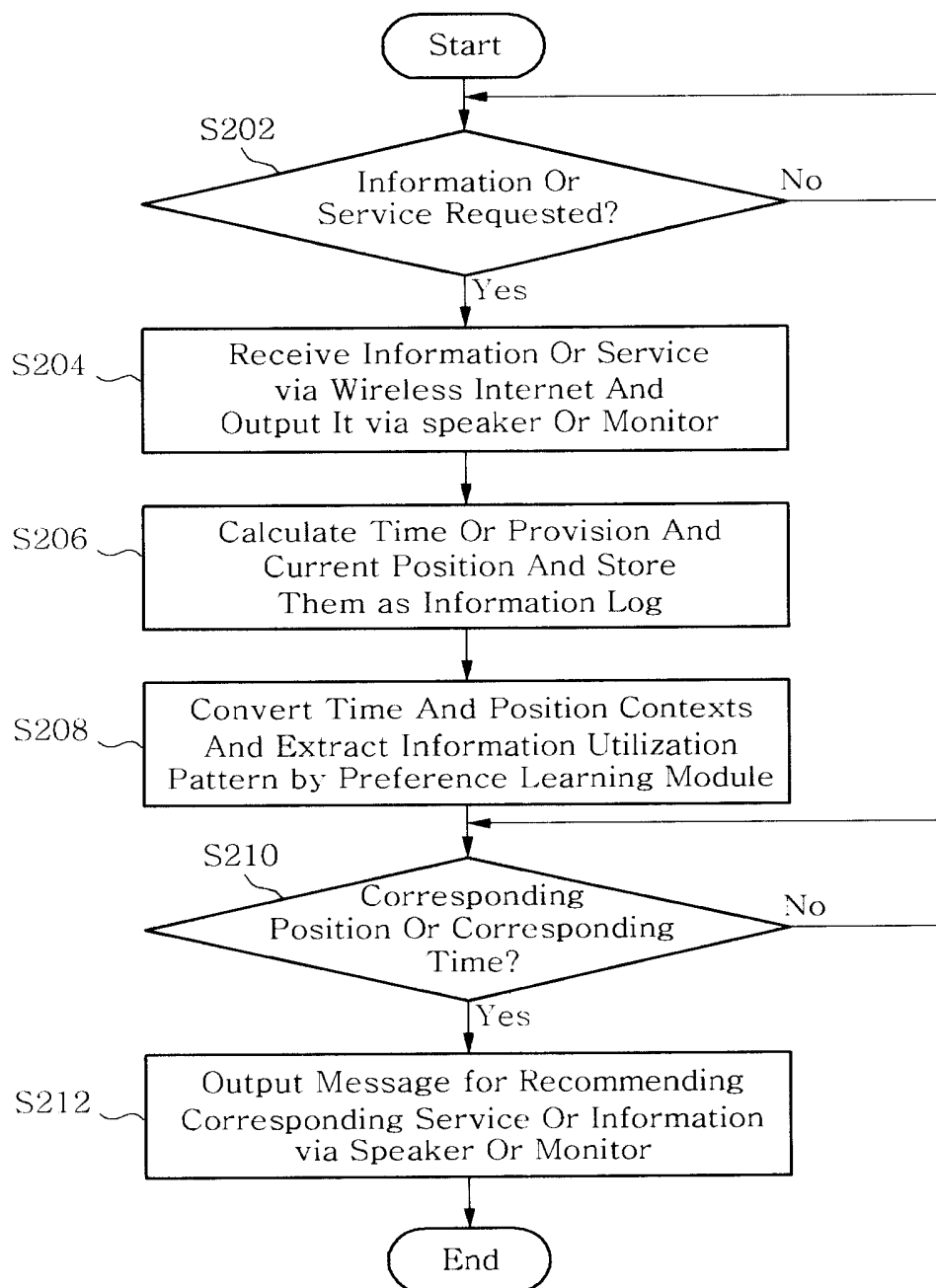


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2006/000322**A. CLASSIFICATION OF SUBJECT MATTER****G06F 17/00(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 G06F 17/00

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 1975Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
KIPOnet DB; user* & recommend* & target* & information***C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 2002-7742 A (OZ TECHNOLOGY INC.) 29 JAN. 2002 SEE THE WHOLE DOCUMENTS	1,5,6,7
A	KR 2003-3396 A (KOREA TELECOM INC.) 10 JAN. 2003 SEE THE WHOLE DOCUMENTS	1-10
A	KR 2004-26388 A (ELECTRONIC COMPONENTS RESEARCH INS.) 31 MAR. 2004 SEE THE WHOLE DOCUMENTS	1-10
A	KR 2005-5591 A (NEXOLWIZ WILL INC. ETR.) 14 JAN. 2005 SEE THE WHOLE DOCUMENTS	1-10



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Name and mailing address of the ISA/KR

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