(54) Title: APPARATUS AND METHOD FOR RUNNING CONTEXT-AWARE FRAMEWORK FOR RESOURCE SHARING BASED CONTEXT INFORMATION

(57) Abstract: Provided is an apparatus and method for running a CIB-aware framework for resource sharing. The apparatus includes a CIB storage unit, a device information manager, a resource wrapper, and a resource encoder. The CIB storage unit stores shared resource, resource description and context information. The device information manager provides a function for management and query of information stored in the CIB storage unit. The resource wrapper receives information shared by one or more external devices, and converts and reconfigures the received information in accordance with the system characteristics of the corresponding device. The resource encoder generates a predetermined format of U-MO resource description for the corresponding device provision information, and provides the generated U-MO resource description to the external device.
Description

APPARATUS AND METHOD FOR RUNNING CONTEXT-AWARE FRAMEWORK FOR RESOURCE SHARING BASED CONTEXT INFORMATION

Technical Field

[1] The present disclosure relates to an apparatus and method for running a Context Information Base (CIB)-aware framework for resource sharing, and in particular, to an apparatus and method for running a CIB-aware framework for resource sharing, which can provide a service spontaneously detects/determines peripheral situations and can provide a combined service in various ways through distribution of performances, provision services and resources by using a CIB-aware framework for resource sharing.

Background Art

[2] The feature ubiquitous computing requires an intelligent space that enables a computer system to reconfigure a computing environment anywhere and anytime. Such an intelligent space is defined as a Ubiquitous Smart Space (USS). The USS includes intelligent objects, and the system spontaneously detects/determines situations to share a service suitable for a user, thus providing the service autonomously in a timely manner.

[3] In the USS, a Ubiquitous Mobile Object (U-MO) device intelligently provides a service, stores the mobility for various resources and the minimum resource information necessary for a user and performs a function of managing/querying the stored information.

[4] In order to provide a user-centered service in the USS, it is important to provide a user with the corresponding service after detecting a desired service of the user by using information about the current/peripheral situations of the user.

[5] Therefore, the USS requires a situation-aware framework that integrates, reasons and learns various contexts obtained through a dynamic environment.

[6] A situation-aware framework running apparatus and a situation-aware service technology according to the related art used method which acquires fundamental data about the current situations from a specific input device in a ubiquitous environment and home on the basis of a wired/wireless communication network and reasons the acquired data normalized data about the current situations.

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As an example of the related art, the Korean Patent Application No. 10-2005-017652 discloses a situation-aware framework that includes: a context description module for managing context information obtained from a sensor; a context normalizing module for converting the context information detected from the sensor into a normalized structure; a context integrating module for using the context information received from the context normalizing module to generate an integrated context on the basis of a detected context; a context reasoning module for reasoning context information of a upper level from detected context information of a lower level; a context filtering module for selecting only useful contexts and storing the selected contexts in a database; a context learning module for obtaining context information learned on the basis of the information stored in the database; and an event triggering module for automatically giving a command for an action or an event for the safety or convenience of a user.

As another example of the related art, the Georgia Tech Aware Home project provides a situation-aware service technology that uses various household appliances and sensors, which are connected through a home wired/wireless communication network, to select a user-requiring service for maximization of the convenience of the user and to help the situation of the user.

Specifically, the service detects situation information of a user through various sensors such as cameras and microphones for sensing the position, location and action of the user in a home, detects the profile of the user, various situation data, sensors and other environment data dynamically toward the development of the home network technology detects situations intelligently according to the situations and a database that can store, manage and discard various data in order to provide a service adaptive to the situations by using a reasoner technology; and provides a user's action pattern, repeated sensors, and environment data through a self-learnable minor technology, thereby sharing resources.

However, the service processes various contexts for user's situations detected through a specific input device on the basis of wired/wireless networks. Therefore, the service must have all the functions for a middleware providing service and a situation-aware service providing device, thus increasing the scales of the device and the middleware.

Moreover, the service uses a framework centralizing all the data of the input device for central determination and making to centralize all the performance and power, thus causing a limitation in the service provision coverage and performance,
the service type and the mobile service.

What is therefore required is a technology for diversifying combinable services through distribution of performances, services and resources.

Disclosure of Invention

Technical Problem

Accordingly, the present disclosure provides an apparatus and method for running a CIB-aware framework for resource sharing, which can provide a combined service in various ways through distribution of performances, provision services and resources by using a CIB-aware framework for resource sharing by which a U-MO device spontaneously detects and determines peripheral situations to provide a service.

Technical Solution

According to an aspect, there is provided an apparatus for running a Context Information Base (CIB)-aware framework for resource sharing, the apparatus comprising: a CIB storage unit storing shared resource, resource description and context information; a device information manager providing a function for management and query of information stored in the CIB storage unit; a resource wrapper receiving information shared by one or more external devices, and converting and reconfiguring the received information in accordance with the system characteristics of the corresponding device; and a resource encoder generating a predetermined format of Ubiquitous Mobile Object (U-MO) resource description for the corresponding device provision information, and providing the generated U-MO resource description to the external device.

According to another aspect, there is provided a method for running a Context Information Base (CIB)-aware framework for resource sharing in receiving resource description and shared resources by using a CIB-aware framework running apparatus including a CIB storage unit, the method comprising: requesting, by a device, desired context information or shared resource search to the framework running apparatus sharing one or more device information; searching for the desired context information or the shared resource information from the framework running apparatus; and converting the searched information into a predetermined format of Ubiquitous Mobile Object (U-MO) resource description information and providing the converted information to the device.

According to another embodiment, there is provided a method for running a Context Information Base (CIB)-aware framework for resource sharing in adding shared

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resource description to a CIB-aware framework running apparatus for resource sharing, the method comprising: receiving Ubiquitous Mobile Object (U-MO) resource description shared by one or more external devices; correcting the U-MO resource description into resource description based on a system of the corresponding device; and storing the corrected resource description in a CIB storage unit of the corresponding device.

Advantageous Effects

[17] The apparatus and method for running a CIB-aware framework for resource sharing according to the present invention makes it possible to provide a combined service in various ways through distribution of performances, provision services and resources by using a CIB-aware framework for resource sharing by which a U-MO device spontaneously detects and determines peripheral situations to provide a service.

Brief Description of the Drawings

[18] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

[19] FIG. 1 is a block diagram of a U-MO software platform according to an exemplary embodiment;

[20] FIG. 2 is a block diagram of a CIB framework running apparatus according to an exemplary embodiment;

[21] FIG. 3 is a block diagram of a device information manager according to an exemplary embodiment; and

[22] FIGS. 4 and 5 are flow diagrams illustrating a process for an operation of the device information manager according to an exemplary embodiment.

Best Mode for Carrying Out the Invention

[23] Hereinafter, specific embodiments will be described in detail with reference to the accompanying drawings. The present invention may, however, be embodied in different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the present invention to those skilled in the art.

[24] FIG. 1 is a block diagram of a Ubiquitous Mobile Object (U-MO) software platform according to an exemplary embodiment.
Referring to FIG. 1, on a U-MO software platform according to an exemplary embodiment, a Context Information Base (CIB) running apparatus 200 provides a framework for storing/managing context information collected from a resource provider & discovery unit 150, and cooperates with a service broker 110, a service reasoner 120, a resource composer 140, and a resource provider 150.

Also, the CIB running apparatus 200 converts information collected from an external U-MO device in accordance with its own storage, and generates a predetermined format of U-MO resource description information provided from an internal device to an external U-MO device.

FIG. 2 is a block diagram of a CIB framework running apparatus according to an exemplary embodiment.

Referring to FIG. 2, a CIB framework running apparatus according to an exemplary embodiment includes a CEB storage unit 210, a device information manager 220, a resource wrapper 230, and a resource encoder 240. The CIB storage unit 210 stores shared resources, resource description and context information. The device information manager 220 provides actions of management and query of information stored in the CIB storage unit 210. The resource wrapper 230 receives information shared by one or more external devices and converts/reconfigures the same in accordance with the system characteristics of the corresponding device. The resource encoder 240 generates a predetermined format of U-MO resource description for the corresponding device provision information and provides the same to the external device.

Herein, the devices are U-MO devices that share separate resource and context information stored in separate CIB storage units through a CIB framework.

The CIB storage unit 210 physically stores/manages context information. The CIB storage unit 210 stores the shared resources and context information defined in an extensible Markup Language (XML) in an XML-based multilevel category structure.

Also, the CIB storage unit 210 responds to a query of the device information manager 220 using an XPath (XML Path Language).

Example 1 below illustrates a portion of an XML schema stored in the CIB storage unit 210.

Example 1
Herein, the context information is information about various resources and objects usable by a U-MO device. Examples of the type of the context information include hardware context information that is resource information of peripheral devices such as printers, monitors and keyboards; user context information that is user information such as user profile and location; physical context information that is physical information of temperature, humidity and illuminance; and history context information that is information about context records depending on the user preference and the
The device information manager (e.g., U-MO IB manager) 220 is the main manager of a U-MO software platform, which provides services of storage, addition, change, deletion and query of information in the CIB storage unit 210.

Herein, the respective components of the U-MO software platform access the CIB running apparatus 200 through the device information manager 220.

Based on the local information of the current system, the resource wrapper 230 re-configures information of shared resources received from the resource provider & discovery unit 150.

For example, the resource wrapper 230 recalculates a resource use time of 30 minutes expressed as expire="00:00:30:00" among information of resource description on the basis of the current system time, and reconfigures information of a formula expressing as expire="2007:11:21:12:40:00" that the resource use expires at November 21, 2007 12:40:00.

Upon receiving a request for description information about shared resources from an external U-MO device, the resource encoder 240 searches for resource information on the basis of a discovery query through a query processor 221 of the device information manager 220, and generates Resource Description Framework (RDF)-based U-MO resource description information provided by the resource provider & discovery unit 150.

The generated U-MO resource description information is transmitted through the resource provider & discovery unit 150 to the U-MO device that transmitted the discovery query.

FIG. 3 is a block diagram of the device information manager 220 according to an exemplary embodiment. FIGS. 4 and 5 are flow diagrams illustrating the processes for the operations of a query processor 221 and a control processor 222 of the device information manager 220 according to an exemplary embodiment. Hereinafter, the operation of the device information manager 220 will be described in detail with reference to FTGS. 3 to 5.

Referring to FIG. 3, the device information manager 220 according to an exemplary embodiment includes a query processor 221 and a control processor 222. The query processor 221 requests a search for the context information and shared resource information. The control processor 222 requests addition, correction and deletion of the context information and addition of the shared resource information in the CIB storage unit 210.
The query processor 221 generally provides a shared resource information request Junction and a context information search request Junction.

From an XML-based discovery query request as Example 2 below, the shared resource information request Junction generates an SPRQL-based shared resource information request for an RDF search for each discovery query element as Example 3 below.

Herein, the search result of the CIB storage unit 210 according to the generated SPRQL-based shared resource information request is provided in an RDF format as Example 4 below.

Example 2

```xml
<?xml version="1.0" encoding="euc-kr" ?>
- <UMODiscoveryQuery xmlns="http://www.keti.re.kr/ubicom/umo/" version="1.0">
  <UMOD[version="1.0"] name="Ice: Mobile device OuV" />
  <ResourceDiscovery group="001" type="002" item="001" />
  <ResourceDiscovery group="002" type="001" item="001" />
  <Restriction name="horizontal resolution" compare="greater then or equals" value="1024" />
  <Restriction name="vertical resolution" compare="greater then or equals" value="768" />
</UMODiscoveryQuery>
```

Example 3

```sparql
PREFIX umo:<http://www.keti.re.kr/ubicom/umo#>
PREFIX ns:<http://www.w3.org/1999/02/22-rdf-syntax-ns#>

SELECT ?x
WHERE {
  ?x ns:type umo:Monitor .
}
```

Example 4

```sparql
PREFIX ns:<http://www.w3.org/1999/02/22-rdf-syntax-ns#>

SELECT ?x
WHERE {
  ?x ns:type umo:Monitor .
  ?x umo:Monitor_horizon_resolution ?y . Filter (?y >= W1024W")
  ?x umo:Monitor_vertical_resolution ?z . Filter(?z >= W768W")
}
The context information search request function converts a context information search request received from the U-MO software platform into an SPARQL query as Example 5 below to query the CIB storage unit 210, and returns the results about the communication channel and the device ID of the U-MO device as Example 6 below after query.

Herein, the U-MO device may request detailed description information according to a service provided to a user.

Example 5

```
PREFIX info <http://www.keti.re.kr/ubicom/umo#>
PREFIX ns <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
Select ?x
WHERE {
  ?x a info:NetworkDevice
}
```

Example 6
Hereinafter, the operation of the query processor 221 according to an exemplary embodiment will be described with reference to FIG. 4. FIG. 4 is a flow diagram illustrating a process for the operation of the query processor 221 according to an exemplary embodiment.

Referring to FIG. 4, in step S410, the query processor 221 requests search about a desired context information or a shared resource to a framework running apparatus sharing one or more device information from a device.

In step S420, the query processor 221 searches for the desired context information or shared resource information from one or more devices in the framework running apparatus.

Herein, as described above, the framework running apparatus converts the search request into an SPARQL format and querys to the CIB storage unit 210 storing the shared context information and resource description.

In step S430, the query processor 221 converts the searched information into a predeterminded format of U-MO resource description information and provides the same to the device.

Herein, as described above, the CIB storage unit 210 provides the result about the query in the RDF format and it is encoded by the resource encoder 240 into U-MO format.
resource description information and provided to the device.

The control processor 222 generally provides a Sanction of shared resource information addition by the resource provider & discovery unit 150 and a function of context information addition, correction and deletion.

The Sanction of shared resource information addition by the resource provider & discovery unit 150 determines an addition location in the CIB storage unit 210 and adds information to the determined location, in order to manage detected shared resource information for each U-MO device.

The Sanction of context information addition, correction and deletion is an abstracted task to an operation for an SPARQL process.

The addition task means a task to add a new RDF model to an RDF model stored in the CIB storage unit 210, and to this end, RDF data containing contents to be added and an RDF subject designating the addition location are necessary.

The correction task means a task to substitute a new RDF model for an RDF model stored in the CEB storage unit 210 and a task to correct the contents of RDF information or specific property, and to this end, an RDF subject having a reference location about the corresponding RDF and RDF data containing new contents are necessary.

The deletion task means a task to delete a portion of an RDF model stored in the CIB storage unit 210, and to this end, an RDF subject designating the deletion location is necessary.

Hereinafter, the operation of the control processor 222 according to an exemplary embodiment will be described with reference to FIG. 5. FIG. 5 is a flow diagram illustrating a process for the operation of the control processor 222 according to an exemplary embodiment.

Referring to FIG. 5, in step S510, the control processor 222 receives U-MO resource description shared by one or more external devices.

In step S520, the control processor 222 corrects the U-MO resource description into resource description based on a system of the corresponding device.

In step S530, the control processor 222 determines a location to add the corrected resource description in the CIB storage unit 210 of the corresponding device, and adds/stores the resource description information in the determined location.

Thereafter, when a request of the external device or each component of the corresponding device is generated, the control processor 222 provides the stored resource description and performs edits including the addition, correction and deletion of the
resource description according to circumstances.

[82] As the present invention may be embodied in several forms without departing from
the spirit or essential characteristics thereof, it should also be understood that the
above-described embodiments are not limited by any of the details of the foregoing de-
scription, unless otherwise specified, but rather should be construed broadly within its
spirit and scope as defined in the appended claims, and therefore all changes and modi-
fications that fall within the metes and bounds of the claims, or equivalents of such
metes and bounds are therefore intended to be embraced by the appended claims.
Claims

[1] An apparatus for running a Context Information Base (CIB)-aware framework for resource sharing, the apparatus comprising:

a CIB storage unit storing shared resource, resource description and context information;

a device information manager providing a function for management and query of information stored in the CIB storage unit;

a resource wrapper receiving information shared by one or more external devices, and converting and reconfiguring the received information in accordance with the system characteristics of the corresponding device; and

a resource encoder generating a predetermined format of Ubiquitous Mobile Object (U-MO) resource description for the corresponding device provision information, and providing the generated U-MO resource description to the external device.

[2] The apparatus of claim 1, wherein the generated U-MO resource description is provided through a resource provider & discovery unit to the external device.

[3] The apparatus of claim 1, wherein the device information manager comprises:

a query processor requesting a search for the context information and the shared resource; and

a control processor requesting addition, correction and deletion of the context information and addition of the shared resource information in the CIB storage unit.

[4] The apparatus of claim 1, wherein the context information comprises at least one of hardware context information that is resource information of a peripheral device;

user context information that is user information;

physical context information that is physical information of temperature, humidity and illuminance; and

history context information that is information about context records depending on the user preference and the lapse of time.

[5] The apparatus of claim 1, wherein the CIB storage unit stores the shared resource, the resource description, and the context information defined in an eXtensible Markup Language (XML) in an XML-based multilevel category structure.
The apparatus of claim 1, wherein the CIB storage unit responds to a query of the device information manager using an XML Path Language (XPath).

A method for running a Context Information Base (CIB)-aware framework for resource sharing in receiving resource description and shared resources by using a CIB-aware framework running apparatus including a CIB storage unit, the method comprising:
requesting, by a device, desired context information or shared resource search to the framework running apparatus sharing one or more device information; searching for the desired context information or the shared resource information from the framework running apparatus; and
converting the searched information into a predetermined format of Ubiquitous Mobile Object (U-MO) resource description information and providing the converted information to the device.

The method of claim 7, wherein the searching for the desired context information or the shared resource information comprises converting the search request into an SPARQL format to query the CIB storage unit.

The method of claim 7, wherein the providing of the converted information comprises:
providing the search result in the format of Resource Description Framework (RDF);
encoding the RDF to generate the U-MO resource description information; and providing the generated U-MO resource description information to the device.

A method for running a Context Information Base (CIB)-aware framework for resource sharing in adding shared resource description to a CIB-aware framework running apparatus for resource sharing, the method comprising:
receiving Ubiquitous Mobile Object (U-MO) resource description shared by one or more external devices;
correcting the U-MO resource description into resource description based on a system of the corresponding device; and
storing the corrected resource description in a CIB storage unit of the corresponding device.

The method of claim 10, further comprising:
providing the stored resource description when a request of the external device or each component of the corresponding device is generated.

The method of claim 10, further comprising:
performing edits including the addition, correction and deletion of the resource description.

[13] The method of claim 10, wherein the storing of the corrected resource description comprises:

determining a location to add the resource description in the CIB storage unit; and

adding information in the determined location.

[14] The method of any one of claims 7 to 13, wherein the CIB storage unit includes information about resources and objects that is providable by the corresponding device and is defined in an extensible Markup Language (XML) in an XML-based multilevel category structure.

[15] The method of any one of claims 7 to 13, wherein the resource description includes the communication channel and the address of a device storing the corresponding resource.
[Fig. 4]

START

REQUEST DESIRED CONTEXT INFORMATION OR SHARED RESOURCE SEARCH TO FRAMEWORK RUNNING APPARATUS

S410

SEARCH OF REQUESTED CONTEXT INFORMATION OR SHARED RESOURCE INFORMATION

S420

PROVIDE SEARCHED INFORMATION IN THE FORMAT OF U-MO RESOURCE DESCRIPTION INFORMATION

S430

END

[Fig. 5]

START

RECEIVE SHARED U-MO RESOURCE DESCRIPTION

S510

CONVERT U-MO RESOURCE DESCRIPTION INTO RESOURCE DESCRIPTION OF CORRESPONDING DEVICE SYSTEM

S520

STORE CONVERTED RESOURCE DESCRIPTION

S530

END
A. **CLASSIFICATION OF SUBJECT MATTER**

**H04L 12/28(2006.01)**

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)

IPC 8 H04L, H04Q, H04B, H04W

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), Google Scholar "context information base", "CIB", "shar*", "convert", "transform", "format", "resource description", "RDF", "Ubiquitous"

C. **DOCUMENTS CONSIDERED TO BE RELEVANT**

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<td>A</td>
<td>JP 07-1 14468 A (PERSONAL JOHO KANKYO KYOKAI) 2 May 1995</td>
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Date of the actual completion of the international search

30 MARCH 2009 (30 03 2009)

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Name and mailing address of the ISA/KR

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<table>
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