A Design of Building Group Management Service Framework for On-Going Commissioning

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Abstract. Building Energy Management System (BEMS) is one of the major technologies for energy saving. However, the existing BEMS is developed by the bottom-up approach for the specific purpose or function. And it requires a field work for the building Commissioning or the Measurement and Verification (M&V) service. For the top-down approach, this paper proposes the Building Group Management Service Framework for On-Going Commissioning. This service framework is provide an infrastructure for building group energy management services such as a building information integration service, a building energy monitoring service, a statistical service, an analysis service, a facility diagnosis service, an on-going commissioning service, M&V service and so on. These services are registered in the Control Center by Energy Service Company (ESCO) and used by a building manager who joined the Control Center.

Keywords: BEMS, BAS, Building Group Management, Commissioning, Service Framework.

1   Introduction

The building energy consumption (Residential, Commercial and Public buildings) is over 30% of the world energy consumption. In South Korea, the Building sector accounts for 25% of total energy consumption and about 45% of total electricity consumption [1]. So, many research and development are underway to save the energy, especially electricity, in buildings. In case of the large scale buildings, BAS (Building Automation System) and BEMS are used for saving the energy through the monitoring, control and analysis services. However, the existing BAS and BEMS are developed by the bottom-up approach for the specific buildings and the purpose of services. Therefore, it is difficult to extend new services to the existing BAS and BEMS infrastructure. In addition, there are IT-based online building energy management systems, but they cannot replace most of field works such as building commissioning and M&V, etc.

In this paper, we propose the Building Group Management Service Framework for On-Going Commissioning. It is not only for the specific buildings and the services but also for any buildings and energy management services. Building manager who

wish to receive building management services be registered the Control Center. Then, the Control Center collects building energy management information such as building profile, energy, facility, environment through the common data protocol. And the energy management services also are registered the Control Center by ESCO (Energy Service Company).

2   Related works

A number of companies are entering the energy management space. Honeywell, Johnson Controls and Siemens are leading companies in this field. A BEMS is similar to a Building Management System (BMS), yet is specifically focused on energy efficiency optimization and energy management. While a BMS does have energy management aspects, it also includes the monitoring of fire systems and security systems [2].

A variety of solutions from various companies has limitations on scalability and interoperability because they focus on a specific building and service. In addition, the different vendor's BAS/BEMS solution uses various protocols such as BACnet, Modbus, LonWorks, KNX, ZigBee, etc. To integrate with heterogeneous BAS and BEMS, Integration Network Protocol is introduced [3].

Building Commissioning is one of the ways to reduce building energy consumption. Commissioning is a quality-oriented process for achieving, verifying, and documenting that the performance of facility systems and assemblies meets defined objectives and criteria. Commissioning reduces risk, enables the smooth operation of a newly constructed building, and can reduce lifecycle energy and maintenance costs. Commissioning is performed when a building is constructed. This process is typically conducted once every 5 to 10 years by engineers on site. Over the long term, the business model for commissioning services will eventually shift to a real-time fault detection and diagnosis service, enabled by On-going commissioning based-on online building energy management system [4][5].

In this paper, introduced service framework provide infrastructure for building group management and online building energy services management such as a building information integration service, a building energy monitoring service, a statistical service, an analysis service, a facility diagnosis service, an on-going commissioning service, M&V service, etc.

3   Building Group Management Service Framework for On-Going Commissioning

As shown in Figure 1, Building Group Management Service Framework for On-Going Commissioning consists of Open Gateway and Control Center Server. Open Gateway is in the building that has been registered in the Control Center. And it integrates heterogeneous BAS/BEMS, sensor and meter information using integrated protocol. Open Gateway transmits data to Control Center after verifying all received

data. In addition, Open Gateway has scalability for added sensors and meters because all of data are managed as an object in a database.

Fig. 1. A configuration of Building Group Management Service Framework for On-Going Commissioning

Control Center provides data warehouse and web-based GUI service. In order to ensure accessibility to building energy application services, Control Center generates data warehouse based-on time-space aspect. Web-based GUI service offers an environment which can register, request and manage services to users such as Control Center administrator, building manager, ESCO provider, energy diagnosis expert.

The Figure 2 shows a service flow among the users in Control Center. ESCO can register own building energy management services after joining the Control Center. To register building energy management services, ESCO upload information of service profile that consists of service specification, objectives, pricing, execution environment, target building information, etc. These services can be executed as web-based application or system application. While web-based application is connected to web-based Control Center server using Open API, system application is installed in building manager's Open Gateway. In the case of building manager, the manager who wants to receive building energy management services joins the Control Center in advance. Then, the building manager can see the list of services registered in the Control Center and may be recommended appropriate service through the building profile information. When the administrator in Control Center approves the building manager's service license request, the manager executes service in anytime. The Control Center performs the role of intermediary between a service provider and a service user. the building manager who joined the Control Center basically receive the services such as building energy monitoring and statistics, association analysis

between environmental information and energy consumption, comparing usage service among the buildings in Control Center, etc.
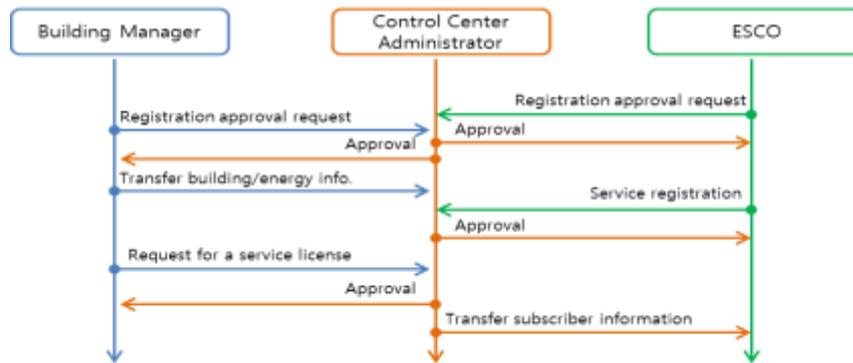

Fig. 2. A flow of web-based user interface service in Control Center

In addition, in order to receive the service that needs additional installation of sensors and meters, just install and insert the information as an object to this service framework without system modifications or upgrades.

The Building Group Management Service Framework for On-Going Commissioning can construct infrastructure for integrated building energy management as a national level and contribute to the activation of ESCO business.

4   Conclusion and Future Works

Recently, the efforts to reduce building energy are very active and there are many buildings that have BAS and BEMS solution. However, it is difficult to integrate different vendor's BAS/BEMS solutions that use various protocols for the building group energy management aspect. And, advanced BAS/BEMS technology still cannot replace most of field works. To solve this limitation, we introduce a service framework for the whole building energy management as a national level including integration, management and application of building energy information.

The system infrastructure in this service framework is developing on the basis of this design. As a future work in this paper, we will focus on the empirical studies to increase participation rate of ESCO and to develop a various building energy management service applications.

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