Academic Room Monitoring and Management Framework

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Abstract The most attractive problem in campus asset management is academic room monitoring and management. Academic rooms consist of classroom, seminar/conference room, laboratory, studio, workshop room and other room. Limited academic room is a main constraint in room scheduling problem and potentially arise scheduling collision. Another problem is improvement to room monitoring and management especially room assets. This paper will introduce and investigate a framework of improvement to academic room monitoring and management in campus intelligently. Framework will consist of global business process, common information model and academic room system architecture.

Keywords Business Process, Academic Room, Common Information Model, Framework

collaboration; (3) what data that must be shared between entities; (4) what mechanism to monitor academic activity intelligently. The main objectives are to investigate and introduce a framework of improvement to academic room scheduling, monitoring and management in campus. Main contribution of this paper is to introduce academic room framework in monitoring academic room activity intelligently.

The rest of paper will describe related work in the second section, third section will discuss global business process of academic room, fourth section will describe common information model that captured from global business process. The fifth section discuss about academic room system architecture for academic activity monitoring intelligently. The sixth section will discuss three previous sections to identify the objectives achievement that is described in first section. The final section describes conclusion and future work of this research.

1. Introduction

Most attractive problem in campus asset management is academic room scheduling, monitoring and management. Academic rooms consist of classroom, seminar/conference room, laboratory, studio, workshop room and other room. Problem that usually arises is scheduling collision for classroom. Limited number of classroom is main constraint to manage and schedule rooms. Another problem is room asset management. Room assets must be well prepared for academic activity such as teaching and learning process. Room asset management will support in teaching learning activity monitoring. Successful teaching and learning process is important key to make better academic quality.

This paper will capture a case study of a campus in academic room problem. The questions that can be identified in this paper are: (1) which entities that is involved in the framework; (2) how the entities do

2. Conceptual Background

2.1. Business Process Modelling

Business information modelling is introduced by Business Process Management Initiative (BPMI). First version has published in 2004 and second version in 2008. Notation of the model is called Business Process Management Notation (BPMN). BPMN defines a Business Process Diagram (BPD), which is based on a flowcharting technique tailored for creating graphical models of business process operations. A Business Process Model, then is a network of graphical objects, which are activities (i.e., work) and the flow controls that define their order of performance [1]. The BPMN Business Process Diagram has been designed to be easy to use and understand, but also provides the ability to model complex business processes [2].

Owen and Raj [2] also explained that BPMN provides a number of advantages to modeling business processes over the Unified Modeling Language (UML). First, it offers a process flow modeling technique that is more conducive to the way business analysts model. Second, its solid mathematical foundation is expressly designed to map to business execution languages, whereas UML is not. BPMN can map to UML, and provide a solid business modeling front end to systems design with UML.

Here are a sample of business process modeling by Owen and Raj for online auction system:

Figure 1. Simple BPMN Business Process Diagram for an on-line auction system

The figure above illustrate business process in internal system, to overlook how BPMN can figure collaboration, here are the example from [2] that drawn in figure 2.

Figure 2. BPMN Business Process Diagram with processes drawn in pools

2.2. Common Information Model

A common information model (CIM) defines information that is available for sharing among multiple business processes and the applications that support them. These common definitions are neutral with respect to the processes that produce and use that information, the applications that access the data that express that information, and the technologies in which those applications are implemented [3][18-23][24].

The key thesis of the ANSI/SPARC Committee was that traditional integration practices required *point-to-point* interfaces between each application and the data sources it depended on [3], as illustrated in Figure 3. This required the development of a mapping between the definition of the data available from the source (the *internal schema*) and the definition of the data required by the application (the *external schema*). The committee referred to such an approach as a *two-schema architecture*. The interfaces between the components had to implement this mapping in order to transform the physical representation, the syntax, and the semantics of the data from its source to its destination.

Figure 3. Two Schema Architectures

The ANSI/SPARC Committee recommended an alternative architecture, as depicted in Figure 4, in which interaction among applications is mediated through an integration broker that implements what they called a *conceptual schema*, and what this paper refers to as a *common information model* or *CIM*. (Also known as a *Common Business Information Model*, *Canonical Business Information Model*, *Normalized Information Model*, *Common Business Object Model*)

In this architecture, individual applications map their schemas only to the conceptual schema and interface only to the component that implements the conceptual schema (herein referred to as the *integration broker*), which is responsible for translating data from the source application

first into the neutral form of the CIM and from that into the form required by the target application. Since each exchange passes from the internal schema of the source application through the conceptual schema of the integration broker to the external schema of the destination, the committee referred to this approach as a *three-schema architecture*. Further reading can be found in [4][7][16][17].

Figure 4. Three Schema Architectures

2.3. Intelligent Infrastructure

Curtis *et al* conclude that monitoring and control of infrastructure systems require that sensing and actuation be designed to maximize controllability and observed ability [8][13][14][15]. The objective of intelligent infrastructure to enhance overall business performance and how this will help to deliver the academic of the future [9]. Ollier [9] remain this will require a step change in performance and a new business based approach. An integrated approach to asset management and a change in maintenance philosophy from 'Find and Fix' to a 'Predict and Prevent' will make a significant contribution to meeting these aims. Performance of intelligence infrastructure has introduced by Leduc [10] as follow: (1) Diversity: Considering the variety of existing equipment and the different modes of communication utilized within your infrastructures; (2) Scalability: Does your site and its equipment inventory change over time?; (3) Reliability: By providing a continual accurate reading, the monitoring unit will eliminate costly dispatching, reduce maintenance expenses and provide reliably steady information over the decades to come; (4) Simplicity: Whether remote or local, the external monitoring units must offer a wide variety of easy-to-use operating functions [24][25][26][27].

The most popular example for intelligent infrastructure in manufacturing system is drawn in figure 5 below:

Figure 5. A remote monitoring system for enterprise internal production management

3. Global Business Process

This section will initiate the answer of three questions such as: (1) which entities that is involved in the framework; (2) how the entities do collaboration; (3) what data that must be shared between entities. Business process will show shared information and identify business information to detail and also which entities will be involved in the system. Here is global business process for academic room scheduling, monitoring and management framework that is drawn in figure 6.

Figure 6. Global Business Process for academic room scheduling, monitoring and management framework

4. Common Information Model

Previous section has described global business process and the process can be map to common information model as follow.

Table 1. Mapping of Facility, Academic and Teaching Learning Office for CIM

Facility	Academic	Teaching Learning
Common Data: 1. Room Master List 2. Asset Master List	Common Data: 1. Lecturer 2. Subject 3. Class	Common Data: 1. Lectures 2. Curriculum
Common Information: 1. Academic room is a group in room master list 2. Asset master has a relationship to academic room. 3. Periodically academic room is prepared	Common Information: 1. Academic maintain lecturer data and subject 2. Each subject has a relationship to lecturer 3. Class has a subject and lecturer	Common Information: 1. Lectures is part of curriculum 2. Curriculum is part of department 3. Curriculum and lecturers source is updated periodically
Business Process Information: 1. Room and Asset Tracking 2. Check and Update Asset Room 3. Classify academic Room 4. Prepared Room for Academic Activity	Business Process Information: 1. Academic Room Scheduling 2. Academic Room Management 3. Teaching Learning Monitoring 4. Teaching Learning Reporting	Business Process Information: 1. Improve Activity Procedure 2. Conduct Standard Procedure 3. Collect availability plan
Application Data: 1. Room Entity 2. Asset Entity	Application Data: 1. Lecturer Entity. 2. Subject Entity 3. Class Entity	Application Data: 1. Plan Entity 2. Monitoring Entity 3. Activity Reporting

Based on table above, entities that will be involved in CIM such as (1) Room; (2) Assets; (3) Lecturer, (4) Subject, (5) Class, (6) Plan, (7) Monitoring, (8) Activity. Interface that can be captured from table above are:

1. Facility $\leftarrow \{ \text{Room, Class} \} \rightarrow$ Academic
2. Academic $\leftarrow \{ \text{Class, Plan, Monitoring, Activity} \} \rightarrow$ Human Teaching Learning Office
3. Facility $\leftarrow \{ \text{Room, Monitoring} \} \rightarrow$ Teaching Learning Office

Common Information Model that can be generated from description above (drawn in figure 7):

Figure 7. Common Information Model Architecture for Academic, Facility and Teaching Learning Office

Figure 8. Teaching Learning Monitoring Business Process (left) and Academic Room Monitoring Architecture

5. Academic Room System Architecture

Global Business process has drawn teaching learning monitoring business process and this section will detail the process as down by figure 8 (left). Diagram show that monitoring process involved several sensors to optimize teaching learning activity. The system architecture has drawn in figure 8 (right). There are several sensors that controlled by PC which connected to wireless LAN for transfer data to monitoring centre. The sensors consist of lighting, temperature, fan/ac, presence detector, camera and RFID. There is also main control for lighting, temperature, fan/AC and presence detector. This main control connected to PC controller. Intelligent process will be determined by PC controller and reported to monitoring centre using wireless LAN

6. Discussion and Conclusions

The questions that can be identified in this paper are: (1) which entities that is involved in the framework; (2) how the entities do collaboration; (3) what data that must be shared between entities; (4) what mechanism to monitor academic activity intelligently. Although globally drawn but the figure can be mapped to common information modelling and provide necessary information. The contribution of this paper is shown by system architecture and will be developed further in future works [11, 12].

This paper already success describing academic room monitoring and management and propose an intelligent system to monitor teaching learning activity. Teaching learning activity is important key in academic process quality improvement. The challenge for future works can be identified as follow: (1) Business process improvement detail and its implementation; (2) Implementation of common information model to be integrator broker for several applications that had been developed; (3)

Development for system architecture logically and physically.

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