CONTEXT-AWARE AUDIT SPACE MANAGEMENT SYSTEM

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ABSTRACT

This paper highlights the large demand issue of space usage in teaching and learning environment in Universiti Teknologi MARA (UiTM). The spaces usage in UiTM has raised serious concern due to the large of various type of working environment with dynamic number of workers and students. The space capacity with its related data are growing and most of the time requires real-time information access. As current process only can be done manually, providing comprehensive and accurate information about the teaching and learning spaces are quite limited. Therefore, this paper presents the design of a context-aware audit space management system that will provide a comprehensive space information at a real-time. This paper highlights the related of components in an automated space-time audit. The component based will be integrated and tested in the existing space management system.

Keywords: Context-aware; audit space; management system;

1. INTRODUCTION

Space management is one of the important elements that can ensure organization's activities run smoothly especially for education management's university that involves large number of students with many subjects and teachings components. An increasing number of students is expected to occur at every coming semesters. Therefore, the space management planning is highly critical in the university mainly in real-time spaces management. Based on the observations in Universiti Teknologi MARA (UiTM) environment, the existing spaces around the campus are highly overload with many resources. The spaces are mostly unorganized with limited functions of space management system. Often, the spaces recorded in the existing space

management system are not supported with synchronization of real space used. Based on these issues, it is very difficult for the other related systems to manage the time-based sharing in the academic spaces system such as class and teaching scheduling for all the classes. Currently, the auditory system for classes is manually named and checked. The data of audit space number is not recorded in a centered database, which will cause of human errors with inaccurate existing codes management and manipulation. Bahagian Kualiti Audit dan Kualiti (BKAF) in Jabatan Pengurusan Fasiliti, UiTM has responsibilities to reorganize and improve the management of UiTM space functions. The system recorded spaces used in a manual method, which saved as image of drawing file. Then, a space management system is introduced by BKAF department to manage the space usability in all UiTM's campuses in Malaysia. The system is responsible to manage the space by using ARCHIBUS FM where the system will save all the space data in the central database. So, the team of audit space in BKAF have to conduct the space audit job manually due to some modules that are not included. The information cannot be shared and compared between the new and old data as their audit space data does not captured the time-based of the space used in this organization. From previous surveys of space used in the university, it shows an increasing use of space utilization. However, current records cannot be searched by Audit Team to solve the problem of space used at real-time. From the space investigation, the records must provide by the team for the type of usability of rooms with net square feet totals and occupants. They must perform the investigation of the physical of space to make sure all current space is being fully utilized. Due to the shortage of space in campus, the facilities or reallocation of space information must be shared to check the availability of the spaces. The problems in relation to the space management can be divided into five areas [1] such as the following:

- Information – Inaccurate information due to the system has not integrated each other.

- Innovation – Demand of the space increasing by time.

- Design – No data update due to the space changed requirements.

- Communications – No policy guidance notes from space management team to user.

- Management Techniques – Inappropriate used the policies as formal by space management team. Lack of management techniques to manage the space requirement, space used and space availability. Hence, this paper identifies the main components in existing space-time audit system that deals with real problem as comprehensive information, and to give the descriptions of incorporating the new defined component in the automated space-time audit activities.

2. RELATED WORKS

This section highlights several existing audit space systems. The purpose of this investigation is to identify main component in existing space-time audit system that will deal with real problem is comprehensive information. In dealing space usage to hospitality propose, [2] highlighted that there are three phases by using a model; analysis of business unit process, acquire data, and implementation. In the analysis of business process phase, all the department of the hospitality must have corporation for each other to avoid a redundant data management. The data migration in a central database and the data collection will be suit to the reality usage. An important business process of a hospital will integrate all the acquired data to be examined and analyzed separately to achieve the goals of space audit. Therefore, an implementation of dedicated system such as centralize the database, will create effective business processes. The space management tools need to be implemented to all buildings to avoid the duplication of business process. [3] highlight that Massachusetts General Hospital's asset management systems propose the tools of Inventory Tracking System for the space equipment. Space is also an asset that to be considered with the equipment attached. The hospital uses an access system database, and the module audit is the section of asset module component for the system. This module allows users to track the equipment attached in the space and the results of the audit.

In [4], the module allows operators to see the status of an operating theater either available or not, then will schedule the patients in emergency condition for surgery faster.

In summary, this module shows that the space of real-time overview of scheduling. In [5], it defines that the space needed for academicians and general staffs are very important to be record. The university management must ensure all the resources to manage an optimal space used with the operational in the university where Space Audit Procedures Flowchart will help their process to define the general teaching space, specialist teaching spaces and define the remaining space. [6] work is for the government of Western Australia used to improved pedestrian safety, consultants and community groups to identified findings of the situation in audit report. A map is attached so that readers can easily see how each segment was rated. The technology of keeping the site data is very important in order the government to monitor the visitors or walk people around the walk space. However, the walk space is an infrastructure of the space. In space management, there consist of infra space and civil space such as building. The walkability tools can be undertaken at any time. The walkability audit performed at a time when a large number of users are walking. Table 1 is composed to highlight such important foundations of an audit-space system.

**Table 1.** Summary of Existing Audit-Space System

No	Domain	Component of Audit	Database Type	Input	Output
1	Hospital [3]	Integrated system with all system departments.	Support all database types	Variation of data file system	Real-time info about - room no - floor no - building no
2	Hospital [5]	Asset Module Asset Audit Audit tray method	Access database	Data Entry	Audit trail capture: - -historical auditor - types of item -result of audits - reports
3	Hospital [4]	Facilities usage scheduling	Support all database types	-Data Entry -Validate all data	-All modules integrated each other -Show facilities usage real-time
5	Walkability Audit Tool [6]	Audit report location and characteristics	NA	-Read by map -CDC's Walkability Audit	Audit report – commonly used walking routes - identified safety hazards

From the table, the database is important which will be accessed in a centralize manner to retrieve the data. The database should work with audit-space components that can record spaces characteristics and statuses at real-time. The user must be provided with show situational view context-aware elements such as space usage and present the reports for space safety, hazard and the availability of the space.

3. METHODOLOGY

This research will use three major steps to develop the space audit system: planning, implementing and testing as shown in Figure 1. The first step is planning, which involve finding what type of data to be collected and stored. To achieve the research objectives, this research employed a qualitative approach. The data and information were collected through interviews with the Audit Space team and Space Management System at BKAF department, users of the

space and several of student numbers. The total numbers of interviews conducted for collecting the data requirements are seven.
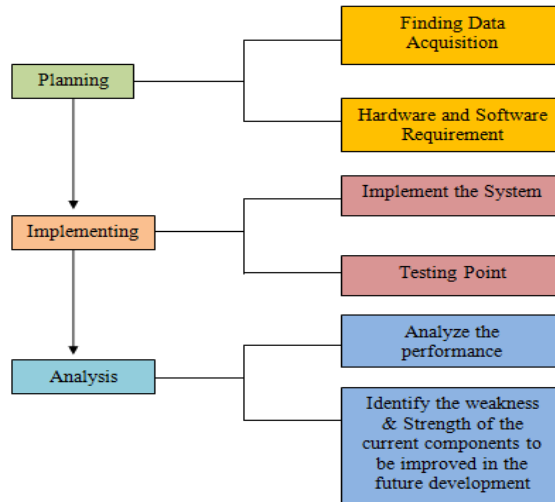
Fig. 1. Overall methodology

There are many problems to address and procedures that must be followed before collecting all the data and information for a study of this type. After collecting the data and information, the analysis of data was conducted. Content Analysis was selected as the most appropriate method to analyse the data to summarize qualitative data and attain the conclusions. In the content analysis phase, strategies used in UiTM space is identified. The obtained data and information were then grouped. To improve the usability of the existing system used in UiTM, 5Es techniques in [7] will be applied.

Based on the literature review, the existing Space Management System must include the new output to improve the current system to audit the usage of the space in UiTM Campus. The output will contain context-aware elements providing the real-time information about the space usage in terms of the room number, floor number and building number that are currently used. Furthermore, the audit reports must provide information to track the space currently used. The report must include information of the safety used and how the function of the space can be replaced. Besides, the new output of the new modules must attach with prior notification/ arrangement of the space usage, such as the classroom that has book by other class, there must have a notification that the class existing occupied.

In the planning phase, the hardware and software requirement must decide to meet the version of development latest software. The existing modules include in the Space Management System at UiTM such as 1) Space Management, 2) Design Management, and 3) Building Operation Management. In the new modules, there have a new task for the system; Audit trail, where the functions are to capture the historical of the auditor, capture the space unique number

that have been modified by the auditor and will give the results of monthly audits as a report. All the modules listed are integrated but to add two new modules, must integrate with the old modules. The new two modules include using the PHP language and interface design using the HTML language. These modules will use an Oracle Database for better usage in order to integrate with existing modules in the system. The integrator between all the components of the system modules based on the database integrated. The table and field created must be related in the existing database structure.

The second phase is implementing the components with testing point that the components based on specified integration plan. The components will interact with other components or functionality in the software development. Basically, the components define easily with the meaning of system interface and will integrate with other components in the software in order to complete the software process [8]. In this research, there are two components for the Space Management System; 1) Audit Space Module and 2) Audit Space Summary & Reports. The goals for developing another two components are to fulfill the user requirements to update the audit space usage in the UiTM and at the same time will increase productivity, quality, and performance of the existing space management system.

The new components function will integrate with the others existing components and the data will store in the same location of the Oracle database. Table 2 is a summary of the components specification for development:

Table 2. The new components

No	Components	Specification	Implementation	Component Models
1	Audit Space Module	Audit space status of: - -Occupied -Non-occupied -Rented	Integrated with Space Management System Module	-Using PHP and HTML languages - Oracle Database
2	Audit Space Summary / Report Module	-Report of the space by status -Summarize of the space usage	Integrated with Space Management System Module	-Using PHP and HTML languages - Oracle Database

The testing planning for development of two components will provide the test plan template. The document provided intends to record the the functionality, interface and output or input of the components. The test plan document will be used to verify the software meets its design and user requirements. The test plan will apply the following strategies [9]:

- Design Verification– perform during development stage of the software
- Production Test – perform during the preparation of the software for performance

verification and quality control

- Acceptance Test – perform at the time of delivery or installation of the software

- Service and Repair Test – perform over the required of software service life

- Regression Test – perform on existing operational components and verify applies new component will not affect the existing component process.

Testing plan document will help software engineer to define the complex of new components development to be deploy or in the stage of the development.

The third phase is to analyze the steps for developing and designing the new components for audit space management system. The analysis consists of studying the organization process, getting the operational data, understanding the operational information flow, finding out bottlenecks and evolving solutions for overcoming goals. These analyses consist the process of entire system that include identifying the existing data store and audit manual processes.

To improve the existing component model, the concept of collection of space information to reuse with design components must be expanded. Integrated tools in the database design for the table relationship must relate to the existing table for space management system. The performance of the new system will be evaluated according to the effectiveness of new components. The existing module interface will be tested by measuring the response time or the number of instructions at the system functions. The existing components are developed as client side where the user's computer needs to be installed with the Space Management system component.

4. CONCLUSION

This paper highlights the importance of facilities management in managing the space used. Therefore, designs of the new system and plan for development and testing have been presented. Corresponding with the rapid pace of lack of the number of space usage and the demands for basic spaces such as office and classrooms, there is a need for the space audit services in UiTM. Thus, it is vital for UiTM to have reliable strategies for managing its space usage status.

This work has identified two related findings that fulfill the research objectives. The first finding shows that UiTM has facing the problem of lack of information in terms of the space usage. The second finding present the strategies used for handling space usage along with its equipment. Based on these issues, this work has provided a design of handling spaces in real-time that can be adopted to provide an effective space usage in the UiTM.

5. REFERENCES

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