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DEVELOPMENT OF GIS-BASED CLASSROOM MANAGEMENT INFORMATION SYSTEM IN UiTM

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Abstract
Universiti Teknologi MARA (UiTM) is Malaysia's largest institution of higher learning in terms of size and population; consequently it needs an efficient database building information model (BIM) in managing classroom and other facilities. Geographical information system (GIS) is one of the tools that have the capability for such application today. Therefore, this study is to develop a proposed classroom management information system in the Centre of Studies Surveying Science and Geomatics (PPSUG,) UiTM Shah Alam using GIS, Microsoft Visual Basic (VB) and MapObjects Windows. The integration of BIM and GIS technologies not only opens up a suite of new analysis options for facility operators, but also allows the results of these analyses to be reported and visualized at all geographic levels of detail. The Standard System Development Lifecycle (SDLC) is adapted to achieve the objectives of study; i) to analyze the user requirement on the proposed system; ii) to design and develop the system; and iii) to implement and evaluate the system. 90% of the selected respondents strongly agree that the existing classroom system should be improved with dynamic query functions, mapping direction, graphical visualization, and printing functions. This proposed system allows the user to have a dynamic view and search the spatial classroom information. The result of study could be used by the Department of Facility Management and PPSUG as a geospatial framework for Sustainable Classroom Management Information System (SuCeS) in UiTM.

Keywords: Geographical Information System (GIS), Classroom Information System, Building Information Model (BIM), Standard System Development Lifecycle (SDLC).

1. Introduction

Recently, the rapid development of geographic information system (GIS) technology has significant contributed on the field of facility and human resources management. A GIS has seen many applications such as for building management (Shukla and Rath). Bulding or classroom spatial information are stored in digital layers and database, then the manipulation of these layers will provide a very powerful tool for the applications such 'query process' or for 'decision making' (Matori and Mohd Saat, 2003). GIS-based classroom information system in PPSUG is developed to meet the current advances in the information technology and provide a better facility management system in the campus.

2. Sustaining Classroom Management Information System Using GIS

Sustainable classroom management can help students take responsibility for their own actions and behavior. It provides lecturers with a structured system that helps them to run the classroom efficiently. With a good classroom management system, the lecturer has a better sense of control over the classroom management system and there is no need to make things up as he goes along. This study emphasizes the design and development of GIS based classroom management information system with the aid of building information model (BIM), spatial analysis, and the standard system development lifecycle (SDLC).

2.1 Buildings in Centre of Studies Surveying Science and Geomatics, UiTM Shah Alam

Building can be categorized in various types such as office facilities, educational facilities and leisure facilities. Educational facilities are becoming increasingly specialized. Previously, classrooms intended for pre-scholars

are fundamentally different from those that best serve high school seniors or the training of mid-career professionals. Today, even the traditional idea of classroom as an instructor focused learning space is changing. The growth of computer-based instruction, video projection and other telecommunication requirements is causing us to rethink traditional educational patterns and spatial relationship.

Universiti Teknologi MARA (UiTM) is Malaysia's largest institution of higher learning in terms of size and population. It has experienced phenomenal growth since its inception in 1956 and still growing. There are 12 branch campuses, 3 satellite campuses, 9 city campuses and 21 affiliated a college which is expended nationwide by UiTM. PPSUG is one of the centres of sciences and technology uner Faculty of Architecture, Planning and Surveying. There are six levels of floor at PPSUG with the three building blocks (Block A, Block B, Block C) and seven courses offered in this department from undergraduate level to postgraduate level.
PPSUG has their own infrastructure in order to meet the need of their students and staffs. Amongst, include of lecturer rooms, office, classrooms and lecture hall (DKB, DK1 and DK2), equipment store, Geomass room and laboratory of GIS, Remote Sensing, Photogrammetry, Cartography, Engineering and Computer. The centre has not a specific system in managing its classroom or other facilities. Consequently, there are several problem arises such as the number of the equipment in the classroom is not enough for students, the difficulty in obtaining the substitution classroom and lastly the management does not properly check the number of student which is available in each class.

2.2 Geographical Information System (GIS), Building Information Model (BIM) and Standard System Development Lifecycle (SDLC) Towards A Sustainable Classroom Management Information System (SuCeS).

This study proposes a prototype of GIS-based classroom information system towards developing a Sustainable Classroom Management System (SuCeS) in UiTM. The system is created using three combination of techniques which are GIS, BIM and SDLC. The conceptual framework of the system is showed in Figure 1.

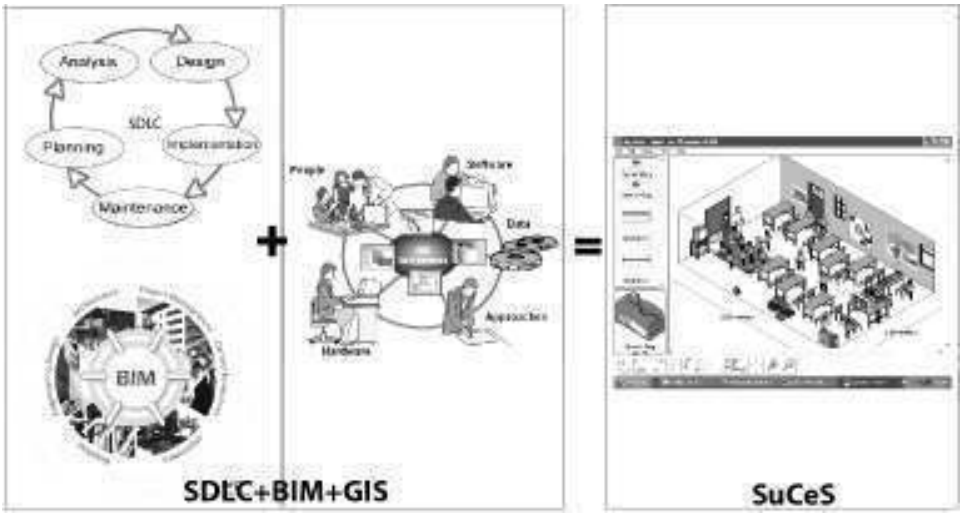

Figure 1: Conceptual Framework of Sustainable Classroom Management Information System (SuCeS) of UiTM
(Source: pictures modified from Schuurman, 2011, Rhodes, 2011, Watson, _, Nemescheck Scia, 2011)

GIS can be describe as a system for capturing, storing, checking, integrating, manipulating, analyzing and displaying data which are spatially referenced to the earth. This is normally considered to involve a spatially referenced computer database and appropriate applications software. A GIS enables to envision the geographic aspects of a body of data. Basically, it lets user query or analyze a database and receive the results in the form of some kind of map. Since many kinds of data have important geographic aspects, a GIS can have many uses such as weather forecasting, sales analysis, population forecasting and land use planning to name a few name.
The process produces the building information model (BIM), which encompasses building geometry, spatial relationships, geographic information, and quantities and properties of building components (Eastman, 2009). Pieces can carry attributes for selecting and ordering them automatically, providing cost estimates and well as material tracking and ordering. This method of management is more practical and efficient. It eliminates many of the uncertainties found during the construction phase since they can be found during the design phase of the project and fixed so they do not occur during the actual construction phase. Also, any changes during

construction will be automatically updated to BIM and those changes will be made in the model. Modern BIM design tools go further.

The standard system development life cycle (SDLC) is the overall process of developing, implementing, and retiring information systems through a multistep process from initiation, analysis, design, implementation, and maintenance to disposal. There are many different SDLC models used in global, but each generally consists of a series of defined steps or phases. For any SDLC model that is used, information security must be integrated into the SDLC to ensure appropriate protection for the information that the system will transmit, process, and store (Radack, 2009).

2.3 GIS-Based Classroom Management Information System

The strength if GIS lies in its capability to carry operation of integrating both spatial (map) and non-spatial (attribute) data to devise solutions for technical and strategic decision-making. Other unique features of GIS include data conversion or exchange, data analysis, data simulation or 3D modeling, decision querying, database connectivity or sharing, retrieval of data, dynamic presentation, user friendly and multi user operations. A few examples of use of GIS in various facility planning and management include infrastructure, town planning, and building.

Smart building is a building that is managed with data and information systems capable of supporting building planners and operators with faster, more accurate decision-making application that deliver authoritative analysis, visualization and reporting. Smarter buildings and facilities are those that are safe, secure, energy-efficient and optimally operated and utilized will result from the convergence and interoperability of GIS, BIM models and specific facilities management technologies like enterprise asset management (EAM), building automation systems (BAS), computerized maintenance management systems (CMMS), computer-aided facility management (CAFM) and integrated workspace management systems (IWMS).

The implicit structure and organization of BIM object attributes in a relational database provide helpful technical integration points with GIS. GIS natively stores data in a geospatial or location-based relational database management system. When BIM models and GIS are integrated, this opens up a suite of new analysis options for facility owners and operators. It also allows the results of these analyses to be reported and visualized at all geographic scales or levels of detail.

Green Building Information Gateway in USA (CBIG) and GeoCampus in UiTM Penang are examples of GIS application in school or university building information management that provides online users with navigate and compare green building over both space and time. GBIG is built with Esri's ArcGIS Server and ArcGIS API for Flex, is being made available in phases for large metropolitan statistical areas across the United States. Using tools within ArcGIS, project can be animated to show growth over a specific time period. While, GeoCampus is as a set of tools, and also the researcher link some scripts with new controls created in any of the multi-dimensional windows such as project, view, table, chart or script.

3. Methodology

The guideline of the standard system development life cycle (SDLC) is adapted to develop the GIS-based classroom management information system in PPSUG (Figure 2). The methodology is divided into three stages; i) to analyze the user requirement on the proposed system ii) to design and develop the system and, iii) to implement and evaluate the system. The selected user requirements analysis is conducted by using the informal method includes observation of the existing system, survey questionnaire and semi structure interview. The selected respondents are chosen based on their professional skill, knowledge and opinions as consumers.

The individual perspectives information on the other hand supplies information regarding the users' perception and expectation through interview, observations and questionnaire. These groups provide useful information for the design of the proposed system user interface. The survey results obtained are analyses using Microsoft Office Excel 2007. ArcGIS, Microsoft Visual Basic (VB) and MapObjects Windows are used to process data and develop the system such as map scanning, registration, creating geodatabase, digitizing process, designing user interface, and programming language. Two selected experts are appointed to evaluate the performance of the system.

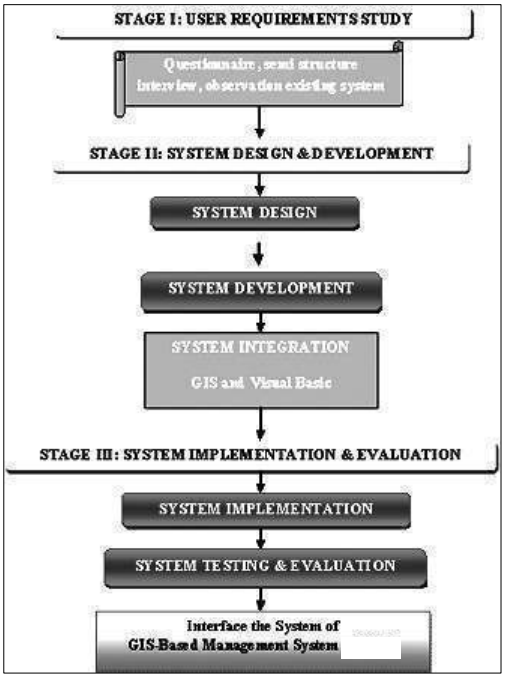

Figure 2: Methodology of Study

4. Result and Analysis

This section focuses on the respondents of user requirement, the functions of developed system and the evaluation of the developed system. The result found out that 90% from the respondents made up of teaching, technician and administrator of PPSUG agreed that the current system should be improved with dynamic functions such as query and searching, mapping direction, graphically visualization, and printing functions (Figure 3). They need a system in order to get information and all the matter about the classroom management when it is needed. In addition, with the availability of the system, classroom management becomes more organized and efficiently when it controlled by the system.

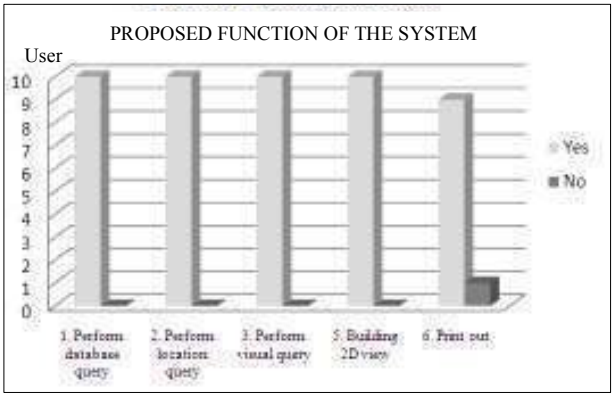

Figure 3: User Requirement for Proposed Functions of Classroom Information System in PPSUG, UiTM Shah Alam

The functions of developed system start with the main user interface as shown in Figure 4. These windows show the picture on the surrounding of the study area. Two links presented in this window are entering the system (ENTER) and exit starting window (EXIT). Clicking at the ENTER link will lead to the Login window of the system. The registered user can access to all the functions available in the Home window such as Floor Level Function, General Function, Navigation Function, and Viewing Window.

From the floor level function, the user allows to display the floor plan map by activated the button of each level that are needed. The general function allow user to perform the visualization of floor plan map in ArcGIS view and perform the query in database. The navigation tool offer functions such as zoom in/out and pan. Once the registered user clicked at the Searching button, the new window called Searching window will be prompted on the screen. User is able to search the classroom details information by clicking on the Classroom Details button. A new Classroom Details window will be appeared on the screen.

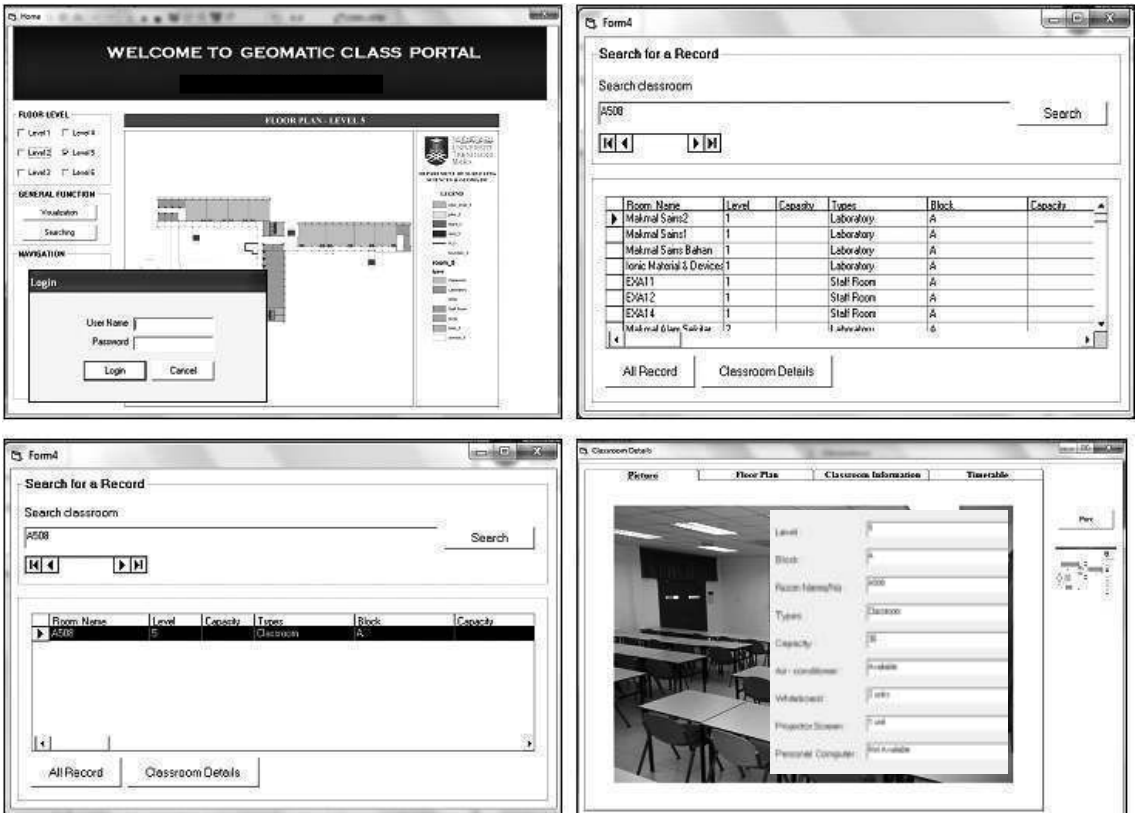

Figure 4: The Functions of the GIS-Based Classroom Information System of PPSUG, UiTM Shah Alam

Based on the testing and evaluation process conducted, it is showed that the evaluators agree with the system functions, but the system interface and database should be improved by providing more classroom information database such as timetable classes, facilities, and list name of staff. They also suggested that the printed plan of classroom information should be located at particular spot areas for spontaneous user references.

5. Conclusion and Recommendation

This study aimed to develop a GIS-based classroom management information system with the integration of ArcGIS, Visual Basic application, Map Objects Windows, BIM and SDLC in UiTM. Three major activities are performed to accomplish the research aims are; i) analyzing the user requirements for the design and development of the proposed classroom system ii) designing and developing the proposed classroom system and iii) testing the performance of developed system. There are several recommendations can be forwarded to make sure that the user are satisfied with the classroom information system: i) fully integrating ArcGIS Software, SQL Database, and BIM ii) integrating system with Internet and iii) performing the system in 3Dimensional visualization

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