Designing an Online Information System on Open Source Platform for Organizing Security Electronic Records of a Public University

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***Abstract*—This paper discussed about the management of records from paper based into electronic record through the development and design of Vehicle Observation System (VOS), an online information system develop under a collaboration between the Security Unit and Faculty of Information Management (IM), Universiti Teknologi MARA (UiTM) Kelantan. The main purpose of the project is to solve the problems of vehicle registration and to create a security mechanism for preventing unauthorized access to the campus facilities in addition to safeguard the campus stakeholders. The project adopting the SDLC methodology and open source information system using the integration of PHP: Hypertext Preprocessor (PHP) and Joomla! Content Management System (CMS).**

***Index Terms*—Records Management, Electronic Records, Vehicle Observation System, Waterfall model, System Development Life Cycle.**

I. Introduction

Information system is set of instruction carried out to perform a specific task. Building information systems encompass varieties of skills, such as mechanical, electrical, security, safety, information and communication systems. The proposed information systems are installed to support the required business or organization functions so that it is essential that they could be carried out without interruption in meeting the users' needs throughout the whole life cycle. Since system developments are complex and encompass many different kinds of components, the ability of the systems to continually perform their required functions is of vital importance [1]. These papers describe about the development of an information system using System Development Life Cycle (SDLC) methodology. This information system is developed under collaboration between Faculty of Information Management (IM) and Security Unit of Universiti Teknologi MARA Kelantan named as Vehicle Observation System or abbreviated as VOS. The primary purposes of this system development are to manage security records created or received by the Unit more systematically in electronic environment and to create a security mechanism for preventing unauthorized access to the campus facilities.

VOS was meant to solve the six problems on manual records management system experienced by the security guards in their daily works. The problems were:

1) Difficulty to trace vehicle registration records by staffs and students.
2) Few staffs could have more than two stickers for their vehicles.
3) The serial number on the vehicle sticker often was not matched with the registration records.
4) A lot of logbooks were required to enter incoming and out coming vehicle movement records that contributed to lack of space for storage.
5) Time delay and more staffs' efforts were needed to access and to retrieve records from logbooks especially when they are missing or lost.
6) Difficulty in generating statistical information for security records.

Apart from these, manual recordkeeping practised by the particular Security Unit was proven as ineffective and therefore the use of VOS is expected to improve effective records management, to increase security measures, to reduce staffs workloads and also to gain staffs and students satisfaction.

II. Literature Review

A. Electronic Records and Records Management Perspectives

The emergence of electronic records has been spearheaded by the emergence of Information and Communication Technology (ICT). The widespread usage of information system has increase the dependency towards the need of a proper records management. An electronic record could be defined in a decontextualised way by identifying and defining its necessary and sufficient components in such a manner that they could be recognized and captured by a digital information system [2]. They are comprised of digitally coded electronic data, which have the characteristics of evidence like the printed records. Records in electronic environments require a 'qualified electronic certificate' or in a more general sense of the term, a "digital signature" in order to have the characteristics of a record (to have legal validity). Digital signature is identified as a "security mechanism included within a digital record that enables the identification of the creator of the digital object and that could also be used to detect and track any changes that have been made to the digital object [3].

International Records Management Trust [4] has further indicated that electronic record is a record that could be manipulated, transmitted or processed by a computer. It is written on magnetic or optical medium including magnetic tapes, cassettes, CD ROMs, hard disks and diskettes, recorded in binary code, accessed using computer software and hardware and easily manipulated that is updated, deleted and so on. Building a trusted electronic records management platform is fundamental to today's organizations [5]. As

Manuscript received May 18, 2011; revised August 14, 2011.
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records migrate from a stable paper reality to an intangible electronic existence, their physical attributes, vital for establishing the authenticity and reliability of the evidence they contain are threatened [6].

How successfully organizations work to achieve trust in their electronic records would greatly influence corporate governance, regulatory compliance and efficient business processes. Experiences of records and archives authorities from many parts of the world revealed that technological elegance is not the answer to the electronic records issues. The solution lies with the establishment of strategic records management within a trusted environment. With the development and implementation of electronic recordkeeping the organization could help to improve customer satisfaction and meet organization objective. Besides providing essential evidence of organizational activities, transactions and decisions, electronic records also support business functions and are critical for the assessment of organizational performance. Without reliable electronic records governments could not manage state resources, its revenue or civil service. It could not deliver services such as education and healthcare. Moreover, without accurate and reliable electronic records and an effective system to manage them, governments could not be held accountable for their decisions and actions and the rights and obligations of citizens and corporate bodies could not be upheld [7].

Records management is referred as "the application of systematic and scientific control to all of the recorded information that an organization needs to do business" [8]. This definition is expanded by Ricks, Swafford and Gow [9] who stated that records management is "a function that provides for the systematic control of records from creation, or receipt, through their processing, distribution, organization, storage and retrieve to their ultimate disposition." Another definition highlighted by the Australian Standard is "the discipline and organizational function of managing records to meet operational business needs, accountability requirements and community expectations" [10]. Nowadays, traditional records management practices have been moved forward from manual to online via the utilization of web-based information system as an enabling tool for creating, classifying, storing, using, disseminating, retrieving, preserving and disposing of records.

B. Concepts of System Development Life Cycle (SDLC)

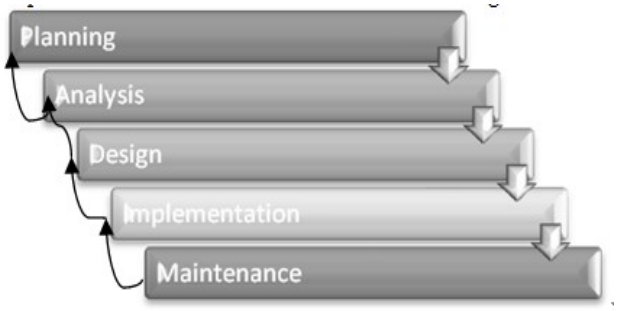

Fig.1.The Traditional Waterfall of SDLC

An information system is a collection of interrelated components that collect, process, store and provide as output the information needed to complete a business task [11]. Most organizations find it beneficial to use a standard set of steps called a systems development methodology to develop and support their information systems [12]. Like many processes, the development of information systems commonly follows a life cycle. Systems Development Life Cycle (SDLC) is the appropriate methodology adopted for the development and implementation of VOS that consists of five major phases namely Planning, Analysis, Design, Implementation and Maintenance as shown in Figure 1.

C. Foundation of Open Source Software (OSS)

An alternative to traditional software development in which proprietary code is hidden from the users is called open source software. It stands for a development model and philosophy of distributing software free and publishing its source code. In this way the code or computer instructions could be studied, shared and modified by many users and programmers. Rules of this community include the idea that any program modifications must be shared with all the people on the project. Examples include the Linux operating system and Apache software used for servers that host websites [13]. In developing VOS, system developers design the menu and interface for static contents using Joomla version 1.5 Content Management System (CMS). For dynamic contents, PHP as web programming language is used to write the functions of adding, saving, editing, searching and deleting the records.

III. Methodology

A. Review of Existing Reports, Forms and Procedure Descriptions

During analysis stage, the system developers have analyzed and reviewed existing reports, documents, forms and standard operating procedures that regularly used by the Security Unit in the process of recording information regarding the vehicle registration process in order to understand and to develop an appropriate business rules. Before this, all information is recorded in a log book. When new semester begins, new log book would be used and the previous books would be kept in a cabinet thus creating voluminous of records. Consequently, much time needed by the staffs to search the exact log books when they are needed.

B. Conduct Joint Application Design (JAD)

To achieve an in depth analysis, Joint Application Design (JAD) session has been conducted with the system stakeholders aimed to obtain their opinions about the manual system they used before, to identify both functional and non-functional systems requirements, to identify their needs and expectations from the implementation of new system and also to find out the impacts and the benefits that would be derived from the utilization of new system to the Security Units' operations, staffs, students and management. Besides obtaining the stakeholders' view, responses from Head of Security Guard and Security Officer also have been acquired to examine how the implementation of the new system could affect security guards' daily tasks. From this session, the majority of the system stakeholders decided that

a new system should be developed to tackle the problems existed from improper records management practiced by the Security Unit in managing the security information so that the operations could be run more smoothly and manageable.

C. Perform Interviews with the End Users

Instead of JAD session, as the end users are mostly involved in using this system, a short interview session is performed with ten security guards and one hundred selected staffs and students to attain their opinions especially on how the development of new system could make ease the process of inserting, searching, retrieving information about vehicle details and generating related statistical information. Although this technique is costly and time consuming, it is believed that these responses are significant in order to know their needs and expectations from the new system, how the system might solve their problems and how the system facilitates these processes.

D. Conceptual Database Design

The next step is to draw a conceptual database design for VOS. As illustrated in Figure 2, student, staff, guard, vehicle and management are objects referred as "entities." An entity is like a noun which describes a person, place, object, event or concept in the business transactions for which information must be recorded and retained. Many relationships between entities are one-to-one (1:1) and many-to-many (M:M). Explaining the diagram, a student could only register one vehicle and then a sticker would be generated. In contrast, one staff might register two vehicles and two stickers would be generated. After that, one guard could register a staff profile and login credential would be created automatically. Both student and staff might check their summon records at one time. Management could appoint many security guards as administrator who has total responsible towards the system usage. Student's identification number is identified as attribute in the STUDENT entity similar as guard identification number attribute for GUARD entity and management identification number attribute for MANAGEMENT entity. Every time the student and staff apply for a sticker, their identification numbers are included to hold their information for establishing the relationship between them and the same would be applied to guard and management.

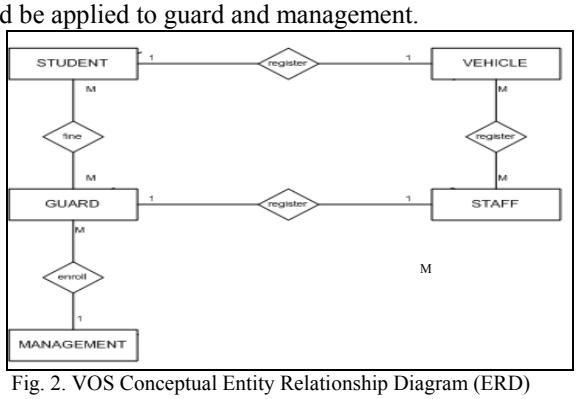

Fig. 2. VOS Conceptual Entity Relationship Diagram (ERD)

IV. Results and Findings

There are few organizational and cultural issues identified by the system developers from feasibility analysis in which included:

1) Low level of computer competency among security guards.
2) Fear in using new technology by security guards.
3) A perceived loss of control by security guards especially when the system has the problems.
4) Resistance to change of security guards in preferable to use manual rather than online.

From the issues stated, it was found that the major obstacle faced is low level of computer literacy among security guards. To deal with this, the system developers have conducted a training session to instruct them to be more competent in using this system in order to increase their IT knowledge and skills. The system developers also noticed that all existing computers provided in the Security Unit are too obsolete. For that reason, the Unit is recommended to upgrade all existing computers to the new one as the new system built required high capability computer performance for ease of access and utilization. In developing the system, the system developers did not encountered any problem as they have adequate resources in terms of personnel, equipments and facilities provided by the Information Systems Unit (USMT) to complete the systems requirements.

In converting data, the system developers decided to perform manual data entry from paper records to the new database system that is MySQL database. Therefore, vehicle registration and observation records have been copied and saved into a new database (see Figure 3).

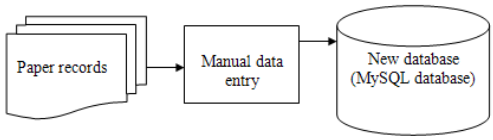

Fig.3. Manual Data Entry from Paper Records to New Database (MySQL Database)

Each of the process outlined is performed by the system developers before the system development started. This data conversion task has been completed within seven days without facing any difficulties in which all data could be easily copied and saved into the database system. The following Figure 4 to Figure 6 illustrated few menu and interface designs to portray the core functions offered by VOS:

Three stages of tests have been performed by system developers during analysis and design phases as depicted in Table I within 3 months. During the test period, the security guards would access VOS through URL http://www.kelantan.uitm.edu.my/vres and then add, save and update records to generate statistical information for auditing and reference purposes by the management.

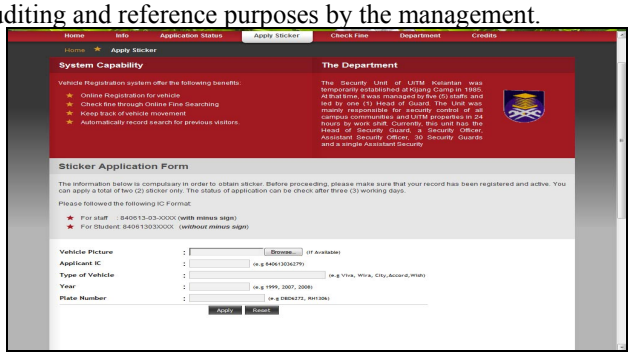

Fig. 4. Sticker Application Form

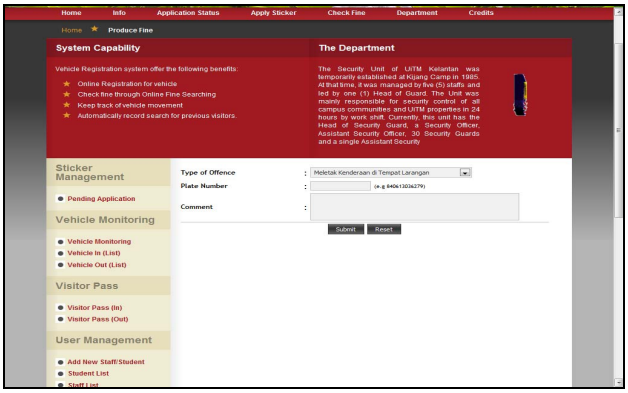

Fig. 5. Summon Issue and Checking Forms

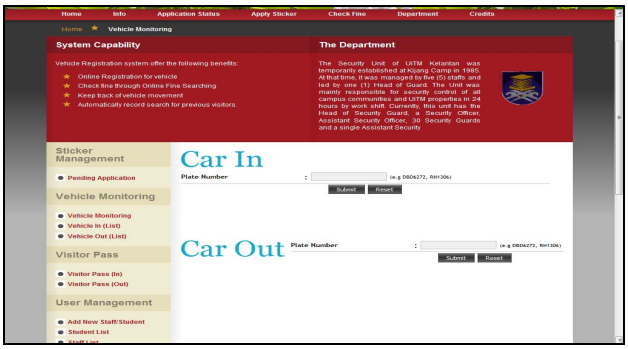

Fig. 6. Tracking Incoming and Out coming Vehicle

V. CONCLUSION AND RECOMMENDATION

VOS is an information system designed to decrease the levels of security cases in Universiti Teknologi MARA Kelantan and it could be commercialized to other university campuses, public and private sector organizations for the same goal. The performance of the system including its features could be upgraded from time to time to cater the needs of end users. In relation to electronic records, the usage of VOS could assist the security guards in managing records better to preserve their enduring value as evidence so that the department would maintain authentic and reliable records as a good business practice. For instances, records about vehicle registration, observation and summon could be created and analyzed automatically for further actions would also beneficial for strategic planning and management. Staff efficiency could be increased in which their routine tasks are accomplished automatically via online. The processes of creating, saving, updating, distributing, accessing, retrieving and deleting of data would be executed more faster as the records have been located in a centralized database that made easy to monitor. In fact, VOS has reduced the use of paper based records as well as lead to cost and time savings, flexible and less human error compared to existing manual system.

Apart from this, the system could be linked to other Universiti Teknologi MARA existing information systems to form a high capability of integrated information system. It is now readily to be commercialized and implemented to address security issues. During analyzing and developing the system, there are three important lessons learned by the system developers. Firstly, feasibility study must be thoroughly carried out during planning phase to identify resources requirements to avoid any wasting of resources. Secondly, this system needed to be analyzed and developed in a proper manner based on end user functions and functional systems requirements and then database model should be clearly designed during analysis and design phases to ensure that development of the system could be easily performed without facing any problem. It is hoped that the system would be capable to minimize unauthorized access and therefore to safeguard the campus belonging and its communities. Future study could be carried out to determine the effectiveness of VOS in achieving these objectives with broader samples.

TABLE I. TESTING RESULTS FOR VOS

STAGE	TYPES OF TESTS	TEST PLAN SOURCE/RESULTS
Unit testing	Black-box testing: Treats system as black box	System specifications = PASS
	White-box testing: Systems developers explore inside system to test its functions	System source code = PASS
Integration testing	User interface testing: Systems developers test each interface function	Menu and interface design = PASS
	Data flow testing: Systems developers test each process step by step	Logical/Relational ERD = PASS
	System interface testing: Systems developers tests the exchange of data with other systems	System Flowchart = PASS
System testing	Requirements testing: Systems developers test whether business functions/process are met	System functions and features = PASS
	Usability testing: Systems developers test how convenient system is used	Menu and interface design = PASS
	Security testing: Systems developers test disaster recovery and unauthorized access	Login page = PASS
	Performance testing: Systems developers examine the system ability to perform under high loads	System functions and features = PASS
	Documentation testing: Systems developers test accuracy of documentation	User documentation/manual = PASS

ACKNOWLEDGMENTS

Special gratitude is expressed to Mr. Mohd Razali Yusoff, Head of Security Officer, Security Unit of Universiti Teknologi MARA Kelantan for his helpful information and suggestion during interview session and not to be forgotten many thanks delivered to security guards for their participation during pilot testing of the system.

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