A Systematic Review for Online Learning Management System

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Abstract. Currently, because of the Covid-19 pandemic there a lot of demand to use online Learning Management System (LMS). The LMS available usually offer similar features and is hard for user to choose which is appropriate for them. The key criteria for analysing LMS are learning skills tools, productivity tools and communication tools. The purpose of this paper is to do systematic review on the current LMS, the problem with current LMS and the potential solutions that might help. To serve this purpose five learning management system are chosen which are Moodle, Sakai, SumTotal, Blackboard and ATutor among the other learning management systems in the market. The reasons are it consists of open source platforms such as Moodle, ATutor and Sakai and commercial platforms such as Blackboard and SumTotal. The findings from this review is quite interesting and it can be used to help users such as university/colleges, and students in selecting their LMS. It also give some ideas to LMS developer in enhancing their LMS or proposing a new features.

1. Introduction

Nowadays, it has been a popular trend in getting new information and communication technology among students. Thus there is a special type of web based content management systems developed which is Learning Management System (LMS) [1]. Because of the wide implementation, there has been a lot of LMS developing in these few years. The LMS available usually offer similar features and is hard for user to choose which is appropriate for them. The key criteria for analysing LMS are learning skills tools, productivity tools and communication tools [2]. They support using multimedia elements, to create and edit lectures, exercises and assignments for each course. The Learning Management System which also known as LMS in the community of higher institution is an online portal which is used to connect between lecturers and students. It is a place where class material and activities can be shared easily. It is also a portal where lecturers and students can communicate and have interaction aside from classroom [3]. Students also can have discussion in forums which would not take up so much time as compared with learning in classroom. In this modern era provided with information technology, internet is easily accessible in urban areas, which is located at the area where it has most universities. Most university students will have internet access at their university and usually there are open labs that student can use the computers to surf internet [2]. Some students also have internet access at home where they subscribe to internet service provider. University students are usually independent in their learning where lecturers hand out lecture notes and students can do more research with the notes given. It is no longer like the learning process taught in primary and secondary school. Students in university are to be trained as learning
themselves such as searching for more information and sharing with lecturers as well after lecturer has taught the particular lesson. Thus students also need to broaden their knowledge by researching for additional information.

Since there are more platforms that LMS can be operate on such as laptop, phone and tablet which are able to give support to students more easily, have high motivation and be more interested while learning. As an example, instructors tend to keep attention of students in the teaching process. Students also not always give response to instructors and also not giving attention in class. This is due to they are distracted or do not understand the materials given [4]. This is a challenge for the instructor and student. Sometimes students wish to ask the teacher to explain again the topic but they often do not take that action. This can lead to the student not understanding the lecture material and not able to learn the next lecture. This can make the student have deficiencies in their knowledge. Hence, proper teaching materials should be implemented so that it can maintain easily. Different types of multimedia content are also enabled so that it can be used with different devices. The main function of Learning Management Systems (LMS) is to give a safe and flexible learning platform for students [5]. This system aims to provide instructor the opportunity to create and maintain learning materials which can organize it as a course that can be part into various modules such as lessons, quizzes and progress tracker for students.

The current LMS support chats, forums and e-book libraries. With the current LMS, the platform has provided lecturers and students this tool that can be used anywhere and anytime. E-learning materials can be easily modified by lecturers and students can get the information they want and also get help by engaging with the lecturers [3]. There is more education institutions have encouraged the use of learning management system in getting the students motivated in learning process. There are also schools and universities that used LMS platform to replace face to face learning. This enables the system to be in wide distribution over past few years [4]. All the LMS have different functions where it is able to give various options to user. Some of the modern LMS are operating on cloud computing where it does not need a system administrator that has experience in system support and maintenance. There are also LMS where they need high level knowledge of programming languages such as Javascript, PHP and databases such as Microsoft SQL Server and MySQL are required.

The system that is being proposed in this research is Learn-On-Line (LOL) Learning Management System that works as a web application. LOL will have different user roles such as super admin, admin, parents and children in the system. Super admin and admin can make changes to the system whereas parents and children could not. Registration and payment functionality will be added to the system. Parents can subscribe to package and make payment. Verification code will be sent to parent’s email. Parents can help children to enrol course or children enrol course themselves. Children also can view family members’ details in the system. Security feature are to be implemented in LOL as it is the problem needed to be solved. Two layer validation are needed to be implemented for all interfaces of LOL. The user password also needed to be hashed with salted password SHA 256 hashing to protect user password. MD5 hashing will be used in LOL to protect the system from cracking by hackers. The process of payment, reset password and confirmation email also needed to be triggered with security token.

2. Research Methodology

The research method used in the proposal is searching for relevant literature. After defining the topic chosen, the next step is to search for literature that is related to research problem. The databases used to search for journals and articles are searched in Google Scholar, EBSCO and JSTOR [6]. The next step is to search on the web about learning management system in the online journal databases. Reading the abstract can have a better idea as to what the main idea of a journal is. Notes are taken down regarding to the research problem. As the reading process continues, citations are kept to remember the sources and save time while getting the references list [7]. The information among the sources gathered are analysed and used in the project proposal. The keywords used in searching the topic are learning management system, LMS, use of learning management system, advantages of LMS, online learning, learning management system for students and learning management system for parents. Keywords are used in searching for related information. The key findings are summarized and discussed thoroughly in this proposal [8]. For the purpose of this research, five learning management system are chosen which are Moodle, Sakai, SumTotal, Blackboard and ATutor among the other learning management systems in the market [8].
The reason these five LMS are chosen because it consists of open source platforms such as Moodle, ATutor and Sakai and commercial platforms such as Blackboard and SumTotal. Moodle is being discussed in the paper as it is the first open source platform [9]. It is a LMS that is built in year 2001 and uses the general public license. This enables user such as instructors and students for the purpose of teaching and learning. It supports the features such as user friendly, being flexible and accessible. The next LMS chosen for this research is Sakai. Sakai is a platform that specifically developed for teaching and learning purposes, and it can support the features that a LMS should have. It is developed with an open source license. Some of the features of Sakai are easy to use, flexible and compatible with Web 2.0 tools [6]. There are tools in Sakai which can be used as a design tool that is suitable for teaching and e-portfolio. This LMS also has been translated to more than twenty languages. The third LMS discussed is SumTotal. The reason this LMS is chosen is because this is more cater to human resources field than the previous LMS discussed. In SumTotal, there have 4 versions which are SumTotal Learn, SumTotal Work, SumTotalelix HR and SumTotal talent [3]. For example, SumTotal Learn is a LMS that is suitable to provide employees more contextual learning. The purpose of SumTotal Work is to enhance efficiency of every aspect of work management which includes salary and expense area. SumTotalelix HR is used for extending and connects different HR processes in presenting a better workforce [5]. The role of SumTotal Talent is to determine underlying talents within consumers and let user has the tools to be more efficient. Blackboard is the fourth LMS being discussed in the research. This LMS is chosen because this is the first commercial platform that is available in the market at the time. Blackboard is a platform that supports institution, students and faculties [4]. This LMS is a licensed system which means institutions need to pay the fee to renew the yearly license in order to continue using it. The price of this system does depend on the requirements of the institution. Institution need to extra fee if it needs any maintenance service to Blackboard [1]. The last LMS being discussed in the research is ATutor. ATutor is a LMS which uses the open source technology to develop and showcase the online courses [6]. The leader in ATutor is able to edit, copy and distribute ATutor which is under general public license conditions of GNU. The main feature provided in this LMS is accessible. This features allows user such as instructors, students and administrators are able to have involvement in the activities covered in ATutor [8]. ATutor provides IMS/ISO support which can be used for students to have more engagement for their learning content and participation in course activities.

3. Results and Discussion

Table 1 shows the comparison between learning management system platforms such as Moodle, Sakai, SumTotal, Blackboard and ATutor. There are 3 LMS that are based on cloud which are SumTotal, Blackboard and ATutor [9]. The LMS that supports this feature does not allow user to install any new hardware of software in using or accessing it. User just need to login to the LMS portal, then the LMS will allow the user to have access to the content of the LMS [10]. Based on the findings, it has shown that not all LMS platforms are able to integrate with other systems. The LMS platforms that can integrate with other systems are Moodle, Sakai and SumTotal. For the LMS mentioned above, they support integration with other systems that can enables user to access the features and functionalities provided [3]. Another feature of synchronous and asynchronous interaction being discussed, there are three LMS which supports this feature which are Moodle, Sakai and Blackboard [5]. This means that the LMS support the feature of having live lectures and also allow students to access course materials or do the activity at their chosen time. In terms of the feature of able to see who is online, the LMS that supports this feature is Moodle and Sakai. This enables the user to be more interactive and have engagement among each other. For example students can communicate among themselves in forum or have discussion about a specific topic [7]. There is only one LMS chosen in this research that supports file storing function for user which is ATutor. ATutor is a LMS that allocates user with a file storing utility. This storage in ATutor is able to be shared with other users [8]. This allows the students to have their files backup in ATutor such as course materials and any additional content.

| Features                          | Moodle | Sakai | SumTotal | Blackboard | ATutor |
|-----------------------------------|--------|-------|----------|------------|--------|
| Easy to use                       | Yes    | Yes   | Yes      | Yes        | Yes    |
| Based on cloud                    | No     | No    | Yes      | Yes        | Yes    |
| Able to integrate with other systems | Yes    | Yes   | Yes      | No         | No     |
| Synchronous                       | Yes    | Yes   | No       | Yes        | No     |
The one common feature that is shared by all of the LMS according to Table 1 is easy to use. Based on the findings, it has shown that all of the LMS is easy to use. Moodle is a learning management system that has a simple interface with drag and drop features for user. Moodle also has resources that are well written for their user as well as new enhancements for user so that it is always updated and make it easy to learn and use for user [1]. Moodle also has latest bootstrap 4 based themes such as Boost and Fordson. The interface of default Moodle is beautiful and easily customizable. Sakai is a LMS that is modern and easy to use. Sakai has a responsive design which makes it easy for instructors and students to achieve high academic achievements despite their location and devices [7]. SumTotal has included the best parts of experience that is consumer driven. SumTotal makes the learning experience to user more engaging and personal while being consistent at the same time. Blackboard is a LMS that is modern intuitive with a fully responsive interface. It ensures to provide easy learning experience to user and powerful that will make sure tutoring and learning to be at any time no matter where the location is. ATutor is an easy to use LMS where it is highly adaptive that is used to develop and provide online courses to user [10].

Problems of the LMS are identified that without having good security is a problem. It can cause data breach. There will have a payment system in LMS. Without having good data security, it is not safe for parents to make payment in LMS [10]. Their data such as sensitive information or important payment details could get stolen. It might cause user to not feel safe to use the LMS because it is not reliable and secure. Not having good security for LMS could cause issue such as hacking as well [11]. It means that the hackers could get access to the user’s computer on a network. Hackers can get into user’s LMS and get their user password. Hackers can even do key logging or spyware installation which countermeasures should be done to prevent this type of security issue [12]. There is another problem in LMS which is not having parental role. Not having parental role can be hard to manage payment related tasks [13]. For example, parent is given the role in a LMS and they could make payment whenever they want at any place. Parents will be able to view and pay the payment with the courses that they have signed up for their children. Parents are not being able to manage their children progress is also the issue of not having parental role in the LMS [8]. Parents are not able to see the courses that children have chosen if they are not given a role to log in the LMS. Parents also unable to add courses for children in the case where they would like to do it for their children. Hence, the possible solutions regarding with the security issue in LMS are salted password SHA 256 hashing, MD5 hashing and security token for user. They can be used to protect the user details and make the LMS experience more secure and reliable. For the parental role issue, solutions that can be used for this LMS are to have parents to enrol courses and make payment. This way parents are able to enrol courses for their children in the LMS. They can also pay course fees in the LMS which makes it convenient for them that they can pay anywhere and anytime [11].

With the discussion findings from the comparison between LMS above, hence the proposed LMS is made. The new LMS is proposed because although the LMS above are easy to use but security can be enhanced in the LMS that can make it more manageable and secure for user. The proposed LMS should have the feature of having two layer validation. This should be available for all the interfaces of the LMS which requires user to key in data. The next feature of proposed LMS is to use a Ajax process which means interfaces that use Ajax to carry out back process is able to get result immediately without reloading the web page [6]. It also enables higher backend code availability. The proposed LMS also shall have cookie which can be used for log in, log out and track user roles in the LMS. This enables the user to be able to login to the LMS automatically with tracking the cookie. As for the main security step of registration for user, the LMS should implement the salted password SHA 256 hashing which can be used to hash the password of user in the registration process. In having this feature in LMS, it is able to protect password of user in more secure way [10]. It acts as user privacy protection because developer will not be able to know the user password while viewing the database. Another security feature should be implemented in LMS is MD5 hashing where the link will be hashed for confirmation email and reset password. The purpose of this feature is to protect the system from being able to crack easily.

| asynchronous interaction | Able to see who is online | No | Yes | No | No |
|--------------------------|--------------------------|----|-----|----|----|
| File storing function for user | No | No | No | No | Yes |
Security token feature also should be implemented in LMS. This is particularly triggered in the reset password, confirmation email and payment process. It is used to help to make the process more secure because every token will have its own expired date according to the token status. Mail will be sent to user’s email whenever a payment is made, so that it can notify user about the receipt of payment. Different user role is also made accessible for different hierarchy level of LMS as they will have their own access and view to LMS [9].

4. Conclusion
The study of different Learning Management System (LMS) is carried out in this paper. The current features of LMS are discussed. The databases that are used in conducting this research are searched in Google Scholar, EBSCO and JSTOR. The five LMS that have chosen for the systematic review are Moodle, Sakai, SumTotal, Blackboard and ATutor. As a result of this study, this five LMS share one common feature which is easy to use. The other features that have included in the findings are based on cloud, able to integrate with other systems, synchronous and asynchronous interaction, able to see who is online and file storing function for user. Problem of current LMS are identified such as not having good security which may lead to data breach. Another problem of LMS is not having parental role. It is harder for parents to manage the learning progress of their children. Therefore it has come out with a proposed system which is Learn-On-Line (LOL) Learning Management System that supports different functionalities and enhanced with security features. A few solutions have been raised which are implementing salted password SHA 256 hashing, MD5 hashing and security token for user. Two layer validations is also one of the solutions to protect user data. By having the security features, the proposed system should have a layer of defence and user privacy protection.
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