

Development of Web Based Examination Question Bank Record Keeping System

^[1] Dzulkipli Marasan, ^[2] Nuredzan Zaludin, ^[3] Azhar Abdul Hamid

^[1] ^[2] ^[3] Department of Information Technology and Communication, Politeknik Kuching Sarawak, Malaysia

Corresponding Author Email: ^[1] dzulkipli@poliku.edu.my, ^[2] nuredzan.z@poliku.edu.my, ^[3] azhar.hamid@poliku.edu.my

Abstract— As the world is mostly in online mode via the internet, Electronic Exam Question Bank Record (E-Exam Question Bank Record Keeping System or E-Exam Question Bank) offers the online presence of a standard traditional exam question bank. E-Exam Question Bank is a web-based system for teachers and lecturers from any school or educational institution to write standard examination questions with answer scheme and save them later into a question bank database for current or future use. Available standard features within was user authentication, creating related course or subject, creating new examination questions based on course and subject, search and view produced questions and managing questions including editing and deleting. E-Exam Question Bank overcomes limitation of traditional exam question bank in managing question sets, such as producing too much printed papers for physical files storage and distribution, and also inconvenience digital storage copying process. Development of E-Exam Question Bank was based on object-oriented method with the end product is an incremental prototype. PHP scripting language chosen to produced its client side and server side modules together with MySQL for database support. Result from system testing, security testing and performance testing shows that E-Exam Question Bank working well online, and in the end has allowed users to enjoy greater accessibility towards one such exam question bank through the internet.

Index Terms— Assessment system, Automatic evaluation, Question bank, Course outcome.

I. INTRODUCTION

This Teaching and Learning (P&P) innovation project started in May 2020 and was fully completed in October 2020. The project called the Electronic Examination Question Bank Storage Record System resulted when most lecturers and teachers faced problems when preparing exam questions, assignments, quizzes, tutorials, and so on where existing exam questions are missing and causing lecturers and teachers to face difficulties in making references to past exam questions when they want to create a new set of questions. In addition, if the questions are saved on the computer only if a problem arises such as a virus attack on the computer or the hard drive is damaged, the saved past exam questions may be lost. It takes a long time to search past exam questions stored on the computer, is high cost, and is not environmentally friendly because it uses a lot of paper. In polytechnics, the difficulty of accessing online learning systems such as CIDOS due to too many lecturers using CIDOS sometimes makes it difficult for lecturers to access CIDOS to see examples of past questions as a reference, which is also the origin of the idea to produce this innovation system. However, this Electronic Examination Question Bank Storage Record System can only be accessed for the use of lecturers and teachers only to produce exam questions, tutorials, quizzes, assignments, and so on as well as answer schemes.

II. LITERATURE REVIEW

A record system is defined as the system in which an organization's information is captured in its entirety. It is considered an important tool for organizational accountability, compliance with legislative requirements, and the development of corporate memory. It should therefore offer complete, accurate, and reliable evidence of all of an organization's transactions [7]. All of its policy documents, including those relating to admission, administrative decisions, electronic or hardcopy documents, internal or external websites including social media sites, digital data such as photographs and videos, registered students' files with all university-related data, staff personnel files, educational plans, and curricula, governing board reports, theses and published research and so on should be captured by university's institutional-record system [8].

Introducing the Internet at schools, colleges, or education institutions has encouraged the development of new tools and systems within the scope of education and training. As a result, a new era of learning and training approaches has emerged, where new educational models have been developed, and students could learn independently at any time or location, simply by connecting to the internet along with the appropriate systems and tools. Teachers, at the same time, could teach through an "online" setting and could schedule lessons and exams without the classical physical constraints. This electronic learning approach, also known as e-learning, has opened new horizons in teaching for both teachers and students [6].

The assessment process in an educational system is an important and primordial part of its success to assure the correct way of knowledge transmission and to ensure that students are working correctly and succeeding to acquire the needed knowledge. Many assessment methods can be used such as conducting some experiments, realizing different mini-projects, and taking quizzes and exams. The evaluation mechanism help students to discover whether they have gained the required knowledge as expected and provide appropriate and timely feedback to teachers to adjust their lectures, exercises, and exams [6].

Furthermore, sometimes hard disk crashes, bugs in software, or file loss were the reasons that cause the questions lost. A long time is required to create new questions due to the complexity of creating the questions [1]. The same issues such as the increasing numbers of students in the University of Jeddah, especially at the College of Computer Science and Engineering (CCSE), which lead to the administration of examinations for each semester have become increasingly laborious, time-consuming, and costly [1].

Due to Internet technology usage in education, the current form of examination has become simpler and easier to use than ever before. The quality of teaching and the efficiency of students' learning has been improved by using internet technology and a web-based database of question databases [2].

From the literature, a web-based Examination Question Bank Record Keeping System was developed to overcome the problems that occurred when using the traditional method or when creating assessment questions manually.

III. METHODOLOGY

A. Analysis using Questionnaire

This study used a quantitative method, that is, a questionnaire as its research method to survey known users' problems when using the current method in creating assessment questions with answers for education purposes. The respondents consist of Malaysia Polytechnic Lecturers and school teachers. The questionnaires were distributed to the respondents before using E-Exam Questions Bank Record Keeping System. The questionnaires which comprised 10 questions mainly focusing on the current method of creating assessment questions with answers for education purposes were distributed to 15 respondents including lecturers from Malaysia Polytechnic and school teachers who taught in various fields. The questionnaires were distributed by sharing a google form link and the results can be collected immediately after the respondents filled in the questionnaires through a google form. After collecting the questionnaires then the data were automatically analyzed with google sheets.

B. Demographic of respondents

During the analysis phase, the survey has been done and the demographic of the respondents has been identified including the percentage of gender, age, job status, duration of teaching experiences, current job place, name of the institution, and state of the respondents. This section will explain the demographic of the respondents involve in this survey.

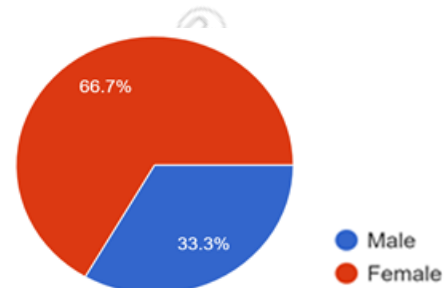


Figure 1 Gender

Figure 1 shows percentage gender of respondents who involve in this survey. 66.7% of the respondents are female while 33.3% of the respondents are male. It shows that many female involve in this survey compare to male.

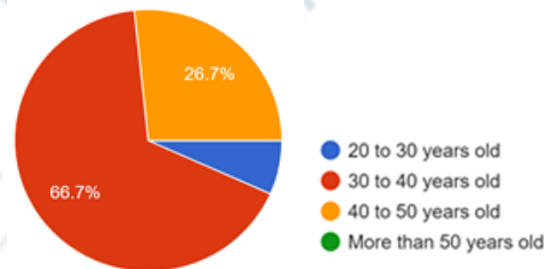


Figure 2 Age

Figure 2 shows the percentage age of respondents who participate in this survey before using the e-exam question bank record-keeping system. 6.6% of the respondents are between 20 to 30 years old, 26.7% of the respondents are between 40 to 50 years old and 66.7% of the respondents' age are between 30 to 40 years old.

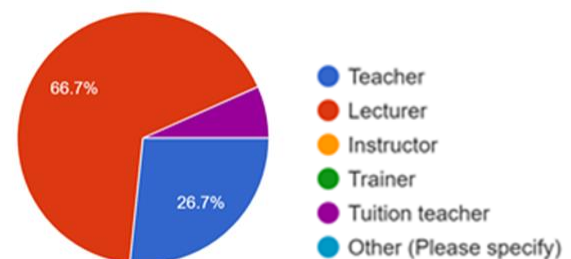


Figure 3 Job Status

Figure 3 shows the percentage of respondents' job status involved in this questionnaire. The analysis shows that 66.7% of the respondents are consists of lecturers, 26.7% of the respondents are teachers and 6.6% of the respondents consist

of tuition teachers. Although their job status is different, they are coming from the same background which is in the education field.

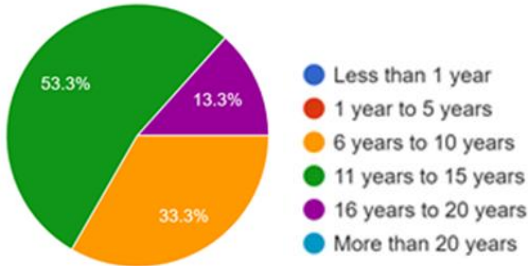


Figure 4 Duration of teaching experiences

Figure 4 shows the percentage duration of teaching experiences of the respondents. The analysis shows that 53.3% of the respondents' duration of teaching experiences are between 11 to 15 years old, 33.3% are between six to ten years old and 13.3% are between 16 to 20 years old.

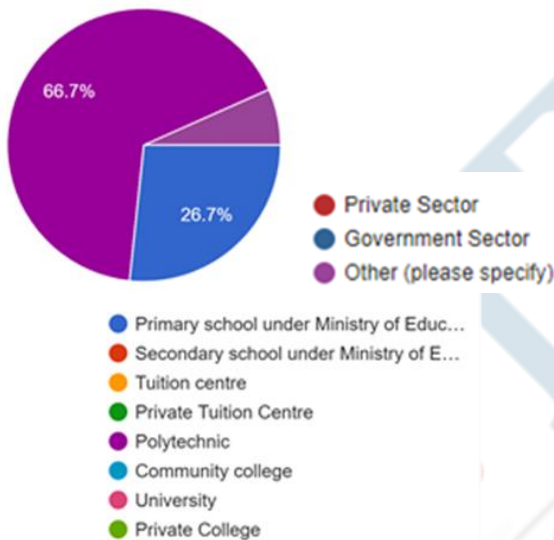


Figure 5 Current job place

Figure 5 shows the percentage of respondents' current job place. The analysis shows that 66.7% of respondents' current job places are from Malaysia Polytechnic, 26.7% of the respondents are primary school teachers under the Ministry of Education and 6.6% of the respondent are from other sectors.

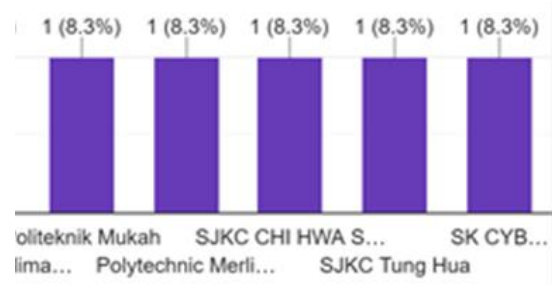
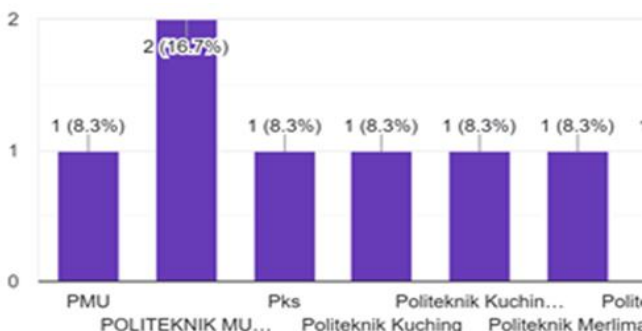


Figure 6 Name of institutions

Figure 6 shows the name of the institution where the respondents work. 33.2% of the respondents are working at Mukah polytechnic, 25% of the respondents are working at Kuching Polytechnic, 16.6% of the respondents are from Merlimau Polytechnic, 8.3% of the respondent work at SJKC Chi Hwa, 8.3% of the respondent work at SJKC Tung Hua, 8.3% of the respondent work at SK Cyberjaya and the rest who did not mention their institution name are working at school in Sarawak and working at the institution in Sabah.

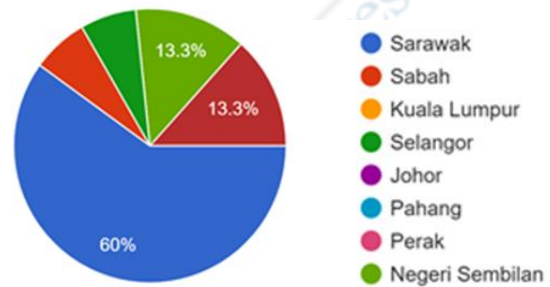


Figure 7 State

Lastly, for the demographic of the respondents, figure 7 shows the percentage of the state where respondents come from. 60% of the respondents are coming from Sarawak, 13.3% of the respondent come from Negeri Sembilan, 6.7% from Selangor, and another 6.7% from Sabah.

C. Survey done on current method use before developing e-exam question bank record keeping system

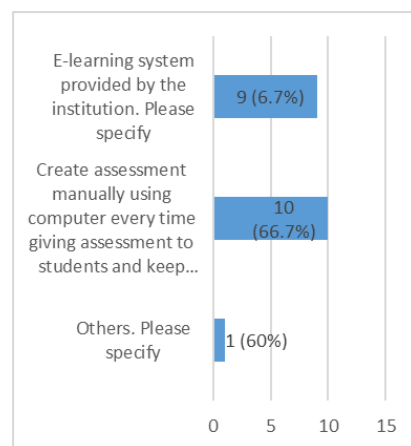


Figure 8 Current method use in creating assessment questions

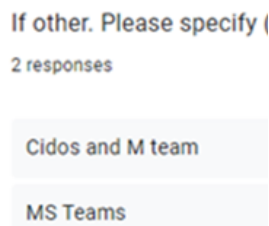


Figure 9 Other method use in creating assessment questions

Figure 8 shows that 60% of the respondents use the e-learning system provided by the institution, 66.7% of the respondents create assessments manually using a computer every time giving assessments to students and 6.7% use other platforms such as Microsoft Teams as shown in Figure 9.

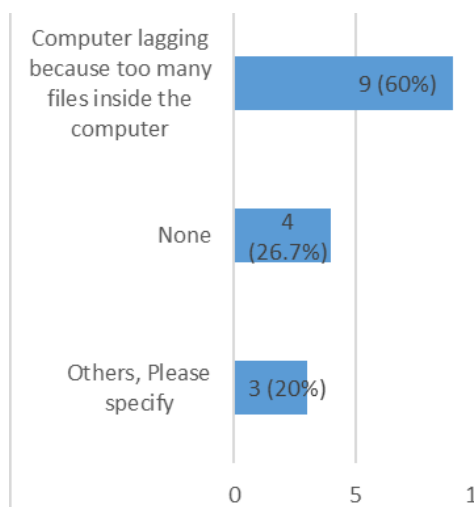


Figure 10 Problem faced when creating assessment questions manually

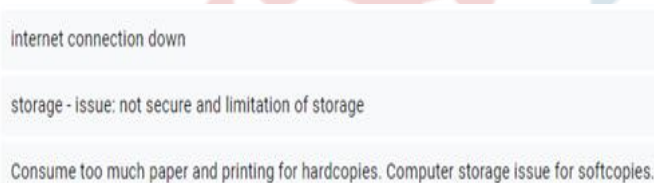


Figure 11 Other problems faced when creating assessment questions manually

Figure 10 shows the percentage of the problem faced by the respondents when creating assessment questions manually. 60% of the problem faced by the respondents is because of computer lagging due to too many files save inside their computer. 26.7% of the respondents said never face the problem when creating assessment questions and 20% said having problems such as internet connection down, limited storage, not being secure, and consuming too much paper when printing for hard copies. Other problems faces when creating assessment questions manually are shown as in figure 11.

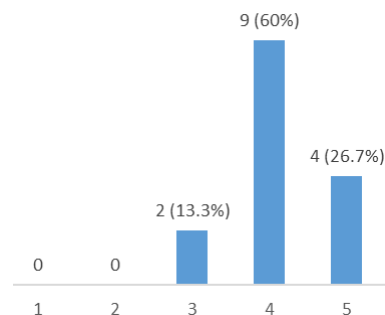


Figure 12 More space is needed to keep assessment questions records

Analysis from Figure 12 shows the percentage of the respondents' view on the current method where it needs more space to keep assessment questions records such as in a file folder (in a computer) and so on. 26.7% of the respondents strongly agree that the respondents choose extremely likely on a scale of 5, 60% choose on a scale of 4 and 13.3% choose the option on a scale of 3. Most of the respondents agree that the current method needs more space to keep assessment questions records.

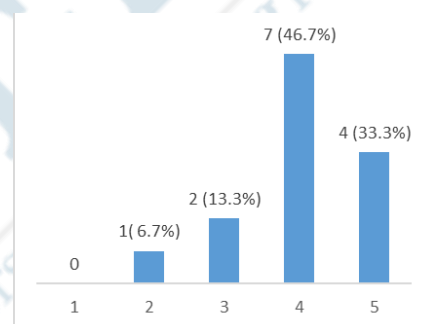


Figure 13 Previous sample assessment questions are easily lost and misplaced

Analysis from Figure 13 shows the percentage of the respondents' view on the current method where previous sample assessment questions easily get lost or misplaced. 33.3% of the respondents strongly agree that the respondents choose extremely likely on a scale of 5, 46.7% choose on a scale of 4, 13.3% choose option scale 3 and 6.7% of the respondents choose option scale 2 (do not agree). The analysis shows that more than 50% of the respondents agree that previous sample assessment questions easily get lost or misplaced when using the current method.

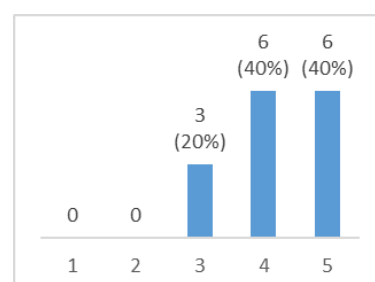


Figure 14 Not environmentally safe when use many papers

Analysis from Figure 14 shows the percentage of the respondent's view on the current method which is not environmentally safe when using many papers. 40% of the respondents strongly agree that the respondents choose extremely likely on a scale of 5, 40% choose on a scale of 4 and 20% choose an option on a scale of 3. The analysis shows that more than 50% of the respondents agree that the current method use is not environmentally safe when using many papers.

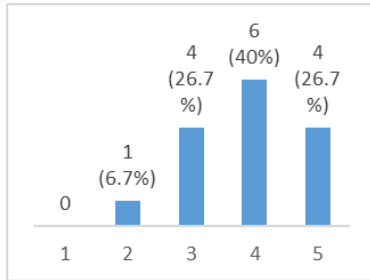


Figure 15 Unsecured because unauthorized users can access the assessment questions

Analysis from Figure 15 shows the percentage of the respondents' view on the current method where the current method is unsecured because unauthorized users can access the assessment questions. 26.7% of the respondents strongly agree that the respondents choose extremely likely on a scale of 5, 40% choose on a scale of 4, 26.7% choose option scale 3 and 6.7% choose option scale 2 (do not agree). The analysis shows that more than 50% of the respondents agree that the current method use is unsecured because everyone can access the record easily from the file such as assessment questions and answers scheme are easily accessed by unauthorized person (unsecured) because no login credential or password to open the files.

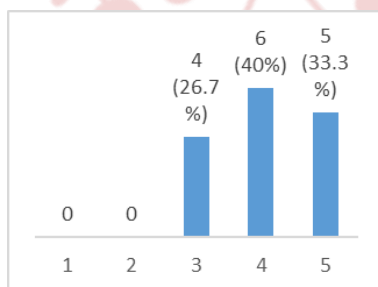


Figure 16 More time is needed to search assessment questions

Analysis from Figure 16 shows the percentage of the respondents view on current method where more time is needed to search assessment questions. 33.3% of the respondents strongly agree where the respondents choose extremely likely on a scale of 5, 40% choose on a scale of 4 and 26.7% choose option scale 3. The analysis shows that more than 50% of the respondents agree that more time is needed to search assessment questions when using current method.

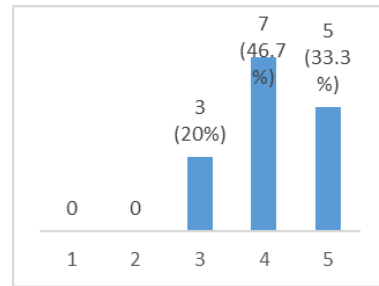


Figure 17 More time and papers needed to add, update and delete assessments questions and answers

Analysis from Figure 17 shows the percentage of the respondents view on current method where more time and papers needed to add, update and delete assessments questions and answers. 33.3% of the respondents strongly agree where the respondents choose extremely likely on a scale of 5, 46.7% choose on a scale of 4 and 20% choose option scale 3. The analysis shows that more than 50% of the respondents agree that more time and papers needed to update, delete and add assessment questions with answers manually.

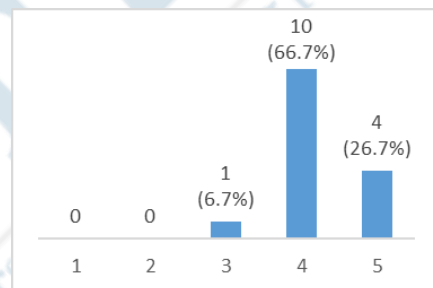


Figure 18 More time to create new assessments questions

Analysis from Figure 18 shows the percentage of the respondents' view on the current method where more time is needed to create new assessment questions. 26.7% of the respondents strongly agree that the respondents choose extremely likely on a scale of 5, 66.7% choose on a scale of 4 and 6.7% choose an option on a scale of 3. The analysis shows that more than 50% of the respondents agree it takes time to create new assessment questions to be given to students or trainees because previous questions are kept in the folder (computer) and no systematic questions bank record-keeping system exist.

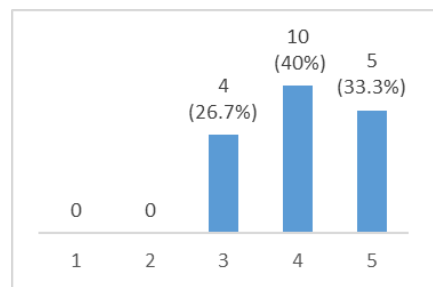


Figure 19 More time to retrieve the previous assessment questions

Analysis from Figure 19 shows the percentage of the respondents' view on the current method where more time is needed to retrieve the previous assessment questions. 33.3% of the respondents strongly agree that the respondents choose extremely likely on a scale of 5, 40% choose on a scale of 4 and 26.7% choose an option on a scale of 3. The analysis shows that more than 50% of the respondents agree that if the user teaches more than one subject and has many years of teaching experience, all previous assessment questions are kept in different folders on the computer, and take time or difficult to retrieve the previous assessment questions.

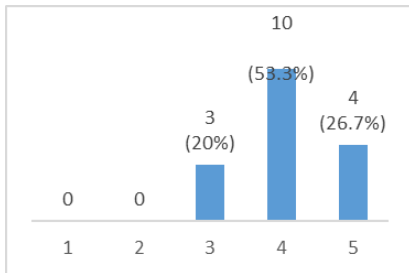


Figure 20 Use system provided by the institution to create questions

Analysis from Figure 20 shows the percentage of the respondents view on current method where they use the system provided by the institution to create questions. 26.7% of the respondents strongly agree where the respondents choose extremely likely on a scale of 5, 53.3% choose on a scale of 4 and 20% choose option scale 3. The analysis shows that more than 50% of the respondents agree that they use assessment questions from bank developing system provided by the institution or other organization such as CIDOS.

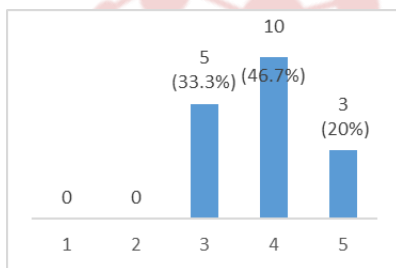


Figure 21 Current system used now is efficient and user friendly

Analysis from Figure 21 shows the percentage of the respondents who view the current method used now as efficient and user-friendly. 20% of the respondents strongly agree that the respondents choose extremely likely on a scale of 5, 46.7% choose on a scale of 4 and 33.3% choose an option scale of 3. The analysis shows that more than 50% of the respondents agree that the current or existing assessment question bank developing system they used now such as the e-learning system is efficient and user-friendly.

Based on feedback, the following requirements have been finalized for the E-Exam Question Bank so that it can offer standard functionalities required for a question bank system:

- The system will have an administrator and users. Both will have access to the same functionalities as listed below, with the addition that only administrators are allowed to manage users.
- Users can produce their own set of new examination questions based on courses and topics and it will be saved on the system's database
- Users can manage, in the form of updating and deleting, their produced examination question sets.
- Users can search for exam questions based on courses and topics. It will be default previewed on the user's computer or smartphone via a web browser. Optionally, users also can print a copy of it.

In addition, the E-Exam Question Bank is a web-based system hosted over the internet and therefore easily accessible online by users.

D. Conceptual Design

E-Exam Question Bank's conceptual design was based on Object Oriented method. This method was widely accepted, well known, and highly considered for software and application development. Interacting components and flow of working modules within the E-Exam Question Bank can easily be represented in Use Case Diagrams and Flow Charts. In addition to this, Entity Relation Diagrams will detail all entities and attributes within E-Exam Question Bank. It contributed to the relational design of the database for E-Exam Question Bank. The system was able to save produced exam question sets in online mode and a much higher storage capacity with the support of a database.

USECASE DIAGRAM AND FLOW CHARTS

The are two actors in E-Exam Question Bank, which is users and administrator. These actors were human end users from the real world. Actors interact with, or use modules available on the system. These modules are referred to as use cases. E-Exam Question Bank in conceptual had actor Users interacting with use cases of Login, View categories, Search questions, Create new questions, and Feedback. Figure 22 and Figure 23 is the use case diagram representing it.

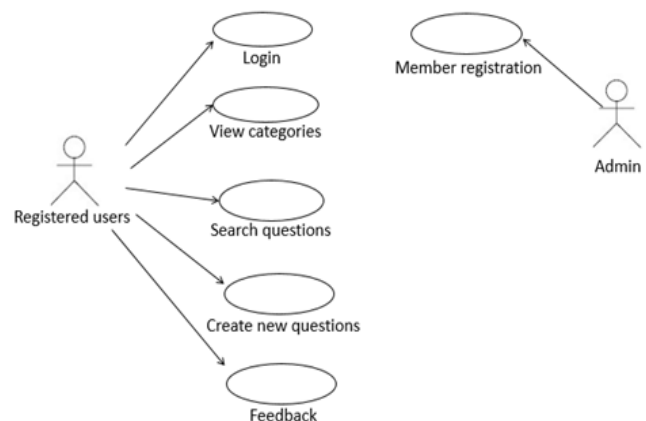


Figure 22 Use Case Diagram (User)

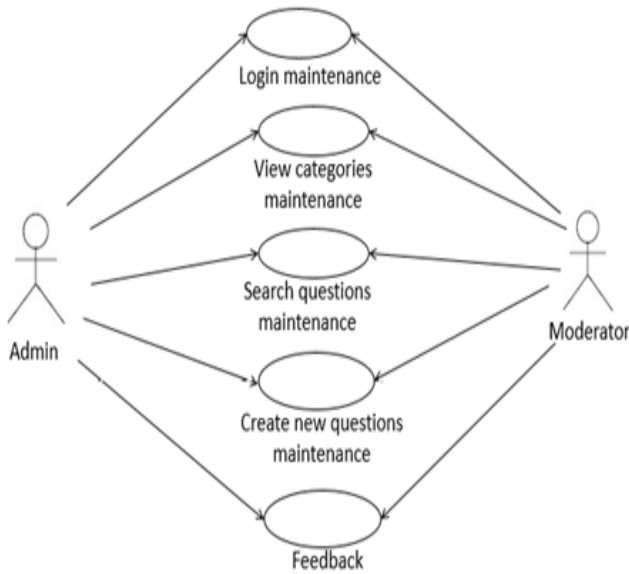


Figure 23 Use Case Diagram (Admin)

Within the use case of Create new questions, the User logs in successfully, then select the desired Course. In the Course, the User will select the related topic and select to write a new examination question. When the User chooses to save the question, it will be saved in the system's database. But if the User decides to discard it, it will lead to options either to create another fresh new question or simply just quit Creating a new question. Figure 24 is the flow chart representing it.

For Edit questions, the User logs in successfully, then select the desired Course. In the Course, the User will select the related topic and then select any available examination question, previously written and saved. Users the allowed to edit the content of the question. Once done with editing, if the User chooses to save the freshly edited question, it will be saved in the system's database. But if the User decides to discard it, it will lead to options either to choose another existing question to edit or simply just quit the Edit question. Figure 24 is the flow chart representing it.

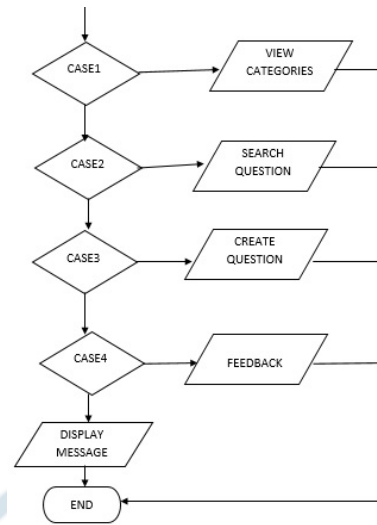


Figure 24 Flow Chart entity relationship diagram

Main actors and several use cases, with their characteristics, used to design the Entity Relationship Diagram. Actors and use cases like Users and Administrator, and use case like Question, defined as entity. While characteristics of each entity, will become its attributes. For example, entity Users have attributes such as user ID, password, name and email. Another example is entity Question with attributes such as ID, user ID, category, topic, name and detail.

Entity Relationship Diagram is the conceptual design of a working database. It helps system or database developers to create tables and columns of key datas or attributes which later will be use to store data. Entity Relationship Diagram also helping developers to identify redundant main attributes between entities. These redundant main attributes, also known as primary keys, will allowed database developer to normalize database tables. Normalizing tables in database helps to ease process like searching for data and manipulation of data. Figure 25 is the Entity Relationship Diagram for E-Exam Question Bank's database.

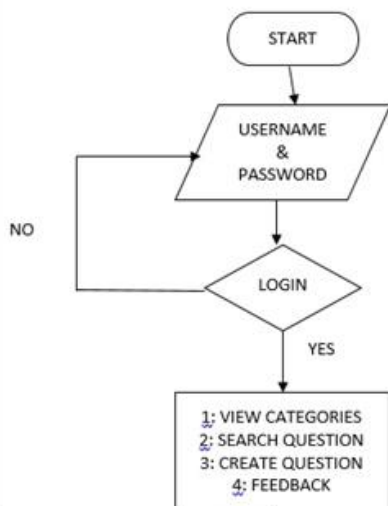


Figure 25 Entity Relationship Diagram

E. Software Package for Development

HYPertext PREPROCESSOR

The Hypertext Preprocessor (PHP) is a widely used open-source scripting language. E-Exam Question Bank system is web-based and written in PHP scripting language to produce dynamic content on each page. Those pages can be seen with a web browser, either on standard Personal Computers or other gadgets such as smartphones, laptops, and tablets. As PHP scripting is compatible to run on most operating systems such as Windows, Linux, or Mac OS, a web-based system written with PHP will be easy to publish and host over the internet.

APACHE WEB SERVER

Managing requests and providing responses for users of E-Exam Question Bank is the job of a web server. In this project, the Apache web server was selected. Apache web server was widely used to serve web sites or web-based applications. It is one of the most robust and reliable web servers available in open source. It can handle very high and demanding amount of requests and responses from hosts. It is recommended to use an Apache web server to serve web based system written in PHP scripting language.

BOOTSTRAP

For user interface layouts of E-Exam Question Bank, Bootstrap open source web user interface was chosen. Bootstrap offers an open source, free-to-download and-to-use, quality web user interface template. Within a Bootstrap template, working programs of Javascript and Cascading Style Sheets (CSS) are attached with them. Those Javascript and CSS programs help to provide robust, interactive, responsive, and nicely presentable user interfaces for dynamic web pages in E-Exam Question Bank. Shown below from Figure 26 – 31 are some examples of user interface layouts developed for E-Exam Question Bank

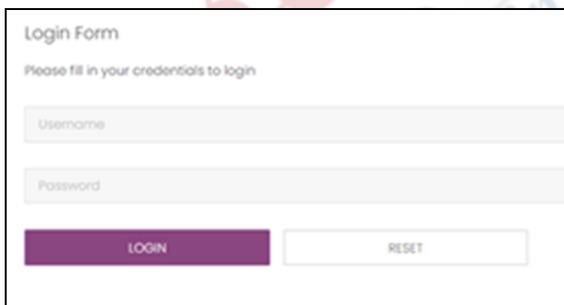


Figure 26 Registered User Login Page

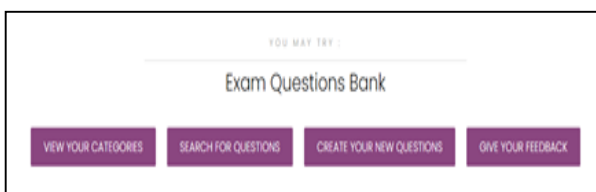


Figure 27 Homepage

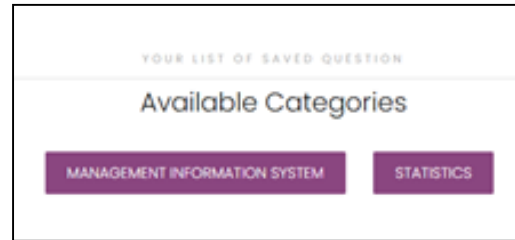


Figure 28 Course Categories Page

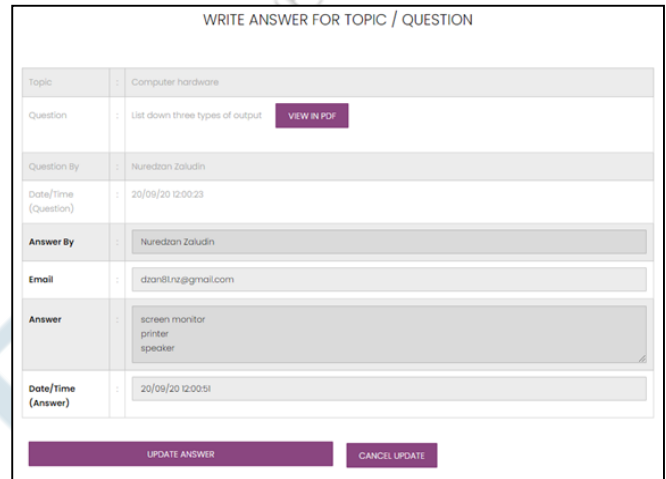


Figure 29 Create New Questions / Answers Page

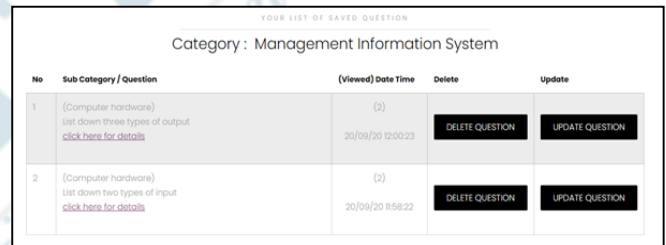


Figure 30 List of Save Questions Page

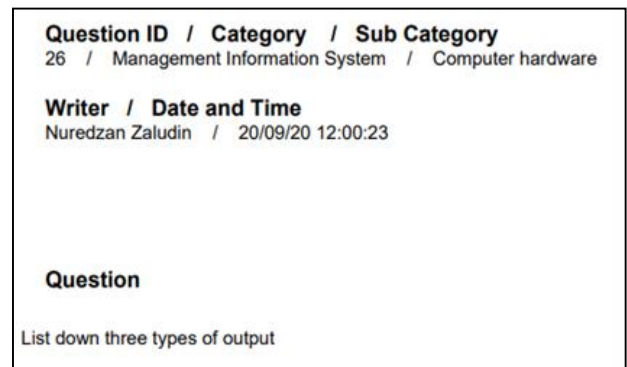


Figure 31 View Questions into PDF format

MYSQL

E-Exam Question Bank uses MySQL relational database to store data. MySQL is open-source software, and highly compatible with web-based systems developed with PHP scripting language and Apache web server. MySQL is also robust and able to handle a very high volume of data traffic.

IV. RESULT AND DISCUSSION

A. Testing

SYSTEM TESTING

Shown below in TABLE 1.1 is System Testing's Test Cases tested on E-Exam Question Bank and the results.

Table 1.1 System Testing's Test Cases

TEST CASE ID	S1	S2	S3	S4	S5
TEST NAME	System Testing	System Testing	System Testing	System Testing	System Testing
DESCRIPTION	The system launches properly through the right URL	The system launches properly on mobile devices	Existing users can log in to the system	All main functionality within the system works	The system log out properly through the right menu
STEPS	1. type in URL link into web browser's address bar 2. search URL with a search engine	1. scan QR code of the system from mobile device	1. fill in username 2. fill in password	1. log in 2. test functionality like create a new question set	1. log in 2. test any available functionality 3. click on to menu log out
TEST DATA	1.URL: www.kenyalangpadu.com/questionbank/landing	1.QR Code provided	1.username 2.Password	1. username 2. password	1. username 2. password
EXPECTED RESULT	Login form appears	Login form appears	Main landing page appears only if the right username and password filled in	All functionality working for a registered user	Log out confirm page appears
ACTUAL RESULT	Login form appears	Login form appears	Main landing page appears, welcome note to user, and main functionality menu appears	All functionality working for a registered user	The system shows confirm successful log out process by user
PASS/ FAIL	PASS	PASS	PASS	PASS	PASS
REMARKS					

SECURITY TESTING

Shown below in TABLE 1.2 is Security Testing's Test Cases tested on E-Exam Question Bank and the results.

Table 1.2 Security Testing's Test Cases

TEST CASE ID	T1	T2	T3
TEST NAME	System Testing	System Testing	System Testing
DESCRIPTION	Non registered users cannot log in to the system	Brute force log in by entering injection script	Brute force log in through active internal menu pages's URL

STEPS	1. Fill in unregistered username 2. Fill in unregistered password	1. Fill in unregistered username combined with injection script	1. find out URL of any active internal menu pages 2. copy URL and paste it to a web browser address bar
TEST DATA	1. Non registered username or/ and password	1. text with injection, or, “ and ;	URL of any active internal menu pages
EXPECTED RESULT	Login form appears	Login form appears	Access to active internal menu pages will be denied
ACTUAL RESULT	Log in denied, user then redirected to log in page with new user registration menu link	Log in denied, user then redirected to log in page with new user registration menu link	Access denied, user then redirected to a warning page, before finally redirected to log in page
PASS/ FAIL	PASS	PASS	PASS
REMARKS			Each one of active internal menu pages within the system was equipped with session checker

PERFORMANCE TESTING

Shown below in TABLE 1.3 is Performance Testing’s Test Cases tested on E-Exam Question Bank and the results.

Table 1.3 Performance Testing’s Test Cases

TEST CASE ID	P1	P2
TEST NAME	Performance Testing	Performance Testing
DESCRIPTION	More than 10 different users accessing the system at the same time	User accessing the system with smartphone and mobile data internet connectivity
STEPS	1. each users log in 2. each users use any available functions within the system	1. each users log in 2. each users use any available functions within the system
TEST DATA	1. 10 or more different registered users 2. the quality of response from the system	1. internet connectivity 2. the quality of response from the system
EXPECTED RESULT	The system should be able to maintain fast response to users	The system should be able to maintain fast response to users
ACTUAL RESULT	Users have no complaint of system slowing down	Users have no complaint of system being too slow or not responding
PASS/ FAIL	PASS	PASS
REMARKS		

V. DISCUSSION

E-Exam Question Bank System proved that an online version of a question bank system can offer adequate functionality, just like a traditional question bank system. Accessing the system is also made easy with only URL typing or QR Code scanning, and can be done from your smartphone. The security of the system has also proven to be good enough. The system also proved that it works well, even in the conditions of heavy data traffic and standard internet speed with mobile data connectivity.

VI. SUMMARY

Development of a web-based Examination Question Bank Record Keeping System can overcome the traditional method of creating assessment questions banks such as limited accessibility, limited storage, slow process of searching, lost or misplacing of assessment questions bank record, unsecured accessibility by an unauthorized user, natural disasters such as flood and others. Moreover this system also can ease the burden of educators in creating and keeping assessment questions bank records where more storage to

keep the questions bank records, fast searching, easy to create, update and remove unwanted questions bank records, secure authentication process, questions can be printed into PDF format and others.

REFERENCES

- [1] Z. Azida, "Designing a Question Bank Management System to Support Outcome-Based Education Approach," IJCSNS International Journal of Computer Science and Network Security, vol. 20, no. 4, pp. 21–33, 2020.
- [2] T. Beihai, C. Shuting and D. Fei "Research and Application of Question Bank Information System Based on Internet Plus," ICDEL 2019: Proceedings of the 2019 4th International Conference on Distance Education and Learning, pp. 61–67, 2019.
- [3] A.A. Olalere, A. O. Samuel and O. S. Babafemi O, "Development Of Web-Based Examination System Using Open Source Programming Model," TOJDE 2017 : Turkish Online Journal of Distance Education-, vol. 18, no. 2, Article 3, April 2017 ISSN 1302-6488
- [4] A. Mohammad Shah Alam, A. Mohammad Imam Hasan and M. M. Rubaiyat Hossain "An Online Examination Management System for Geographically Dispersed Test Centres to Prevent Question Leakage: A Case Study of Bangladesh, " JSRR 2017 : Journal of Scientific Research & Reports, vol. 16, no 5, pp. 1-11, 2017. ISSN: 2320-0227
- [5] Mykhailo I. Sherman, Yaroslava B. Samchynska and Vitaliy M. Kobets "Development Of An Electronic System For Remote Assessment Of Students' Knowledge In Cloud-Based Learning Environment, " CTE 2021: 9th Workshop on Cloud Technologies in Education, December 17, 2021
- [6] Science, C., & Publications, S. (2009). Web-based " Questions-Bank " System to Improve E-Learning Education in Qatari School Hosam F . El-Sofany , Noor Al-Jaidah , Shaima Ibrahim and Salha Al-kubaisi Department of Computer Science and Engineering , College of Engineering , Qatar University , Do. 5(2), 97–108.
- [7] Ngulube, P. (2005). Managing records at higher education institutions: A case study of the University of KwaZulu-Natal, Pietermaritzburg Campus. South African Journal of Information Management, 7 (1) 1-1 doi:. 10.4102/sajim.v7i1. 250 .
- [8] Samsudin, A. Z. H. (2015). A semantic ontology-based records management approach for aca- demic users' decision support. unpublished thesis . Australia: College of Business, Victoria University <https://vuir.vu.edu.au/29725/> .
- [9] A. Muhammed Assaf, L. Abdulkarim, A. Mohamad Gazy, S. Feras, A. Wael, A. Miassar, T. Fuad Trayek, D. V. Leonie Ansems , "Evaluating the effectiveness of student-record systems in conflict-affected universities in northwest Syria relative to student transition and mobility," International Journal of Educational Research Open 3 (2022), 100128.