INTI JOURNAL | eISSN:2600-7320
Vol.2022:22

Design and Implementation of Online Examination System for a Higher Educational Institution

Larry Nyamupanemunda[1] and Deshinta Arrova Dewi[1]

[1]Faculty of Information Technology, INTI International University, Nilai, Malaysia

Emails: i19018190@student.newinti.edu.my, deshinta.ad@newinti.edu.my

Abstract

When Covid19 was declared a world pandemic, online learning was to replace all the physical classes and examinations. The main concern would be managing question papers online and plagiarism opportunities that may occur during the examination. This paper highlights the developing an Online Examination System (OES) in the form of a web-based application that enables lecturers to manage their exam papers, assign them to their students, utilize auto-grading objective questions and provide feedback for subjective questions. The OES is accessible by mobile phone users whereby both lecturers and students are equipped with their dashboards to manage their needs. The OES framework focuses on a single university due to the closure of the campus and social distancing measurement to perform data collection. This paper includes the impact on the transition of physical to online examination, problem identification with solutions, and to what extent the OES can assist lecturers to conduct a smooth online examination. The OES was developed using PHP with MySQL, HTML, CSS, Bootstrap, JavaScript, and AJAX. The usability and user acceptance testing was conducted. The results show that most respondents agreed there is a need to have a system such as OES with future enhancements on the proctoring technology to prevent plagiarism. The outcome of usability testing was satisfactory and most respondents suggested including more enhanced features in the next development.

Keywords

Online Examination System, Web Application, Education during Covid19

Introduction

The year 2019 was a life-changing year for many of us as there was a discovery of a new virus called Covid 19 (Asselah, DavidDurantel, EricPasmant, GeorgeLau, & Schinazi, 2021). Months later after further research about the virus, (Cucinotta & Vanelli, 2020) World Health Organization declared Covid 19 a world pandemic. New terms such as social distancing were developed and very crucial reduction of Covid 19 spread control (Aslam, 2020). Social distancing is maintaining physical distance between people to prevent the spread of contagious diseases. For social distancing implementation to be effective, all areas with crowds were to be temporally closed. Crowded areas closed include schools, churches, restaurants, sports, and many more.

Submission: 4 November 2021; **Acceptance:** 11 May 2022



Copyright: © 2022. All the authors listed in this paper. The distribution, reproduction, and any other usage of the content of this paper is permitted, with credit given to all the author(s) and copyright owner(s) in accordance to common academic practice. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license, as stated in the website: https://creativecommons.org/licenses/by/4.0/

With all these areas closed, there are a lot of positive and negative impacts to follow but the focus of this paper will be on one part of the university's effect which is the online examination. When students were repudiated on physical classes by the social distance implementation, the alternative was online classes and examinations. Now students could study in the comfort of their own homes, be in class on time since there was no need to travel anywhere and most of all enjoy having final examinations without any supervision (Loeb, 2020) (King & Guyette, 2009). All of these may seem like great benefits, but they all come with severe negative consequences such as idleness, less focus in classes, and a tendency to conduct dishonesty cases in the final examination. With time it would not be a surprise to learn that most graduates from 2020 and 2021 must go through another type of assessment before they are hired by a company or pursue higher education.

This paper is meant to highlight the author's contribution to developing an Online Examination System (OES) in the form of a web-based application in regards to the need for a platform for online examination during the pandemic covid19. The OES aimed to be an alternative for lecturers to manage their exam papers, assign them to their students, utilize auto-grading objective questions and provide feedback for subjective questions. This is in line with the statement of the previous researcher (Frankl & Schratt-Bitter, 2012) that due to online examination issues there should be some attempts solutions to bring back the legitimacy of the online examination. In regards to the dishonesty cases that potentially happen during online examinations, the OES is designed with a feature that limits the number of times students cannot be seen on screen. The hardware requirement of the OES to be used by the client (students/participants of online examination) is a web camera and internet connection. Without these two types of equipment, the OES would not be utilized fully.

Before the pandemic occurs in Malaysia, all final examinations were conducted on the school or university premises where there was maximum supervision by the lecturers to avoid any dishonesty cases. When social distancing was implemented, online classes were not a problem because the university already had platforms at its disposal to use. Students already had some extra classes and discussions online before the pandemic which made the transaction to online learning convenient for most students and lecturers. The main issue is the online examination as it is not easy to monitor all the students from their homes, leaving room for dishonesty cases. In this view, there is a need for an alternative system that allows lecturers to manage their online examination effortlessly and maintain interactive communication with students in terms of marking and provide sufficient feedback about students' performance. Also, a mechanism that allows lecturers to be aware when unusual behavior appears during online examination whereby students were missing on the frame for quite some time (restriction feature of the OES).

The research objectives of this paper are specified as below:

- RO1: To study the impact of the transition from physical examination to online examination.
- RO2: To identify problems with traditional or current online examination systems and find solutions to be implemented in the new online examination system.
- RO3: To find the extent to which an online examination system can assist universities in monitoring their students during the final examination.

In Malaysia, it was common for universities to conduct a traditional examination system (Shen, Cheng, Bieber, & Hiltz, 2004) which is a physical examination without any digital devices such as laptops, cell phones, and smartwatches. This helps the university to make sure that there are no dishonesty cases during the examination. Some lecturers are performing tasks as

invigilators to be there to assist students with what they need, i.e., need for extra papers, pens, and pencils, or escorting them to the fresh room. When social distancing became effective due to the pandemic covid19 situation, things began to fully rely on online platforms just like all the other institutions around the world. Since this was a sudden change, most universities were not prepared, which led to online solutions with the most vulnerabilities. Students have ways to be dishonest during the final examination in the current online examination system which includes plagiarism, discussing answers with other students and getting someone else to do the final examinations for them, sharing/mirroring screens, etc.

Most of the Online Examination System problems can be solved by improved monitoring and restriction introduction (Ahmed, et al., 2021). The new system should be able to monitor the students and have restrictions with constant consequences. When students are doing examinations from their homes, they should be different rules since they cannot be monitored everywhere. For example, when students move away from their laptops they cannot be seen anymore, and they can have an opportunity to be dishonest. The new system should limit the number of times students are off the screen and the limited number of times students can be off-screen. This piece of information describes the impact of the transition from physical examination to online examination. It became a great motivation for the OES implementation.

Several existing online examination systems are currently being used now by different institutions (Hameed & Abdullatif, 2017). Some of the systems that this paper looks at include Eklavvya, Examsoft, and Mettl. All these are good systems that are designed to make sure that the candidate who is taking the examination is authentic and can be monitored. However, they come with pricing that prevents some institutions to do a subscription. Different systems monitor differently, some record throughout but some just take screenshots after a certain time. Most of these do not have one most important feature which is restrictions. The OES developed in this study is much simpler and free of charge. It has a feature of restriction that ensures students are monitored at all times during the online examination.

Methodology

There are three steps necessary that had been carried out as research methodology in this study. First is requirement specification that consists of a population sample study and interview conducted remotely (online) due to social distancing measurements in Malaysia. Several questions are included in the study and some are depicted in the following Table 1 and Table 2.

Table 1: Lecturer Questions

Question	Purpose
1. How did the change from a traditional system to an online system affect the way you prepare for final exam questions?	To see the impact of change on the lecturer's job
2. How do you ensure that there is no cheating?	To see if there are already implemented methods to avoid cheating
3. Which feature do you need to be in the new online system?	To know what more features to add to the system from the lecturer's view.
4. Is it difficult to evaluate the student's answers? Why?	To check the difficulty level and improve it.

Table 2: Student Questions

Question	Purpose

1. How did the change from a physical exam system to an online exam system affect the way you prepare for final examinations?	To see the impact of change on the student life
2. Which feature do you need to be in the new online system?	To know what more features to add to the system from the student's perspective
3. What issues do you face in the current system?	To understand the current problems and find the way to solve them.

The second is system design and implementation of the OES after the requirement specification is defined and understood. We use the Use Case diagram to describe the entire process and users involved in the system prototype. The OES was developed using PHP with MySQL, HTML, CSS, Bootstrap, JavaScript, and AJAX. The system dashboard with a few features of OES is depicted in figure 2. The restriction feature was designed with a live counter that identifies the duration and times objects missing from the screen (students or participants of online examination).

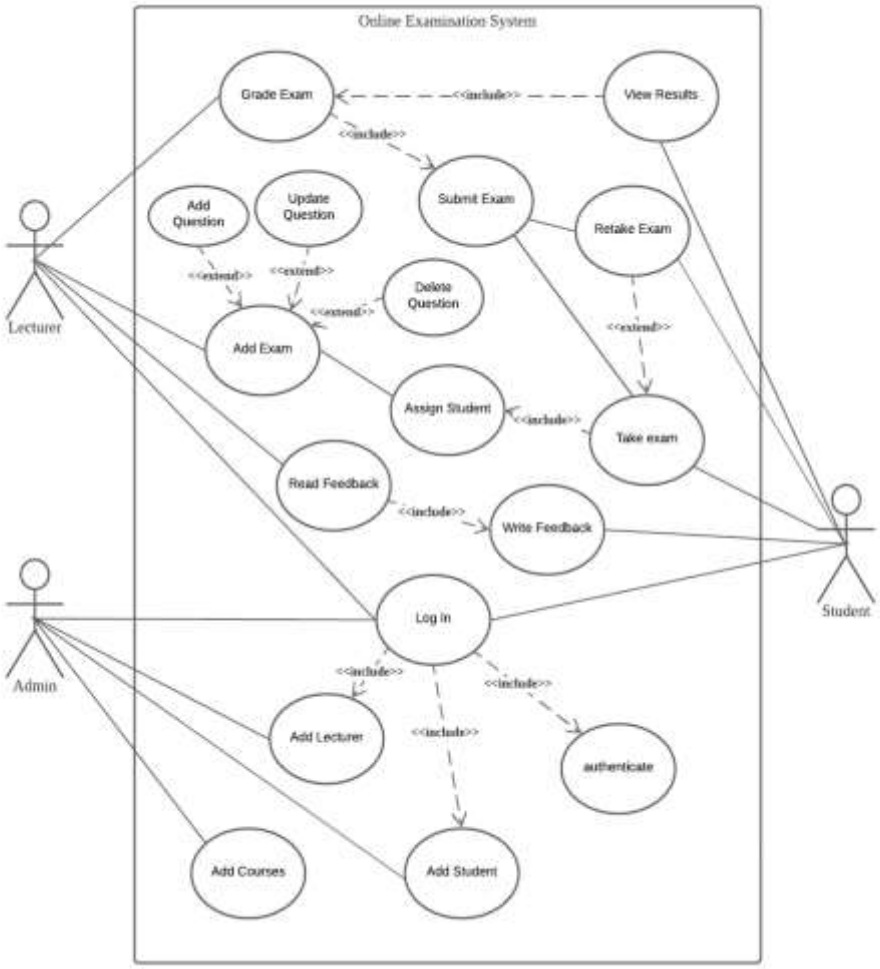


Figure 1. System Design using Use Case Diagram

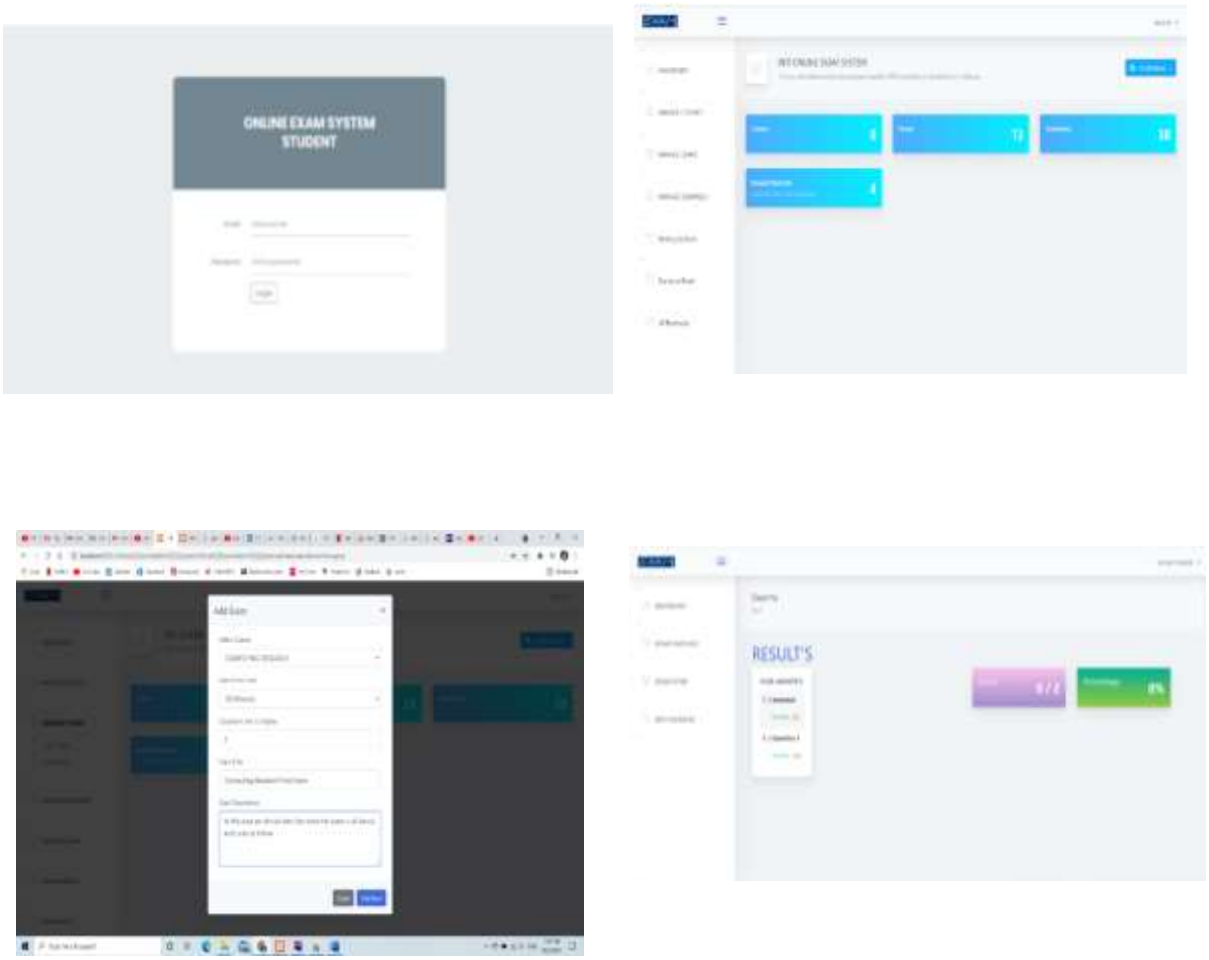


Figure 2. The Implementation of Online Examination System (OES)

The third is usability testing which emphasizes the usefulness, findable, accessible, usable, and desirable components of the OES. The usability testing was also conducted online (remotely). Some of the questions involved in this activity are:

1. The effectiveness of OES
   - Is the OES easy to learn? Is the OES useful and adds value to the target audience? Our Content, Color, Icons and Images used are aesthetically pleasing?
2. The efficiency of OES
   - Little navigation should be required to reach the desired screen in the OES, scrollbars should be used infrequently, and minimum searching within the OES features.
3. The accuracy of OES
   - No incorrect data and no broken links should be present within the OES.

Results and Discussion

This section illustrates the undergone testing with a sample of results. In general, the OES works "against" students during online examinations, it was always anticipated that most students will be "against" the OES. This was the most important perception because, in the students' responses, all negative answers were taken as positive in the system development. For example, in our results, most students are against the use of plagiarism in the final examination, and the developers (authors) take it as a definite inclusion of plagiarism in the final version of the online examination system. Lecturers' responses were taken as there are and given options setting the examinations. For example, there can turn plagiarism on and off for the students depending on how the lecturer wants to conduct the system.

The following Table 3 and Table 4 depict the questions asked during (online) usability testing that involved students and lecturers of a private institution in Malaysia as respondents. The name is displayed on the table randomly using a pseudo-name with details. Additionally, Figure 2 illustrates the satisfactory level of the current OES after usability testing was concluded. Most respondents recommended further improvement before the system is launched while others stated it's sufficient to be used by now. Following this, a testing scenario was developed that includes six types of testing. This information is depicted in table 5 along with its description and results.

Table 3: Results sample student Frederick (Respondent-3)

Name:	*Frederick (R3)*
User:	*Student*
Authentication / Login:	*Simple*
Taking exam:	*Quick and easy*
Re-taking Exam:	*Need to wait*
Adding Feedback:	*Can ask lecturers for more time for the exams.*
How did the change from a traditional system to an online system affect the way you prepare for final examinations?	*So easy to get ready for the exam, as all the exams are now an open book, we can use the internet and slides to study.*
Which feature do you need to be in the new online system?	*Multiple Choice Questions that we can instantly get results that will be cool.*
What issues do you face in the current system?	*Slow in getting our results*
Additional Information:	*-*

Table 4: Result sample student Nur (Respondent-14)

Name:	*Nur (R14)*
User:	*Student*
Authentication / Login:	*Simple*
Taking exam:	*One click, and then confirmation*
Re-taking Exam:	*Complicated, must wait for an admin to approve you.*
Adding Feedback:	*Can add anonymously.*
How did the change from physical exams to the online exam system affect the way you prepare for final examinations?	*More flexible time to go through the notes, and no more all-night studying and memorizing.*
Which feature do you need to be in the new online examination system?	*When refreshing the pages due to for example system or internet lagging, I do not want to lose my answers.*
What issues do you face in the current system?	*nothing*
Additional Information:	*-*

Table 5. Testing scenario

Type of Testing	Description	Results
Unit Test	Lecturer set the examination and the approved students can access the examination in their system.	Successful
API Testing	Authentication, Email, and Password for login and facial recognition against student identification card verification.	Successful
Integration Test	Individual modules are combined and tested together in a group. Admin adds students to the system as a user using student email and default password. The added student logs in using the same credentials in the system.	Successful
System Test	This is to test a complete and fully integrated online examination system.	Successful
Install/Uninstall Testing	User requirements to install/uninstall the system so they can use it.	Successful
Agile	Continuous testing of the system, Continuous Feedback.	Successful



Figure 3. Satisfactory level towards OES

Conclusion

This paper highlights the development process of the Online Examination System (OES) and the achievement of the three objectives that follows. The satisfactory level toward OES is encouraging along with the improvement needed for the OES in near future.

Acknowledgments

The OES system has been successfully developed within six months in the year 2021 by the author as a final project in the MIT program (Master in Information Technology). The authors would like to thank the Faculty of Data Science and Information Technology (FDSIT) at INTI International University for providing support and guidance toward the success of the OES and the completion of this paper as a publication.

References

Ahmed, F. R., E.Ahmed, T., A.Saeed, R., Alhumyani, H., Abdel-Khalek, S., & Abu-Zinadah, H. (2021). Analysis and challenges of robust E-exams performance under COVID-19. *Results in Physics https://doi.org/10.1016/j.rinp.2021.103987, 23*.

Aslam, F. (2020). COVID-19 and Importance of Social Distancing. *Social Distancing, 1*.

Asselah, T., DavidDurantel, EricPasmant, GeorgeLau, & Schinazi, R. F. (2021). COVID-19: Discovery, diagnostics, and drug development. *Journal of Hepatology, 74*(1), 168-184.

Cucinotta, D., & Vanelli, M. (2020). WHO Declares COVID-19 a Pandemic. *Acta Biomed. 2020; 91(1): 157–160. PMCID: PMC7569573 PMID: 32191675 doi: 10.23750/abm.v91i1.9397, SARS-CoV-2 data (NCBI)*, 157-160.

Frankl, G., & Schratt-Bitter, S. (2012). Online Exams: Practical Implications and Future Directions. *Conference: ECEL 2012*.

Hameed, M. R., & Abdullatif, F. A. (2017). Online Examination System. *International Advanced Research Journal in Science, Engineering and Technology, 4*(3), 106-110.

King, C. G., & Guyette, R. W. (2009). Online Exams and Cheating: An Empirical Analysis of Business Students' Views. *Journal of Educators Online 6(1) DOI:10.9743/JEO.2009.1.5*.

Loeb, S. (2020). *How Effective Is Online Learning? What the Research Does and Doesn't Tell Us.* EducationWeek.

Shen, J., Cheng, K.-E., Bieber, M., & Hiltz, S. R. (2004). *Traditional In-class Examination vs. Collaborative Online Examination in Asynchronous Learning Networks: Field Evaluation Results.* New York: web.njit.edu.