Prototype of Secure Exam Browser during Online Examnination

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***Abstract*— The secure exam browser is an innovative tool that enhances the reliability and security of online exams by integrating face recognition and tracking technology. It captures the student's face before the exam to ensure accurate identification and reduce the risk of impersonation. During the exam, the system continuously monitors the student's face to maintain exam integrity and detect any suspicious behavior. This tool provides several benefits, including real-time surveillance that reduces the likelihood of cheating. It streamlines the authentication process, eliminating the need for extensive manual invigilation and improving the overall test experience. The secure exam browser has undergone rigorous testing, proving its effectiveness in capturing and verifying face characteristics while monitoring for anomalies. With its user-friendly design, compatibility with various devices and browsers, and robust security features, it safeguards the validity of exams and prevents unauthorized access. For educational organizations and institutions concerned about protecting the integrity of online examinations, the secure exam browser is an invaluable asset. It ensures secure authentication and monitoring through sophisticated facial recognition and tracking capabilities, creating a dependable and trustworthy environment for conducting high-stakes exams.**

Keywords—secure exam browser, student's face, facial recognition

I. INTRODUCTION

The COVID-19 pandemic has had a significant impact on universities, leading to changes in their operations and financial models. With a decrease in student populations, universities have been compelled to reduce course offerings and faculty numbers, resulting in professors being assigned multiple courses per semester. To mitigate the financial implications, universities have started charging students separately for general education classes and courses funded by COVID-19. In this context, the Secure Exam Browser plays a crucial role in administering secure exams and preventing cheating. The browser's features, such as restricting access to unauthorized resources and tracking students' face movements, contribute to ensuring exam integrity. Additionally, the software enables instructors to monitor students during exams and maintain a secure testing environment. By employing the Secure Exam Browser, universities can enhance exam security and support effective online learning practices.

II. LITERATURE REVIEW

A. Effects of Covid Pandemic in adopting technology in universities[8]

The Covid-19 pandemic had a profound impact on universities worldwide, particularly in the context of conducting exams. Students faced unprecedented difficulties during this period, with exam performance being affected by factors such as poor health and disruptions caused by travel restrictions. The absence of trained support personnel further added to the challenges faced by students who were unable to sit for exams under normal circumstances. As a consequence of the pandemic, universities had no choice but to cancel exams, leading to significant disruptions in the education system. This disruption not only compromised the credibility of education but also resulted in substantial losses for students across the globe. Additionally, universities struggled to cope with the lack of staff and resources required to support the increased number of students taking exams, raising concerns about potential tuition increases in the future.

Amid the Covid-19 pandemic, safe exam browsers emerged as a valuable tool for universities and students to address the challenges of remote learning and online exams. These browsers provide a secure environment for students to take exams and quizzes remotely, surpassing the capabilities of traditional browser extensions. Students enrolled in online courses or studying from home can use safe exam browsers to complete their tests without any issues. Furthermore, these browsers facilitate exam preparation by allowing students to practice taking online exams and quizzes, leading to better understanding of the course material. In some cases, instructors may use the browser to display questions for students to practice before their final exams. The safe exam browser is also utilized in situations

where instructors need to provide website access or communicate instructions to students electronically. Its effectiveness extends beyond exams, as it can play a crucial role in online testing and remote tutoring applications. During the Covid-19 pandemic, the popularity of safe exam browsers significantly increased, as they offer students a worry-free and contamination-free method of taking exams. Modern safe exam browsers utilize advanced technology to provide a secure and reliable platform for exam administration, with professional moderators reviewing and releasing questions one-by-one to ensure fairness and integrity.

B. *Facial Recognition and Tracking[2]*

Facial recognition and tracking technology have gained popularity in monitoring examinations, especially for universities offering long-distance learning options. This technique utilizes computers to identify human faces and determine if they match stored images for authentication purposes, allowing systems to flag unauthorized individuals. Advancements in computer technology and security have made facial recognition and tracking the latest trend for organizations seeking to enhance facility security. Even during the Covid-19 pandemic, this technology has been employed to ensure students can take exams online without cheating, thanks to its accuracy and reliability. Facial recognition and tracking systems find applications in access control, surveillance, and crowd management. The process involves video cameras capturing images, which are then compared to stored images for user authentication. Biometrics, which refer to personal traits like fingerprints, palm prints, hand geometry, iris patterns, and faces, form the basis of this identification process. Face recognition systems, a type of biometric identification, utilize facial features for identification purposes. Using facial recognition for identity authentication offers several advantages, including ease of learning and practice, the absence of personal information storage, non-intrusiveness, and the minimal physical requirement for identification documents. However, it is important to consider the potential risks and disadvantages associated with this technology as well.

III. METHODOLOGY

A. *System Architecture*

The system architecture shown below outlines the different aspects of the program including the side of the lecturers and the side of the students. The ways in which both sides communicate in the system and the way they affect each other in the usage of the entire secure exam browser application.

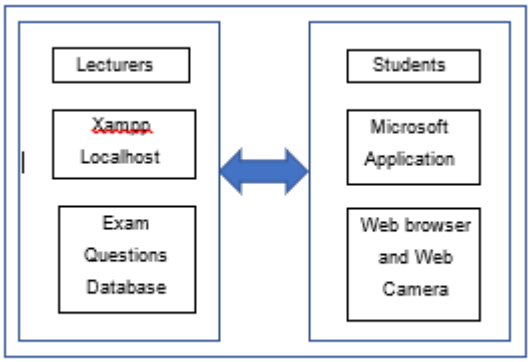
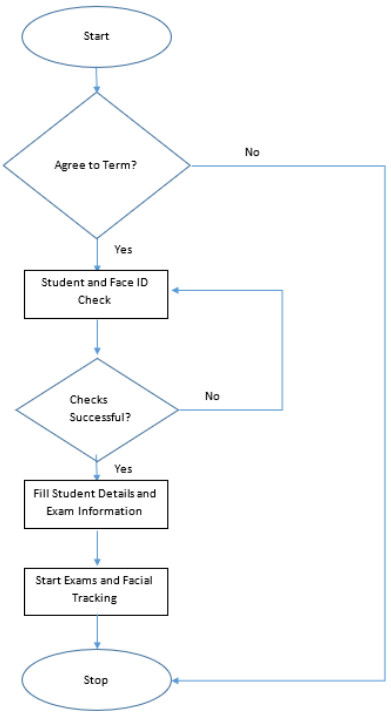


Figure 3.1 System Architecture

B. *System Flowchart*

The system flowchart is shown in the figure that follows. Users will be able to install both Google Chrome and the Visual Studio application that has been designed. After this, the user will be taken to agreements page which they agree to the terms and conditions of using the application including those of the university. The next stage is to input the camera and take a photo of the student carrying their own School ID. This will then lead to a student details section which will ask them to fill in all their details. The next step is to go into the browser and start live tracking of the entire face and also do the exams in the spaces provided. This is shown in the following figure.



IV. PROTOTYPE DEVELOPMENT

The software development lifecycle includes prototype development, which enables developers to produce an initial

version of an application to gather input, confirm concepts, and show functionality. In this context, the introduction will concentrate on creating prototypes using Microsoft Visual Studio, the C# programming language, and XAMPP, which supports HTML.

The system was built using the Windows Forms Application feature of Microsoft Visual Basic, which utilizes the Windows user interface (UI) technologies to provide visual feedback for system functions. Windows Forms include various UI elements such as buttons, checkboxes, and text input fields, which were extensively used in this application for data collection and student information storage. To accommodate different browsers, the Windows Forms application can be manually adjusted to suit user preferences. The designer had the option of using the Internet Explorer Forms Control or Visual Studio designer when creating the forms. The Internet Explorer Controls and Components Gallery provided pre-designed basic controls for forms applications, but custom controls could also be created. The application was designed with universality in mind, ensuring compatibility with multiple browsers in the market. It employed standard forms that appear in the Windows Control Panel and Internet Explorer, making it compatible with various browsers and operating systems.

V. TESTING AND RESULTS

A. Functionality Testing

The results of functionality testing indicate the effectiveness and reliability of the button's functionality within the system. The testing reveals whether the system button successfully restricts access to unauthorized applications and websites during exams, while also ensuring uninterrupted exam sessions without data loss. It highlights the ability of the system button to handle potential challenges such as overrides or bypass attempts, thus maintaining the integrity and security of the exam environment. The results also provide insights into the proper functioning of the button, enabling users to address any identified issues and make necessary improvements to enhance the overall performance of the secure exam browser with face monitoring.

B. User Acceptance Testing

The results of user acceptance testing for a secure exam browser demonstrate the acceptance and satisfaction level of the users with the system. The testing reveals whether the browser meets the users' expectations, requirements, and usability standards. It assesses aspects such as the ease of installation and configuration, the effectiveness of the exam mode and face monitoring features, and the overall user experience during exam sessions. The results provide valuable feedback on the browser's performance, user interface, and functionality, enabling stakeholders to address any identified concerns and make necessary adjustments to enhance user satisfaction. Successful user acceptance testing ensures that the secure exam browser meets the needs of the users, establishing trust and confidence in its reliability and effectiveness.

C. Security Testing

An open-source tool for detecting security flaws and vulnerabilities in web applications is called OWASP ZAP (Zed Attack Proxy). It supports the early identification and correction of potential security flaws by developers, quality assurance teams, and security experts.

From the scanning result, there is no high risk. There are 2 medium risk and 4 low risk to be attack. The medium risks are missing anti-clickjacking header and content security policy (CSP) not set. The low risks that have been detected are big redirect detected (potential sensitive information leak), cross-domain JavaScript source file inclusion, server leaks version information via “Server” HTTP Response and X-Content-Type-Options header missing.

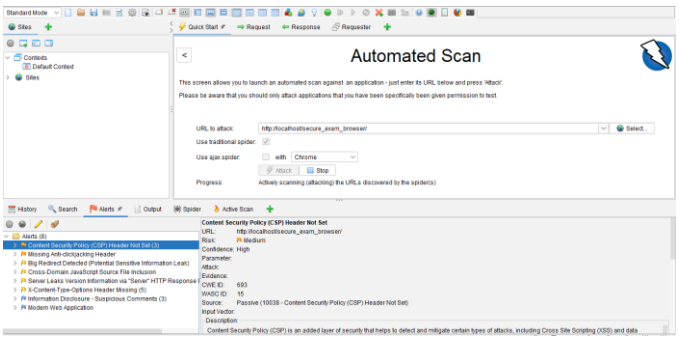


Figure 5.1 Scan using OWASP ZAP

VI. CONCLUSION

The system built was able to achieve the objectives as set out in the beginning of this project and therefore can be seen as a successful attempt to build a properly working safe examinations browser. The benefits of the use of the system are plenty given that it is very easy to use and thus makes it essential tool for universities to acquire and develop for their own usage. In addition to teaching, the safe exam browser can be used for homework help. Students may find extra motivation for completing a project or quiz when they know the teacher is checking how things are going and therefore making them become more actively participating in the entire classroom and work. These proactive teachers can set up alerts when it's time to change habits that are not working or understand why bad ones need to be changed. It ss important to note that students can use the browser to incorporate video features like Skype and Google Hangouts. This benefit gives them a way to improve their communication skills by having face-to-face conversations with other students and teachers around the world and therefore make collaboration easier.

REFERENCES

[1] Anwyl-Irvine, A., Dalmaijer, E. S., Hodges, N., & Evershed, J. K. (2021). Realistic precision and accuracy of online experiment platforms, web browsers, and devices. *Behavior research methods*, *53*, 1407-1425.

[2] Arnautovski, L. (2019). Face recognition technology in the exam identity authentication system-implementation concept. *Proceedings of Papers*, 50.

[3] Chirumamilla, A., Sindre, G., & Nguyen-Duc, A. (2020). Cheating in e-exams and paper exams: the perceptions of engineering students and teachers in Norway. *Assessment & Evaluation in Higher Education*, *45*(7), 940-957.

[4] Ebenezer, c. N. (2021). A secure online computer-based test system using facial recognition biometric authentication (case study of mountain top university).

[5] Elsalem, L., Al-Azzam, N., Jum'ah, A. A., Obeidat, N., Sindiani, A. M., & Kheirallah, K. A. (2020). Stress and behavioral changes with remote E-exams during the Covid-19 pandemic: A cross-sectional study among undergraduates of medical sciences. *Annals of Medicine and Surgery*, *60*, 271-279.

[6] Fedewa, J. (2021, March 23). What is a browser extension? Retrieved January 26, 2023, from https://www.howtogeek.com/718676/what-is-a-browser-extension/

[7] Frisbie, M. (2023). What Are Browser Extensions? In Building Browser Extensions (pp. 1–15). Berkeley, CA: Apress. from https://brave.com/learn/what-are-web-browser-extensions/

[8] Fruehwirth, J. C., Biswas, S., & Perreira, K. M. (2021). The Covid-19 pandemic and mental health of first-year college students: Examining the effect of Covid-19 stressors using longitudinal data. *PloS one*, *16*(3), e0247999.

[9] Garbett, S. (2022, April 21). How to create your own Google Chrome extension. Retrieved January 26, 2023, from https://www.makeuseof.com/create-own-google-chrome-extension/

[10] Kvartalnyi, N. (2021, March 18). Life cycle of agile software development. Retrieved January 26, 2023, from Inoxoft - website: https://inoxoft.com/blog/agile-software-development-lifecycle-phases/

[11] LockDown Browser. (2019, June 6). Retrieved January 26, 2023, from Respondus website: https://web.respondus.com/he/lockdownbrowser/

[12] Nor, A. N. M., Daud, K. M., Hatta, N. B. M., & Saleh, N. I. M. (2023, April). Overview on Online Examination Proctoring Using Machine Learning. In *Proceedings of the 9th International Conference on Computational Science and Technology: ICCST 2022, 27–28 August, Johor Bahru, Malaysia* (pp. 93-103). Singapore: Springer Nature Singapore.

[13] Reedy, A., Pfitzner, D., Rook, L., & Ellis, L. (2021). Responding to the COVID-19 emergency: student and academic staff perceptions of academic integrity in the transition to online exams at three Australian universities. *International Journal for Educational Integrity*, *17*(1), 1-32.

[14] Safe exam browser - about. (n.d.). Retrieved January 26, 2023, from Safeexambrowser.org website: https://safeexambrowser.org/about_overview_en.html

[15] Shraim, K. (2019). Online examination practices in higher education institutions: learners' perspectives. *Turkish Online Journal of Distance Education*, *20*(4), 185-196.

[16] Skshidlevsky, A. (2022, February 7). What is Lockdown Browser and How it Works. Retrieved January 26, 2023, from Proctoredu.com website: https://proctoredu.com/blog/tpost/4h1kdgu9s1-what-is-lockdown-browser-and-how-it-work

[17] Tweissi, A., Al Etaiwi, W., & Al Eisawi, D. (2022). The Accuracy of AI-Based Automatic Proctoring in Online Exams. Electronic Journal of e-Learning, 20(4), 419-435