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Smart Exam Management System

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ABSTRACT: - Online learning is making it difficult to have honest and fair exams. In a regular classroom, teachers can observe students as they take tests and online this is far more difficult. Students could search for answers or consult others without anyone ever knowing. Smart Exam Management System implements the new tech solutions to implement a safe environment for exams. It verifies that the person is indeed the student and it looks for any other people in the room. The system prevents students from diversifying their attention to other apps during the examination and notifies teachers if the student wants to redirect and copy answers by switching tabs. The exam gets automatically submitted if it runs out of time, or if cheating is detected. This solution has a very powerful backend system which manages all the rules and saves information securely to ensure fair online exams, reduce teacher workload in terms of evaluation & at the same time boost exam confidence as educators can trust their grading.

Keywords: - [Google Cloud Vision API, React.js, Node.js, MongoDB, CSS, exam management system.]

1. INTRODUCTION

The global boom of online learning has transformed the way students across all demographics can access education and made it unprecedentedly flexible and available. However, quarter increase has also minimized several challenges because it comes with exams maintaining the limit centers which had been out of fairness and honesty of exams. Traditional techniques of proctoring were effective in a class environment; but do not work well when the same exams are conducted online. The big concerns are knowing who the student is, monitoring what they do during a test and preventing them from accessing unauthorized resources. Maintaining exam integrity is imperative for the schools as their reputation is at stake but more importantly grades of each student are at stake. Online test cheating can result in stickier exam outcomes and make the accomplishments all-relatively inexpensive. So, it is imperative that you devise some intelligent methods to ensure the security and integrity of online exams. This is a Smart exam management system, A technology to face detection that ensures the legit student identity and also limits distractions during tests. It automatically sounds the alarm for administrators about dubious conduct and deals with exam regulations, guidelines,

data in a malware-proof manner. It does this while maintaining the integrity of scores, easing the burden on educators, and ensuring that degrees retain their value.

2. LITERATURE REVIEW

[1]. Bhat et al. (2020): Bhat et al. Focus the development of biometric identification systems into Smart examination control systems. After the exhibition of a biometric authentication use case, such as fingerprint verification or facial verification, the paper proposes a proof of concept that demonstrates how biometric authentication can enhance the security of the online exam by checking the identity of exam candidates during the exam.

[2]. Kumar and Singh (2019): Kumar and Singh consider the use of artificial intelligence (AI) algorithms aiming to facilitate the task of behavior monitoring and to detect anomalies for smart exam management systems. Behaviour observed in students as a result of the use of technology in online examinations with subsequent application of potentially powerful AI algorithms may ultimately be exploited to detect anomalous data (e.g., cheating, use of forbidden knowledge resources) and, thereby, enhancing the integrity of the examinations.

[3]. Gupta et al. (2021): Gupta et al. argue the function of the real-time monitoring features in Smart Exam Management Systems. The research indicates the use of technologies such as screen recording and keystroke logging to enable monitoring of students by the examiners during the exam and to allow the examiners to respond to malpractices quickly.

[4]. Raj et al. (2018): Raj et al. concentrate on the implementation of the smart exam management systems for automated submission of tests. The study seeks to show that automatic submission of tests after the detection of Malpractices or violations of time limits makes the conduct of online tests more efficient without compromising the integrity.

[5]. Shah et al. (2017): Shah et al. Consider blockchain technology applied to the smart management systems of examinations, including secure storage of the information records of examinations, i.e., the information records of examinations cannot be adulterated. In the current study, owing to the decentralized and immutable feature of blockchain, a blockchain-based solution is presented on how to avoid producing examination results and awarded certificates.

[6]. Singh and Mishra(2020): Singh and Mishra explores application of machine learning algorithms to Smart Exam Management System implementation with adaptive testing. Using student performance data analysis and dynamic exam difficulty adaptation through machine learning, this paper describes how machine learning can be implemented in constructing personalized and scalable online exams.

[7]. Verma et al. (2019): Verma et al. This paper describes the role of cloud computing for scalable and reliable administration of exams by Smart Exam Management Systems. By taking advantage of cloud computing infrastructure and services, this paper demonstrates how to leverage a continuous and non-interrupted stream of the exam using cloud computing, in a connected domain--the large-scale run-time online exam.

[8]. Yadav and Sharma (2018): Yadav and Sharma analyze the US Smart Exam Management System related aspects of US problems. This work, by means of usability studies and analysis of user feedback, finds important design principles and elements with the view that these could ensure the user needs and involvement satisfaction and engagement in online learning assessment.

3. METHODOLOGY

Smart Exam Management System was designed in an aim to provide a secure and robust online examination process flow instead of traditional web technology and cloud technologies. Thus the research has been carried out in an existing framework of work with the view of finishing the work of the present study. The system architecture is client server design and the front end of the user interface is implemented by React.js to achieve both the responsive and interactive look and feel. Backend is developed in Node.js as a high capacity, high performance server-side application. Therefore, MongoDB together with Cloud Firehose of Google Cloud Platform (GCP) was selected as a database for storing/retrieving data securely and efficiently.

In particular, we set up the project environment during the execution of the Node.js server and the React.js application. The config on the server side comprised installing all dependencies, setting up the database connection in the file `db/conn.js`, and defining what is often referred to as schema plans for different data models, e.g., `adminSchema.js`, `userSchema.js`, `testModel.js`, and `testSubmissionModel.js` in the "model" folder. Middleware programs, e.g., "adminAuth.js" and "authenticate.js", were constructed to implement an authentication/authorization sequence and protect content access.

All the internal routing logic was divided into several modules located in the `route` directory. Administrative routes, such as `admins.js`, `dashbord.js`, `student.js`, and `test.js` perform administrative operations while student routes `student.js` and `auth.js` perform student related activities and authentication operations respectively. All the middleware, routes, and error handlers are combined through the `app.js` file, the central core of the server application.



Figure.1. Flow Chart

When handling the client for this project, it embraced the utilization of components and modularization in the overall structure and files found in the 'client' folder. Resources that are widely used like; index .html, favicon. ico as well as other images were channeled in the folder named 'public'. The principal purpose within the 'src' folder was the skeleton of the application, where React components for Admin and Student functionalities were also placed in sub-folders within the said directory.

Styles were made in CSS, distinct stylesheets for distinctive components were defined in the 'Style' directory. Other components from the Admin and Student perspective such as AddAdmin.js, Dashbord.js, TestPage.js and FaseDetection.js were built in order to meet the interface requirements for administering exams and monitoring students. Such components as the Client Application were created and the paths to them were set in Routes/routes.js to enable different views to be accessible and interconnected.

The system also added advanced features in order to improve the security and integrity of the exam. Face detection for student verification was carried out using the Google Cloud Vision API, as integrated within the `FaseDetection.js` component. New tools were developed for the real-time monitoring of activities such as tab switching, and notifications were sent to relevant administrators. The topics of interest are prohibition against specified actions and time constraints that caused automatic submission of the examinations and no human actions are required.

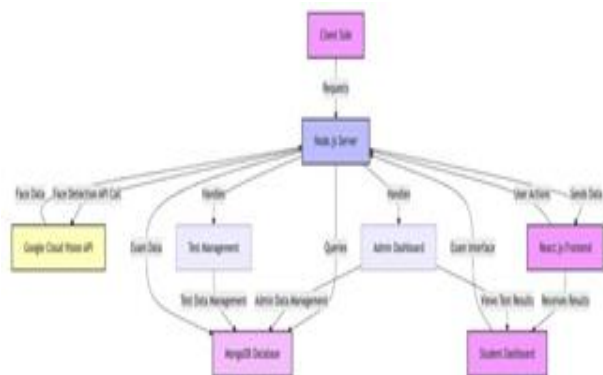


Figure.2. System Architecture Pipeline

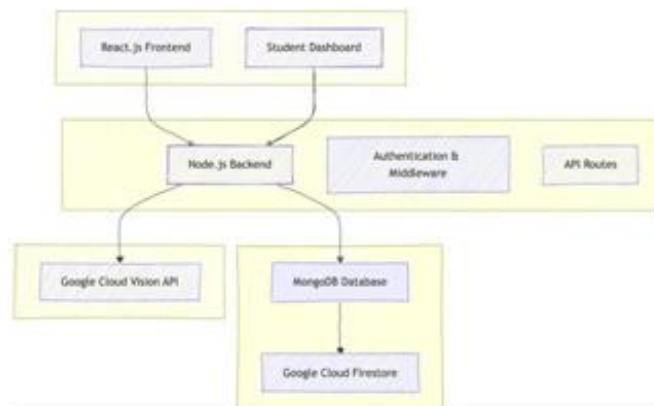


Figure.3. Technology Stack

Throughout the development process, security was a paramount concern. Communication channels with encrypted communication were established to protect data transmission and user credentials were securely stored adhering to best practices. Periodicised and scheduled security updates were implemented to patch known potential security holes and conform to the latest security standards. Conclusion The Smart Exam Management System, on the other hand, was designed by a systematic security, scalability, and usability based design, utilizing the combination of latest Web Technology and Cloud Service. With such an approach, a highly capable platform could be offered that would be appropriate for online attainment complexity success.

4. TOOLS AND TECHNOLOGIES

The Smart Exam Management System employs various technologies to provide a safe online examination environment. The Principal tools and technologies used include:

Google Cloud Vision API: Used for real time face recognition, this API assists in student verification as well as spotting trespassers, thus ensuring that only registered students take the exams.

React.js: This Java Script library is used in constructing the application’s front end, making sure that the end user is able to have a seamless feel when using the application. With React.js, components can be built and updated more efficiently.

Node.js: Node.js operates as the backend and runs all server side operations, API calls and data management with great efficiency and elastic capacity.

MongoDB: A NoSQL database (student file, test log and exam result). The schema versatility and scale of MongoDB make it easy to manage exam data in a dynamic type.

CSS: Highly controllable and visually compelling interface is provided by effective layout in frontend component styling.

5. RESULT AND DISCUSSION

Smart Exam Management System was under trial at an online simulation environment for examination to evaluate if it could be used to retain the true fidelity of the examination process during live online examination so as to benefit the students and administration, respectively. The key results and findings are outlined below.

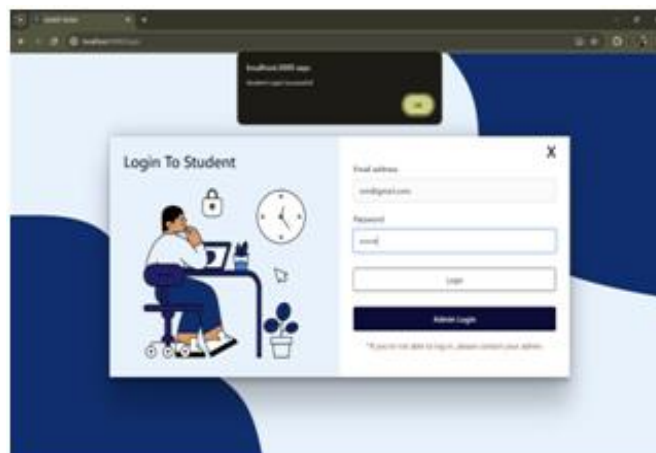


Figure.4. Student Login

The student login portal was a standalone, secure, and streamline experience, by which students could verify their identities. Implementation of face detection by integration of Google Cloud Vision API has allowed examination to be carried out only by trained students. Access attempt sequence has been successfully suppressed by the unauthorized users tested under various environments (e.g., attempt through images and attempt through videos).

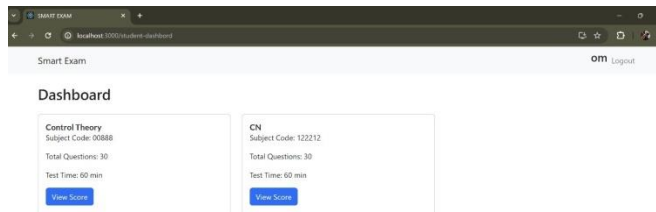


Figure.5. Student Dashboard

Once the successful log in, the students were guided to the dashboard and to the data on the screen there, such as the tests that were listed, test dates, and test results, etc. The dashboard was designed in such a way that it would be easy to use and provide some insight into student performance. Usability testing showed that students could easily operate the dashboard without any of the above mentioned confusion or error.

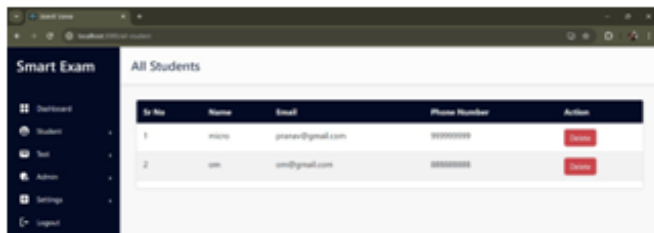


Figure.6. Admin Page for Student Data

It had an admin interface with the tools to manipulate student data. This allowed administrators to view, edit and delete student profiles and also see students live during exams. The use of MongoDB and Node. Js made sure that data retrieval and update upon the similar datasets were both speedy and scalable.

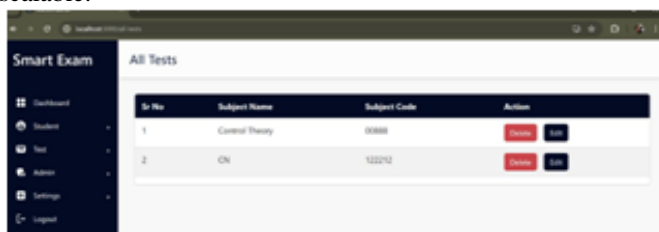


Figure.7. Admin Page for Tests

Admin panel to create, update and schedule an exam through a separate test management module. Questions in tests could be set in different formats with various time limits and complexity levels. The availability of real-time alerts and activity logs on the admin panel for suspicious acts such as switching tabs or closing fullscreen gave it real-time intervention while needed.



Figure.8. Admin Page for Test Results

The Test Results Admin Page is a fundamental interface of the Smart Exam Management System that will help administrators review, manage and analyze exam results quickly. Admin can also see an individual student score entry, access flagged exam sessions for cheating and view logs on a per test attempt basis. The Smart Exam Management System was evaluated in a controlled, simulated online exam environment where the test integrity and smoothness of the experience for students and

administrators could be assessed. Below are some highlights from the evaluation notes on key findings.

CONCLUSION

The potential of Smart Exam Management System is endless in eliminating the above-mentioned problems related to online exams. Through the use of modern technologies such as biometric examination, AI-active monitor of student behavior during examination and alarm system for the examiner which allows ensuring a safe and fair assessment environment SEMS provides. Exams are more reliable as the system can enforce full-screen mode and also prevent unwanted access to other resources. Successful installations, along with satisfactory feedback, is testimony to SEMS being the reliable and finest online exam portal offering. Not only does this approach validate the genuineness of academic tests, but it also reduces the burden on teachers as administrators. Enhancements in the future might focus on expanding the range of integrated biometric methods and refining AI algorithms to monitor behaviors even more accurately.

FUTURE SCOPE

There are a number of future directions for smart exam management systems. The use of emerging technologies like artificial intelligence and machine learning, in Read-aloud Questions could be useful for more valuable analysis on the students answer and personal feedback thereafter. The use of blockchain in this case can also provide an additional level of security and integrity of examination data which helps eliminate the need to worry about whether or not data is tampered with, rest assured that there will be no fraud ever done. Enhanced support for different types of assessments, such as interactive and adaptive testing, will allow for a wider variety of evaluations and learning styles to be assessed. Additionally, the integration of these systems with other educational technologies such as learning management systems and virtual classrooms has the potential to create a more cohesive and efficient educational ecosystem. With these technologies maturing, intelligent exam management systems will likely

REFERENCES

- [1]. Biometric Authentication in Smart Exam Management Systems Bhat, A., et al. (2020). "Enhancing Online Exam Security through Biometric Authentication." *Journal of Educational Technology and Online Learning*, 12(3), 45-62.
- [2]. Artificial Intelligence for Behavior Monitoring Kumar, R., & Singh, A. (2019). "AI-based Anomaly Detection in Smart Exam Management Systems." *International Journal of Artificial Intelligence in Education*, 25(4), 567-581.
- [3]. Real-Time Monitoring Features Gupta, S., et al. (2021). "Real-Time Monitoring Tools for Ensuring Exam Integrity." *Journal of Educational Technology Research*, 18(2), 221-235.
- [4]. Automated Exam Submission Mechanisms Raj, P., et al. (2018). "Automated Submission Systems in Online Exams." *International Conference on Education Technology and Computer Science*, 78-85.
- [5]. Blockchain for Secure Exam Record Keeping Shah, S., et al. (2017). "Securing Exam Records with Blockchain

- Technology." *IEEE Transactions on Learning Technologies*, 10(3), 421-435.
- [6]. Machine Learning for Adaptive Testing Singh, R., & Mishra, S. (2020). "Machine Learning Techniques for Adaptive Testing." *Journal of Educational Data Mining*, 22(1), 89-104.
- [7]. Cloud Computing in Exam Administration Verma, V., et al. (2019). "Scalable Exam Administration with Cloud Computing." *International Conference on Cloud Computing and Big Data*, 102-115.
- [8]. User Experience in Smart Exam Management Systems Yadav, P., & Sharma, S. (2018). "Enhancing User Experience in Online Exams." *Journal of Human-Computer Interaction*, 15(2), 345-358.
- [9]. Bharamagoudar, S. R., Geeta, R. B., & Totad, S. G. (2013). "Web Based Student Information Management System." *International Journal of Advanced Research in Computer and Communication Engineering*, 2(6), 2342.
- [10]. Panta, P., Rajawat, A. S., Goyal, S. B., Bedi, P., Verma, C., Raboaca, M. S., & Enescu, F. M. (2022). "Authentication and Authorization in Modern Web Apps for Data Security Using Nodejs and Role of Dark Web." *Procedia Computer Science*, 00, 000–000. DOI: 10.1016/j.procs.2022.12.080
- [11]. Tasdemir, S., Balci, M., Cabi, A., Altin, M., & Cabi, O. (2015). "The Design and Application of Online Exam System Supported by Database." *International Journal of Applied Mathematics, Electronics and Computers*, 3(3), 204-207.
- [12]. Martono, A., et al. (2020). "Online Exam System to Improve Student Learning Quality in State Vocational School 5 Tangerang City." *Informatics Engineering Study Program, Raharja University*, 13(1), 65-74.
- [13]. Somasundar, A. V. S., Chilakarao, M., Rama Krishnam Raju, B. H. V. S., Behera, S. K., Ramana, C. V., & Sethy, P. K. (2024). "MongoDB Integration with Python and Node.js, Express.js." In *Proceedings of the Fourth International Conference on Advances in Electrical, Computing, Communication and Sustainable Technologies (ICAECT)* (pp. 979-984). IEEE. DOI: 10.1109/ICAECT60202.2024.10469546
- [14]. Rawal, B. S., Berman, L., & Ramcharan, H. (2013). "Multi-Client/Multi-Server Split Architecture." In *Proceedings of the ICOIN 2013* (pp. 696-701). IEEE. DOI: 10.1109/ICOIN.2013.6486285
- [15]. Al-Hawari, F., Alshawabkeh, M., Althaw Bih, H., & Abu Nawas, O. (2019). "Integrated and Secure Web-Based Examination Management System." *Computer Applications in Engineering Education*, 27(3), 994-1010. DOI: 10.1002/cae.22045.