CLOUD-BASED EXAMINATION: ENHANCING SECURITY AND EFFICIENCY IN NIGERIAN TERTIARY INSTITUTIONS

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Cloud Computing offers the use of computing resources over the internet without having the infrastructure. The main content of cloud computing is to tackle software program, data storage and processing potential allocated to external users on demand through the World Wide Web and pay-as-you-use. Information security is a major concern in any communication system, especially on the cloud platform. Examinations are a routine process used to assess the effect of students' learning skills in universities and colleges of education. Nowadays, it consumes more time and resources in organizing and preparing the examination materials, printing papers, scheduling the examination and as a whole organizing the examination. The procedure of picking out questions automatically from the database reduces the time cost of preparing paper-based for teachers or lecturers, the control of the exam time and the submission makes the invigilating easier, the checking of the result automatically lightens the teacher burden and the same time also increase the accuracy. This paper examines the implementation of a cloud-based examination framework, focusing on its capacity to strengthen security measures and minimize administrative workloads in educational institutions.

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Introduction

An innovative technology aiming to reduce the abnormalities frequently connected to conventional evaluation procedures is the use of cloud computing technologies into examination systems (Song, 2021). Using cloud-based solutions has become an essential approach for increasing security and efficiency as educational institutions work to improve their assessment processes. The necessity to have skilled workers that can support economic growth is what motivates the desire for strong educational frameworks, especially in tertiary institutions (Mabele, 2018). Educational institutions can simplify their test procedures by using cloud computing's scalable resources, which enable effective data management and storage. Exam questions stored in a centralised database enhance accessibility while ensuring that assessments meet institutional requirements. This technique saves teachers time on preparation and assessment, which is particularly essential in higher education since faculty members frequently balance their responsibilities related to research and teaching.

In paper-based examinations, institutions deal with issues such as inadequate responses, delayed data analysis, and constrained capability of obtaining input from numerous evaluators. These limitations hinder assessment's overall effectiveness and delay student feedback, which eventually affects the learning process (Morris et al., 2021). Cloud-based platforms minimise logistical obstacles and enhance the exam experience for students as well as instructors because they can support large numbers of users at once and offer the

scalability required to manage peak demands during exams (Chatterjee et al., 2022; Matthew et al., 2018).

An important consideration in a communication system is information security, especially in online testing platforms that handle sensitive student data. The chances of unauthorize access or data breaches can be reduced by implementing robust security measures in place, such as encryption methods, access limits, and frequent security audits. This will ensure data privacy and secure student information. These security measures ensure the reliability of academic evaluations and the accuracy of the examination process, particularly at higher education institutions. (Arsalan & Ali, 2024; Mohammad, 2024).

Problem Statement

The implementation of centralized databases in cloud-based examination systems within Nigerian educational institutions faces significant security challenges that undermine the integrity of educational assessments. One major issue is the lack of robust authentication mechanisms; many institutions do not utilize advanced security features such as biometric verification, including facial recognition and thumbprint scanning, which can lead to unauthorized access to sensitive examination data. This vulnerability allows individuals without proper credentials to manipulate exam materials, compromising the integrity of the assessment process. Additionally, insufficient data encryption protocols further expose sensitive information during transmission and storage. The absence of strong encryption standards increases the risk of data interception and unauthorized access, jeopardizing the confidentiality of examination processes. (Awoniyi et al., 2024; Garg & Goel, 2022). These challenges highlight the need for more efficient and secure examination systems.

This research aims to address these concerns by proposing a cloud-based examination system that provide valuable insights for educators, administrators, and policymakers in implementing secure, technology-driven examination processes.

A review of related literature

According to Song (2021), an examination system is a database-driven program that stores records of test paper details, questions bank data, and user information. A computer connected to a network is used to administer an online test. Because of its speed and efficiency, online examination systems are currently a rapidly growing examination method. The examination can be conducted by the system with little human intervention. In order to save students time during tests, almost all organisations now use online examination systems. A student's performance on an exam can also be easily verified by organisations. Consequently, organisations are releasing results faster. By saving paper, it also benefits the environment (Tripathi et al., 2022). Examinees in online systems receive their login information and password along with their admission card. The examination server has this ID saved already. When the examinee logs in to the server, their profile is already registered. The notification to begin the examination is sent to the examinee at an appointed time. Each answer submitted by the examinee is stored on the server together with their profile details. The online exam method also permits the examinee to revise their response if necessary within the exam period; however, after the allotted time, no revisions will be permitted. Because computers are faster and more accurate than humans, this further makes checking the response simple and error-proof (Akazua et al., 2016).

Numerous studies have recommended technological improvements to improve the online exam experience. A comprehensive review of the literature on virtual testing, for example, demonstrated how technology might enhance academic integrity by monitoring students' behaviour during exams (Muzaffar & Tahir, 2024). To effectively identify instances of cheating, an automated online exam testing system that collects multimedia data was also put into place. As the need for comprehensive solutions that consider security and user experience issues grows, so do these technological advances.

Chan and Ahn found that unsupervised online test scores were comparable to proctored in-person exam scores. According to this study, which looked at data from almost 2,000 students in a range of academic areas, student rankings remained consistent across exam formats. According to the findings, online assessments can provide accurate assessments of students' learning, refuting the misconceptions about how reliable online testing settings are in emergency situations (Chan & Ahn, 2023).

Biccard et al. (2023) looked into students' perceptions of the first online exams administered during the pandemic. According to the study, key factors influencing student achievement include online access, exam size, and system interface usability. Students brought up problems including not having enough time to complete assignments and experiencing difficulties obtaining reliable internet connections. The authors emphasised the significance of educational institutions providing adequate support and resources to facilitate successful online assessments.

According to a thorough assessment of online exam solutions by Muzaffar et al. (2021), one important aspect of the examination system was its usability. Still, it was the least researched idea over the preceding five years. Based on the findings of these authors, a system that has strong usability is easy to use and does not require additional training.(Muzaffar et al., 2021a).

As a result of a sudden transition to online learning, many learners experienced anxiety, according to Fawaz and Samaha (2020). They also highlight the emotional discomfort experienced by students who were not accustomed to online learning. Students may experience anxiety when they visit the online exam environment, especially if they are unfamiliar with or find the interface challenging to use. Anxiety is the main cause of the digital divide (van Dijk, 2002, 2017) and may compound issues with usage, skills, or resource access.

A review by Newton and Essex (2024) found that self-reported cheating rates among college students increased from 29.9% earlier in COVID-19 to 54.7% amid the pandemic. This alarming trend highlights the flaws in online assessments and highlights how important it is to use secure assessing services to maintain academic integrity.

Additionally, a systematic analysis by Muzaffar and Tahir (2024) examined a range of monitoring systems designed to detect cheating in real-time, showcasing developments aimed at enhancing online security (Muzaffar et al., 2021b).

Conclusively, online tests in higher education are complexly portrayed in the literature. Online assessments can be accurate, according to research, but there are still issues, especially when it comes to student attitudes, academic integrity, and effective technology use. As institutions adjust to these developments, more research will be required

to create techniques that enhance the security and integrity of online exam systems.

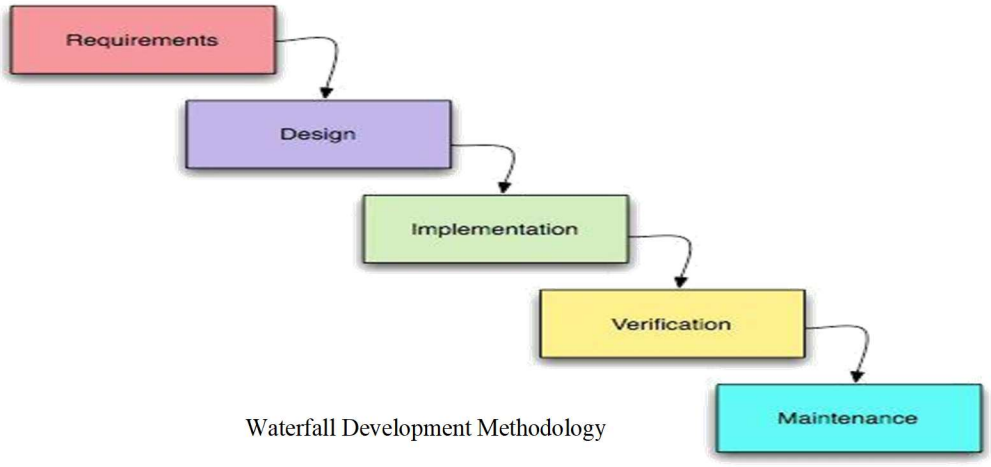
Methodology

This study uses a survey method that is administered electronically, and adopt software development methodology which require careful control due to the dynamic nature of requirements. This is necessity for collaboration, and the importance of documentation. In remote teams, a lack of structured development design and methodology can lead to project delays, as team members may frequently need to seek guidance from project managers, resulting in communication bottlenecks. This can force developers to rely on intuition, increasing the likelihood of bugs in the final product, which in turn consumes valuable time during debugging (Emenike et al., 2023). To address these challenges, many individuals and organizations have established documented phases or stages to standardize their development processes. Continuous refinement of these practices has led to the creation of methodologies that are widely adopted across different teams to enhance their development efficiency.

Software development methodology refers to a structured set of principles or practices used in the software creation process. The primary goal of any methodology is to maintain control over the development process by dividing it into distinct phases, each with specific deliverables. The selection of a suitable development methodology depends on various factors, including the variability of system requirements, project timelines, the expertise of the development team, client specifications, and the programming languages involved.

A Waterfall model development methodology (Alazzawi et al., 2023) was chosen for this study which been accepted by software development teams worldwide. Waterfall development methodology differs from other development models such as agile because agile development model works by trying to fully understand and describe the application in written documents before code development commences.

In the waterfall development methodology, implementation of the requirements/design phase is done to produce functional requirements that will explain he application. This will be followed by a detailed user interface specification and design. Only when these documents are signed by the end user and the development team that the development commence. There has been a great success with large projects developed using the waterfall methodology.



Waterfall Development Methodology

Justification For Choosing Waterfall Development Methodology

In waterfall model, every stage must be fully completed before the commencement of the subsequence phase. At the end of every phase, review takes place to asses if the development is on the right track and if to continue or stop the project. By using this model, testing starts only after the development process is complete. Waterfall model does not allow phases to overlap hence reducing the rate of system development. Design errors are also captured before the development commences saving time during the implementation phase. Waterfall development methodology also emphasizes on technical documentation as a part of deliverables, this makes it easier for new programmers to easily understand the system during its maintenance phase.

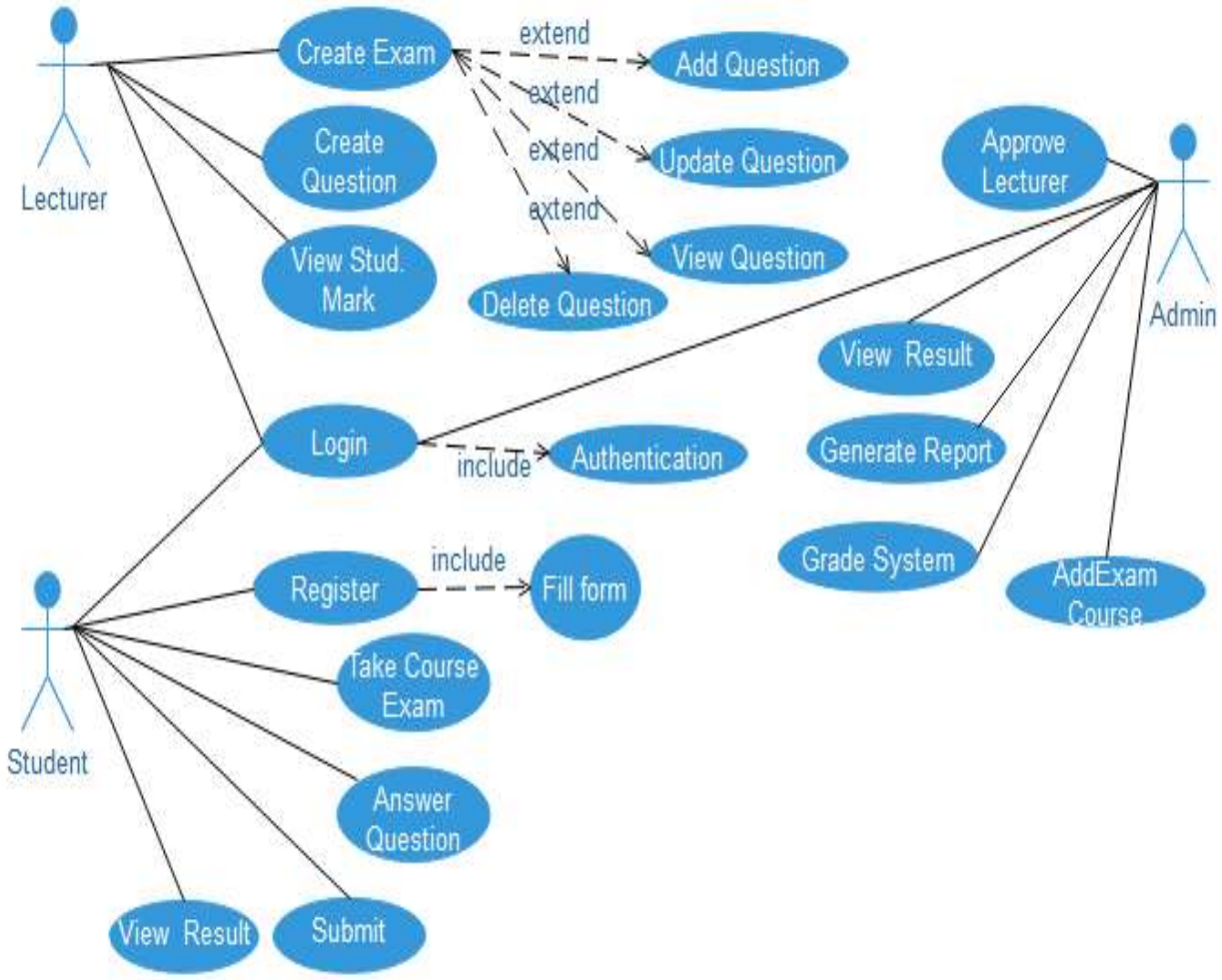
The methodology development approach is object oriented structured and it is easier to measure progress by reference to clearly defined deliverables. Total cost of a project can further be determined after the requirements are established. The methodology also makes testing easier as the testing can be done by referring to the functionalities defined in the functional specification.

Proposed Examination System

Examinations are part of daily academic programs administered by academics to test the understanding of students over modules taught to them. Administering examinations come with so many responsibilities in terms of time management, student management and deciding on the nature of exam to administer. The propose system is meant to solve all the mentioned problems. The system will allow for lectures to create courses, create questions, set the timing and date for a exam. Students on the other hand can be able to enroll for courses created by lecturers, take exams within allotted time and date and view their marks at the end of the exam. After the exam, the lecturer can be able to view student marks and print it for further processing.

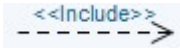
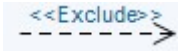
The proposed online examination system's design is based on a clear specification of system requirements, including detailed software components and their interdependencies. Unified Modeling Language (UML) is employed to illustrate the system's functional parts, which not only enhances the clarity of each component's role but also aids developers by simplifying the system's design and ensuring that it meets all required quality and functionality standards. This systematic approach provides a robust framework that aligns the architecture of the system with specific requirements, establishing a foundation for efficient development and implementation of a high-quality online examination system.

Use Case Diagram for the Proposed Cloud-Based Examination System: An Overview of User Interactions and System Functions

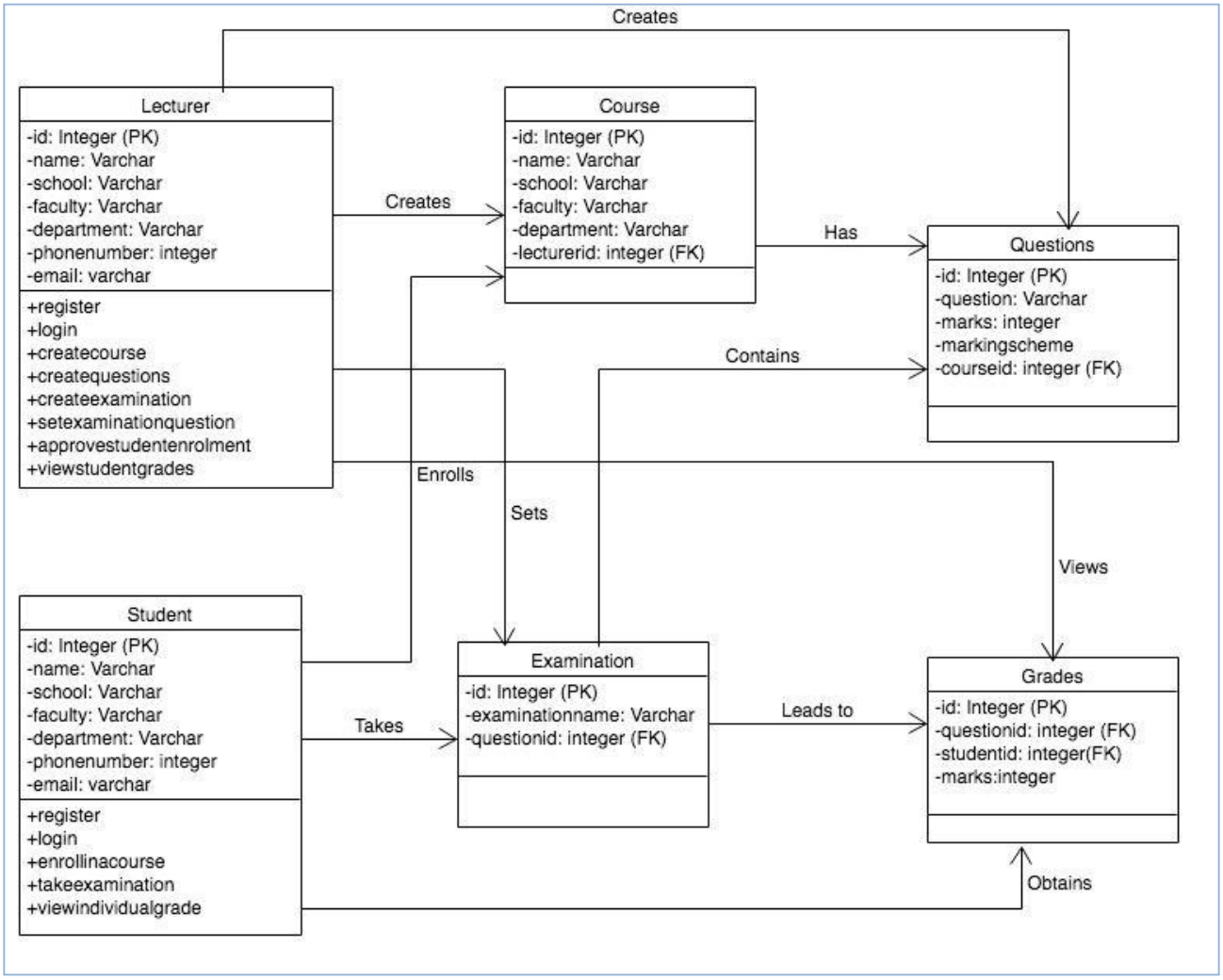


Use Case diagram of proposed system

Use case diagram description

Elements	Description
Actor 	Modeling users of the system. It can be human, other computer system or external device as shown in above Use Case diagram
	Unit of an externally visible operation.
	Identifying compulsory action within Use case
	identifying an alternative action within Use Case
	Identifying communication between actor and use case

Class diagram of proposed system



Class diagram description

Elements	Description
———	Indicate communication between classes.
———→	It shows generalization between classes.
+ and -	The sign are used for attribute and function, + sign indicated that they are public while – sign indicated that they are private.

Class diagram of proposed system

Conclusions and Recommendations

An important development in the educational field is the use of cloud computing technologies to address the issues with online exam systems. Using cloud-based exams in educational institutions has many advantages, such as better marking control, data access that is not dependent on location, more adaptability, scalable solutions, and software updates that happen automatically. These systems also have the ability to automatically generate markings and lower overall costs. Since well-formatted software generates results, the possibility of manipulation is reduced.

Moreover, cloud computing maximises processor usage and transactional capacity during concurrent exam durations, enabling resources to be scaled down when the exams are finished, hence optimising resource utilisation during examination processes. Strong security measures like encryption, access controls, and frequent security audits can be implemented by educational institutions to further improve both the integrity and security of examination processes.

However, recognizing potential obstacles to this shift, such as problems with internet connectivity and data privacy, is essential. Even while cloud-based platforms have many benefits, some hands-on learning courses could still need traditional paper-and-pencil tests to evaluate practical skills. Institutions must make investments in reliable facilities and set up thorough security procedures in order to fully benefit from cloud-based examination. They can significantly improve the effectiveness and safety of their examination procedures by doing this, which will eventually help teachers as well as students.

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