

# Enhanced Digital Examination Assessment System with Secured Access Using Cryptographic Techniques

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## Abstract

**Background:** The technology under investigation has digitalized the previously laborious process of manually grading laboratory tests, paving the way for more thorough assessments, reevaluations, and online compilations.

**Objectives:** On demand, the system will reevaluate your scripts, send you the results through mail, and notify you of your scores after they have been corrected. The ultimate goal is to remove human error from grading examinations by making it possible for corrections to be made on a computer in either online or offline modes.

**Methods:** By using cryptographic methods, sensitive information in the process is protected from being altered in any way. The method allows for streamlined archiving and retrieval of massive amounts of data.

**Statistical Analysis:** All the data collected during the procedure can be stored in a database for later use.

**Findings:** This streamlines the administrative work involved in grading examinations and enables professionals to correct many subjects simultaneously from different places. In this way, we can ensure that the students' grades are as accurate as possible.

**Applications and Improvements:** Hence, the system both maximises the efficiency of the human resources used and shortens the total duration of the examination administration and result analysis processes.

**Keywords:** Digital Examination, Automate, Cryptographic, Assessment.

## 1. Introduction

Using electronic devices like computers, tablets, and smartphones to administer exams, surveys, and other forms of evaluation is known as digital assessment (DA) or e-Assessment. It frequently makes use of supplementary technologies like the web and corporate intranets. The major objective is to provide rapid, simple, and valid item creation, test publication, test delivery, and relevant results reporting. Technology, especially cloud-based digital assessment platforms are what drive digital assessment's design, performance, and feedback [1–5].

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People have realised that there are better and more effective ways to do things, and this is why the pandemic has had such an impact. The field of education is undergoing significant transformation as a result of globalisation and digital technologies [18]. Technology allows for assessment to be integrated into the learning process and adjustments to be made as a result, making teaching and learning more learner-centric. In addition, with advancements in digital technology, classrooms can shift their emphasis from memorization to analysis and evaluation. Teachers are already using new methods in the classroom, and the evaluation process should mirror their efforts. Education will never be the same when the pandemic ends, but everyone will have to acknowledge DA's advantages. Let's take a close look at the benefits and drawbacks of DA [6] and [7].

Assessing student performance with the help of digital tools like computers and the Internet is known as "digital assessment. The term "digital assessment" refers to the use of electronic devices and software to collect and organise evidence of student performance [8].

The significance of online or screen-based assessments for students' learning results was much more apparent. Classes that took tests online or on screens typically outscored those who took paper exams by an average of 5% across a total of five evaluations given throughout the school year [10] [11].

## 2. System Design

### Existing Model

Conventional paper-based exam systems have been used as a yardstick to evaluate students' grasp of course material. It's been used as a yardstick to evaluate the student's grasp of the material. This paper-based examination requires considerable time and effort from humans to administer and grade, as well as presents challenges when it comes to the storage and maintenance of massive records [9]. There is a replacement for this paper-based test: online tests. The administration and protection of the data in such a system present difficulties. A new digital method of analysing answer scripts has been created to address these issues.

### Evolution of the digital paper exam grading system

Instructors in higher education spend a lot of time and effort marking written exams. Paper exams are still widely used in undergraduate education as a means of evaluating students' knowledge since they offer some benefits that may make them irreplaceable. Yet, grading, tallying, and recording paper-based tests takes a lot of time. It's also hard to keep track of them once they've been given back to the pupils. Electronic examinations are a viable alternative since they enable the automation of time-consuming processes such as grade entry, exam return, and so on [12].

It can be difficult to administer electronic tests without making sure every student has access to a safe computer. This means that paper tests will likely remain the norm for some time to come [13]. There are a number of benefits above the status quo that we present here. Even in smaller classes, the approach considerably cuts down on the time needed to oversee the marking (and re-grading) of exams, freeing up valuable time that can be put towards more instructive endeavours like lesson planning and TA supervision. In the same way that fast exam grading can help students learn more, it can also help teachers assess whether or not their pupils are grasping the concepts being tested. There is a time lag between when a student deliberates and attempts to answer an exam question and when they receive feedback on whether or not their attempt was correct due to the traditional practice of returning paper exams a week (or more) later.

Since the exam question and the student's response are still fresh in their minds, our technology returns the graded exam to the student in a substantially shorter amount of time—as little as 8 (eight!) hours, for example. In addition, many educational institutions mandate the simple archiving of examinations, particularly final exams, and this is made possible by the exams' electronic format. This is important since satisfying accrediting standards necessitates evaluating student performance on prior examinations [14] and [15].

The advantages of this method are applicable across a wide range of fields. In fact, two other branches of engineering are already making use of our prototype. The proposed approach can be used with any type of paper-based exam.

### Drawbacks

- There is no protection against paper tracing.
- Difficult to evaluate and predict security levels.
- Evaluations that support an online or offline basis were not present.
- Maintenance of student anonymity and the ability to view their papers anytime.
- Simultaneous grading of exam papers by multiple people from multiple locations.
- Ability to keep track of the enormous range of data.

### 3. Methodology

Creating safe and reliable electronic examinations is a significant difficulty for online education. Due to the importance of the examination process, several security methods must be implemented to maintain certain security qualities throughout the various phases of the test. In this study, we introduce an encrypted online system for managing tests and related data. To ensure the necessary level of security at each exam step, we propose a cryptographic system that must be implemented. Both students and instructors in an online classroom regularly access the World Wide Web to do things like see lectures, communicate with one another, and complete assignments. To achieve such settings in a virtual test model is challenging but necessary for ensuring exam accuracy under such conditions. In-person examinations provide tried-and-true methods of confirming student identity and authorship of tests (checking an identity card and ensuring no one helps the student during the exam). It has been noted that ensuring student identification and authorship in a virtual or remote exam is a challenging topic with a complex solution. Exams in person are still necessary for online schools. But for online schools, the real-life tests are a crucial part of the process. When compared to traditional universities, online-only institutions often lack resources [16–20].

Renting test halls means providing students with access to adequate physical amenities. Additionally, the complexity of exam administration increases due to the need to equip these external examination centres with all necessary management mechanisms to guarantee that students can take their exams where they prefer and that the results will be accurately collected and forwarded to the appropriate teachers for grading. Those are just some of the many reasons why online schools would greatly benefit from upgrading their exam management systems.

A master's thesis features a fully functional version of the secure online exam administration system described here. Java was chosen as the programming language for the system's development because of the flexibility it provides in terms of deployment design. Also, many of the necessary cryptographic APIs for our system may be found in the Java programming language. We've relied on the IAIK library because it provides not only a full implementation of the JCE Framework but also excellent documentation. The system's five primary parts are

the cryptographic scheme component, the XML file, the RMI server, the database, and the graphical user interface.

The current system has a paper-based exam with a 2" inch margin at the bottom as a footer with binary-coded information of exam details and student details. Scanned paper is uploaded, and grading is done per-question, with a provision for adding marks and also remarks. The grades of a student are calculated and stored in a database, and scores are notified to students. There is no facility for evaluation of programme codes.

## System Architecture

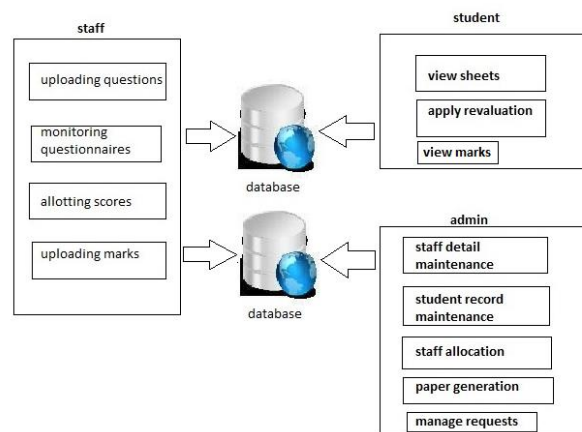


Figure 1. System Architecture

## 4. System Implementation

### Digital Evaluation

In one of our modules, we eliminate the traditional paper-based examination evaluation technique by digitalizing the process. Personnel assigned to correct a given batch of papers make judgements about the accuracy of the scanned answer scripts using either an online or offline system. When grading is complete, students are given access to their final grades after they have been entered into a database. This streamlines the procedure by cutting down on the time needed to carry exam papers.

### Online Compiler

The online compilation feature of this system is particularly useful for evaluating students' proficiency in Java and HTML. This saves the professors the trouble of manually checking each paper. It's important to eliminate bugs like this so that well-written software can get full credit for its efficient code, as this is what ultimately determines how effectively it performs. A student's performance is evaluated and graded based on their actual performance.

Setting frames in Swing allowed for the development of an online compiler, which allows for the entry of code on the left and the display of its parallel output on the right. Particularly, the pipe notion and the compiler tool are utilised to reroute the output from the command prompt to the same screen as the code being generated for it. When a new class file is made, a runtime compilation is performed.

## Advantages

Students' work on computer programming assignments can be graded based on the system's ability to compile their code online and analyse the results. With everything in place, we can guarantee optimal coding efficiency. Syntactic and semantic problems are identified, facilitating a quick grade-equating examination.

The digitalized version of answer scripts allows for a considerably speedier assessment procedure and delivers the scores with greater precision, and students may examine their assessed scripts in real time, so reevaluations are completed much more rapidly.

- The ability to store and maintain huge volumes of data is possible.
- Students can view their answer sheets whenever needed.
- Simultaneous evaluations (online or offline) are possible.
- It eliminates any type of malpractice, such as paper tracing.

## 5. Conclusion

A suggestion has been made to enhance the use of paper for grading. The entire examination procedure has been covered. The fresh information it provides has helped streamline the grading process and cut down on turnaround time. Thus, evaluation in a digitalized way with increased security and quick processing has been achieved. The implementation of an online compiler has also been demonstrated in order to facilitate the evaluation of laboratory-based examinations. Thus, the newly proposed enhancements have been viewed and demonstrated. Its user-friendliness means that students receive their scores quickly, and reviewing their scripts while the answers are still fresh in their minds improves their subject knowledge.

## 6. Future Enhancement

Android and iOS will be the next platforms to implement the proposed approach. This will allow the system to function as an app on tablets all over the world. The instructors can use a stylus to grade remotely, at their own convenience. The system's adaptability will increase as a result of this. Since it is based on an open-source platform, the system may be tailored to meet the specific requirements of any educational institution, and it can be used by any school that wants to implement it. Nevertheless, the licencing details are still being ironed out. Continuous attention will be paid to enhancing the system's portability and user friendliness. Since the system is built on an open-source platform and licencing is currently underway, it can be adapted to meet the specific requirements of any educational institution and used by any of its affiliated teachers and students.

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