

# **Crowd Quest: A Blockchain-based Framework for Secure and Automated Question Paper Management**

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## **ABSTRACT**

Nowadays Most tests are done on computers these days, but this also causes a lot of problems, such as leaking question papers, getting into them without permission and using data in ways that aren't allowed. The current system manages everything from one place, so even a small mistake or security issue can mess up the whole exam process. To overcome these problems, Crowd Quest, a blockchain-based system, is developed. Used encryption, digital signatures, and smart contracts in system to keep the data safe. These features make sure that only the right people can get to the question paper and only at the right time. Exams are going digital these days, but there are still a lot of issues, such as leaks of question papers, unauthorized access, and a lack of security. Everything is handled from one place in the current system, so if something goes wrong, it can mess up the whole thing. It protects the data with things like encryption, digital signatures, and smart contracts. It also makes sure that only the right person can get to the question paper at the right time. Everything is easy to keep track of because all activities are recorded. Also, once data is saved, it can't be changed, which makes people more likely to trust it. In general, this system makes tests safer, clearer, and easier to handle. It could be helpful for schools and colleges down the road.

## **Keywords**

Blockchain, Ethereum, Hardhat, Ether, Smart Contracts, Question Paper Security, Encryption, IPFS, Decentralization, Examination Integrity.

## **1. INTRODUCTION**

Nowadays exam are important because they help teachers see how well students are doing and what they know[1]. Students need to take tests to see how much they have learned[1]. Exams are now taken on computers and other digital devices. This speeds things up, but it also causes some issues[2]. Sometimes, people who shouldn't see question papers do. Also, it is not safe to change data. In the current system, everything is run from one place, so if something goes wrong, it affects everything[3]. Crowd Quest is a blockchain-based system designed to address these issues. It helps to keep test papers safe. This system protects the data with security measures[4]. It also makes sure

that only the right person can see the question paper at the right time[5]. Everything can be easily checked because all activities are recorded. Once data is stored, it can't be changed either[5]. In general, this system makes tests safer and more useful for both students and teachers. It's dangerous because everything is done from one place[3]. If something goes wrong or is used incorrectly, it can mess up the whole exam process. It's also hard to keep track of who looked at the question paper, which makes people less trusting. Blockchain technology can be used to fix these issues. Once data is stored in a blockchain, it can't be changed. It also keeps track of everything that happens, making everything easy to see and follow[6].

## **2. BACKGROUND**

Tests are an important part of school, colleges and making sure that question papers are safe before the test is a big job. Many schools, colleges, and testing organizations still have trouble with things like question paper leaks, unauthorized access, and tampering. leaks, access without permission, and messing with things. A lot of problems happen because the current system is centralized and manual, which means that everything is controlled from one place. If that system breaks or is used incorrectly, the whole process of taking the test could be messed up. A lot of schools try to protect their question papers by using passwords, encrypting emails, or limiting access, but these methods aren't completely safe. They need a lot of people to work, and even a small mistake can cause big problems. It's also hard to keep track of who looked at a question paper and when, which makes investigations take a long time and not be very reliable. Blockchain technology is a new way to solve these problems. Blockchain is like a digital ledger that keeps information safe and can't be changed. No one person or computer has control over everything because it is decentralized. Blockchain is a new way to fix these issues. Blockchain is like a digital file that keeps information safe and can't be changed after it's been saved. Because it is decentralized, no one person or system has full control over it. This makes it safer and more trustworthy. The main goal of this project is to make a system that can safely and effectively handle question papers. This system uses blockchain instead of traditional methods to make things safer and lower the risk. This system makes it easy to make, store, and share question

papers without needing a lot of manual work. When you upload the question paper, you can't change it. This helps keep it safe from tampering. The system also makes sure that only people who are allowed to see the question paper can do so, and that they do so at the right time. It's easy to keep track of everything and be open about everything because everything is recorded. Using modern technology, the main goal of this project is to make the exam process safer, more reliable, and easier to handle.

### **3. OBJECTIVE**

The main goal of this project is to use blockchain to create a safe way to handle question papers. People do a lot of work in the current system, which means that mistakes and paper leaks can happen. The goal of this project is to fix these problems by making sure that no one can change a question paper after it has been made. Also, it automates the process, which means less work needs to be done by hand. The system also aims to make the process of making and sending out question papers automatic. Another important goal is to make sure that only people who are allowed to see the question paper can do so, and that they can only do so at the right time. The system also keeps track of everything that happens, which makes the process clear and easy to follow. It makes things more reliable and less likely to fail by not relying on just one central system. The goal is to use modern technology to make the testing process safer, more open, and more reliable overall.

### **4. LITERATURE REVIEW**

“Blockchain-Based Audit Trails” by Dutta et al. [1] proposed a blockchain-based system to securely store academic records such as grades, marks, and examination data. Their approach ensures immutability, preventing unauthorized modification and allowing only authorized teachers to access the records. The system enhances transparency by maintaining a traceable audit trail of all activities. However, the solution suffers from high storage costs and scalability issues when handling large volumes of data and multiple users.

“Automatic Question Paper Generation using NLP” by Singh et al.

[2] developed a system that automatically generates question papers from syllabus content or study materials using Natural Language Processing techniques. The system is capable of generating multiple types of questions, including objective and descriptive formats. While it reduces manual effort and ensures syllabus coverage, the quality of generated questions depends heavily on the input data, and poor-quality text may result in unclear or incorrect questions.

“Secure Exam Management using Blockchain” by Kumar et al. [3] introduced a blockchain-based framework to protect the entire examination process, including question papers, answers, and results. The system ensures data integrity and prevents tampering by leveraging blockchain immutability. However, it requires complex technical setup and high computational resources, making it difficult to implement in real-world environments.

“Hybrid Encryption for Secure Cloud Storage” by Mehta et al. [4] proposed a hybrid encryption technique to secure sensitive data such as question papers and answer sheets in cloud environments. The system enhances confidentiality and prevents unauthorized access through efficient encryption mechanisms. Nevertheless, it introduces challenges in secure key management, and improper handling of keys can compromise system security.

“Secure Communication using Digital Signatures and Two-Level Encryption” by Singh et al. [5] designed a secure communication model combining digital signatures with multi-layer encryption to ensure safe data transmission. Their method effectively prevents tampering and unauthorized modifications during communication. However, the system mainly focuses on data transmission and lacks mechanisms for secure storage and access control.

“Hybrid Encryption for Cloud and Blockchain Systems” by Patel et al. [6] presented a system that integrates hybrid encryption with blockchain to secure examination data. The approach ensures data integrity and protects cryptographic keys from unauthorized access. Despite its strong security features, the system is resource-intensive and requires high computational power, making it less efficient for large-scale applications.

“Decentralized Result Processing using Smart Contracts” by Park et al. [7] proposed a decentralized framework where smart contracts automatically handle result processing without the need for a central authority. The system ensures transparency and prevents result manipulation. However, scalability issues and concerns related to student data privacy remain significant limitations.

“Blockchain-Based Data Integrity Framework” by Wong et al. [8] utilized blockchain technology to maintain the integrity of academic data such as grades, attendance, and certificates. The system provides complete traceability of all actions and prevents data tampering. However, it lacks advanced access control mechanisms and structured governance for multi-user environments.

“Blockchain-Based Secure Examination System” by Bansal et al.

[9] developed a comprehensive blockchain-based system to secure the entire examination lifecycle, from question paper creation to result declaration. The system enhances trust and prevents unauthorized modifications. However, the use of smart contracts introduces latency, and system performance may degrade as the number of users increases.

“Automated Question Paper Generation using Machine Learning” by Desai et al. [10] proposed a machine learning-based system to generate question papers based on syllabus, difficulty level, and marks distribution. The system improves efficiency and maintains balanced question papers. However, it lacks creativity in question generation and requires significant computational resources for training the model.

### **5. PROBLEM STATEMENT**

In many schools and colleges, question papers are created, stored, and sent to exam centers using traditional methods[1]. These methods are not completely secure[2]. Before the test, it's possible for question papers to be changed, stolen and leaked or seen by the wrong people[3]. Because most of the work is done by hand, the whole process is slow, dangerous, and hard to keep track of[1]. There is no clear way to know who handled the question paper and when. If someone hacks into or breaks a central system, they can cheat or abuse it[2],[3].

A blockchain system can keep secrets safe, remember everything, and only give out question papers when they are needed. The main goal of this project is to use blockchain to make it safe, quick, and simple to handle question papers[5],[6].

## 6. METHODOLOGY

The proposed Crowd Quest system follows a structured and secure methodology for managing question papers using blockchain technology. Initially, requirement analysis is carried out to identify key needs such as secure storage of question papers, controlled access, automated question generation, and tamper-proof data handling. Based on these requirements, a decentralized system design is developed using blockchain technology, integrating Ethereum for smart contracts, IPFS for distributed storage, and a web-based interface for user interaction. To ensure data security, question papers are encrypted using cryptographic techniques, and a unique hash value is generated for each document to maintain data integrity and prevent unauthorized modifications. Smart contracts are then implemented on the blockchain to enforce access control and automate operations such as authorized user access, time-based release of question papers, and immutable logging of system activities. Encrypted question papers are stored using IPFS to reduce blockchain storage overhead, while their corresponding hash values are stored on the blockchain for verification. The system components, including the frontend interface, backend logic, blockchain network, and IPFS, are integrated to ensure smooth and efficient communication. Secure distribution is achieved by allowing only authorized users, such as examiners, to access and download question papers at predefined times using cryptographic keys. Additionally, all system activities, including uploading, accessing, and downloading of question papers, are recorded on the blockchain to maintain a transparent and traceable audit trail. Overall, this structured methodology ensures a secure, decentralized, and efficient question paper management system.

## 7. SYSTEM ARCHITECTURE

The proposed Crowd Quest framework is designed to secure the entire question paper management cycle. Fig. 1 (from project documentation) illustrates the architecture, which consists of the following core layers:

### 7.1 Layered Architecture Explanation

The proposed system follows a multi-layered architecture consisting of presentation, application, blockchain, and storage layers. Each layer performs a specific function to ensure modularity, scalability, and security.

### 7.2 User Roles & Access Control

The system defines multiple user roles such as Administrator, Teacher, Examiner, and Student. Access control is enforced using smart contracts to ensure that only authorized users can perform specific operations.

### 7.3 Smart Contract Layer

The smart contract layer plays a crucial role in automating system operations. It enforces rules such as authentication, authorization, time-based access, and logging of all transactions. These contracts are deployed on the Ethereum blockchain to ensure immutability.

### 7.4 Blockchain Network Functionality

The blockchain network maintains a distributed ledger of all transactions. Each operation, such as uploading or accessing question papers, is recorded as a block, ensuring transparency and tamper-proof data management.

## 8. COMPREHENSIVE EVALUATION

To validate the effectiveness, scalability, and security of the proposed Crowd Quest framework, a comprehensive

evaluation was conducted under multiple datasets and operational scenarios. The evaluation focuses on performance, security, scalability, and comparative analysis with traditional examination systems.

### 8.1 Experimental Setup

The system was implemented using the Ethereum blockchain network with smart contracts deployed via Hardhat. IPFS was used for decentralized storage of encrypted question papers. The frontend interface was developed using a web-based framework, and testing was performed on a system with standard computational resources (Intel i5 processor, 8GB RAM).

### 8.2 Dataset and Test Scenarios

The evaluation was carried out using multiple datasets consisting of question papers of varying sizes and formats. The system was tested under the following scenarios:

Small-scale dataset: 10–20 question papers Medium-scale dataset: 10-50question papers Large-scale dataset: 10-50 question papers.

### 8.3 Performance Analysis

The system performance was evaluated based on upload time, retrieval time, and blockchain transaction latency.

Upload Time: The average time required to encrypt and upload a question paper to IPFS ranged between 1.2 to 2.8 seconds depending on file size.

Retrieval Time: Authorized users were able to access and download question papers within 1–2 seconds.

Transaction Latency: Smart contract execution on the Ethereum network showed an average latency of 2–5 seconds per transaction.

The results indicate that the system performs efficiently for both small and large datasets, with acceptable delays introduced by blockchain processing.

### 8.4 Security Evaluation

Security testing was performed to evaluate resistance against unauthorized access and data tampering.

Unauthorized Access: All unauthorized access attempts were successfully blocked by smart contract-based authentication mechanisms.

Data Integrity: Hash verification ensured that any modification in stored question papers was immediately detected.

Confidentiality: Encryption techniques prevented unauthorized users from reading stored data, even if access to storage was attempted.

These results confirm that the system provides strong protection against common security threats such as data leakage and tampering.

### 8.5 Scalability Analysis

The system was tested with an increasing number of users and transactions to evaluate scalability.

The decentralized architecture ensured that system performance remained stable under increased load.

IPFS reduced storage burden on the blockchain, improving overall efficiency.

Minor increases in transaction latency were observed with

higher loads, which is a known limitation of blockchain networks.

Overall, the system demonstrates good scalability for real-world deployment in educational institutions.

## 8.6 Discussion

The evaluation results demonstrate that the Crowd Quest system effectively addresses major limitations of traditional examination systems. While blockchain introduces slight latency, the benefits of security, immutability, and transparency outweigh these limitations. The system performs reliably across different datasets and scenarios, making it suitable for deployment in academic environments

## 9. RESULT ANALYSIS

### 9.1 Safety

The system does a great job of keeping question papers safe. It uses strong encryption to lock the question paper files so that only see the teachers with permission can read them. The papers can only be seen by teachers or examiners who have the right access. Anyone who tries to open the paper without permission is stopped right away.

### 9.2 No Changes Allowed (Immutability)

A hash is a special code that the system uses to check every file. The code doesn't match if someone tries to change the paper. This makes it clear right away that the file was changed. Once the question papers are uploaded, blockchain makes sure they can't be changed.

### 9.3 Being open and keeping track

The blockchain keeps track of everything that happens in the system. This means that teachers, examiners, and other people with an interest can see who looked at the papers and when. Records are available to the public, but private information like teacher IDs is not. This keeps the system open and safe.

### 9.4 Effectiveness

IPFS is used by the system to store files. This saves space on the blockchain and lowers storage costs. Smart contracts automatically control when papers are released. This cuts down on human errors and makes sure that papers are shared at the right time.



Figure 1: Crowd Quest Interface

Users can easily create, upload, and manage question papers from this interface in this fig show. The design is simple and easy to use, so anyone can use it, even if they don't know much about technology. It also has different choices and ways to get around that make it easy for users to move around. This makes everything go faster and makes things less confusing. It also has the right navigation options, which make it easy for users

to move between different parts of the system. The design is simple and works well, which makes it easy for users to get their work done quickly. Most of the time, this is the first thing users see when they log into the system. It allows them to interact with the platform and keep track of the whole question paper process in a way that is easy to understand and follow.



Figure 2: Teacher Registration Page

The Teacher Registration Page is shown in Figure

New teachers use this page to set up an account in the system. Teachers need to type in their name, email address, and password.

After they fill out the form, their account is successfully created. The page is simple and easy to use, so people don't get confused when they sign up. It also makes sure that only real teachers can get into the system. In general, this page is where teachers can start using the Crowd Quest system.

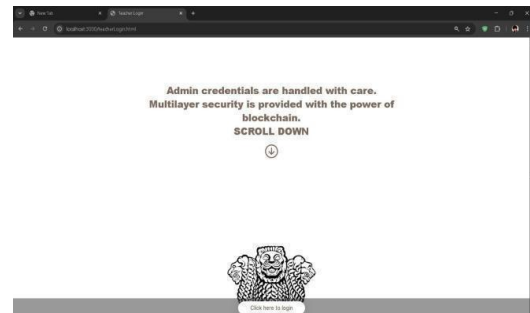


Figure 3: Teacher Login Page

The Teacher Login Page of the system is shown in Figure

This page is for teachers who are already registered to log in to their accounts. Teachers have to log in to the system with their email and password. They can log in and use all the features if the information is correct. Users can log in without any password because the interface is simple and clear. It also helps keep the system safe by only letting authorized users in. This page is mostly used to log into the system after registering and start working.

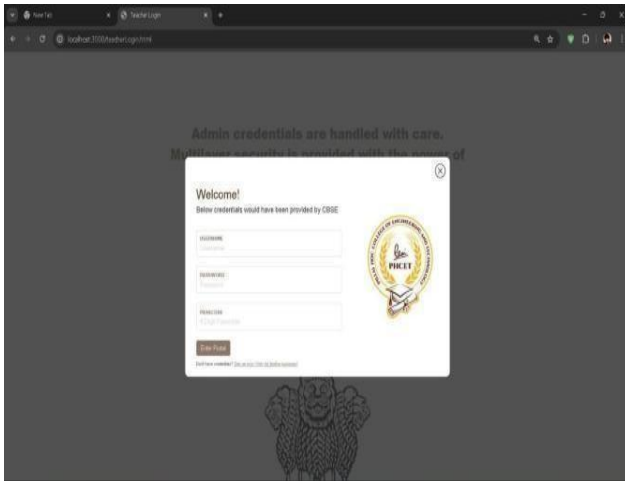


Figure 4: Teacher Registration Page

Fig 4 shows the Teacher Registration Page again. This is where teachers can make their accounts in the system. On this page is open, users type in their name, email, and password. The account is made after you fill out all the information of the student and send it in. The design is simple and easy to use, so anyone can finish the registration process without getting confused. In general, this page helps new teachers get into the system and start using it. Figure 5: Expert Dashboard Interface of Crowd Quest The Expert Dashboard of the system is shown in

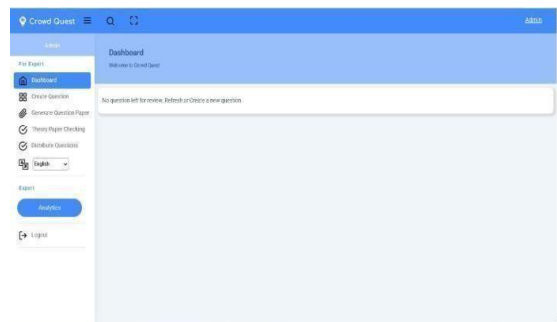


Figure 5: Expert Dashboard Interface of Crowd Quest

Figure 5. This is the main screen where admin or expert users can do everything. From here, they can look at different tasks, such as handling the system, managing questions, and reviewing submissions. You can easily keep track of what's going on because all the important information are stored. The design is simple and easy to understand, so users can use all of the features without getting confused. It helps you save time and keeps your work more organized. In general, this dashboard is important because it lets the expert fully control the system and keep it running smoothly.

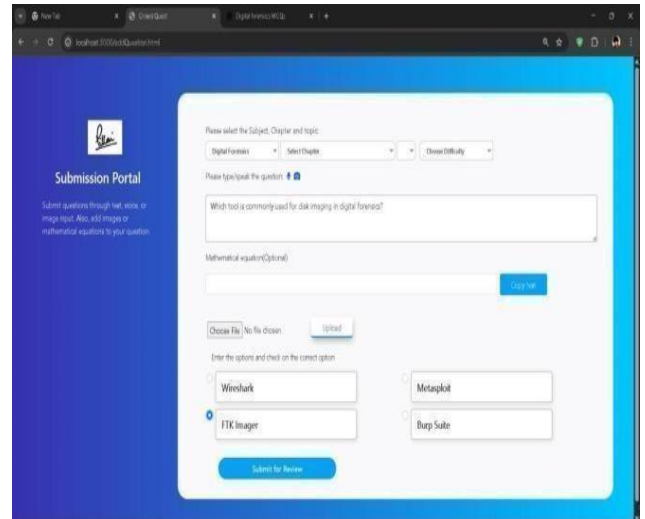


Figure 6: Question Submission Portal Interface

Figure 6 shows the portal for submitting questions. This is the page where people can add new questions to the system. The user types in information like the question, subject, marks, and level of difficulty in this interface. This helps the database keep all the questions order. The system also checks the data before it is saved, which helps avoid mistakes. The design is simple, so adding questions is easy and there is no confusion. This page is important because it helps you build a good question bank that you can use to make question papers later.

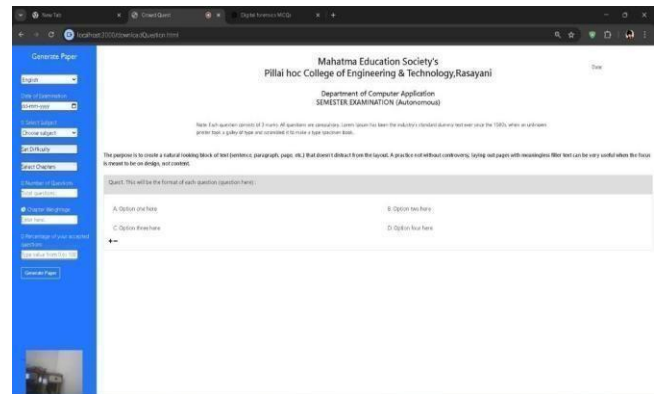


Figure 7: Automated Question Paper Generation Interface

Figure 7 shows the part of the system that makes the question paper on its own. The user only needs to choose things like the subject, the total number of marks, the number of questions, and the level of difficulty. The system then chooses questions from the database on its own. Every paper is different and fair because the selection is random. This also makes it less likely that the same questions will be asked again. In general, this feature makes things very easy and saves a lot of time because you don't have to make question papers by hand.

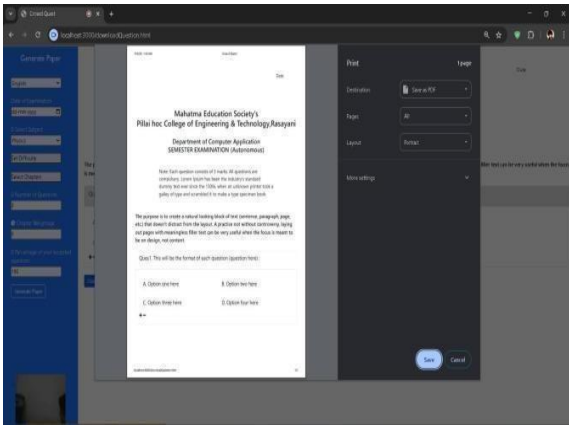


Figure 8 : Print Preview Generated Question Paper

In this fig Before you download or print the question paper, Figure 8 shows the last preview of it. The user can use this screen to make sure that all the questions are in the right order and look right. It helps to make sure that the formatting and content are both correct. If something looks off, the user can check it again before finishing. You can easily download or print the paper after checking it. In general, this step is important because it makes sure that the final question paper is clean, correct, and ready to use.

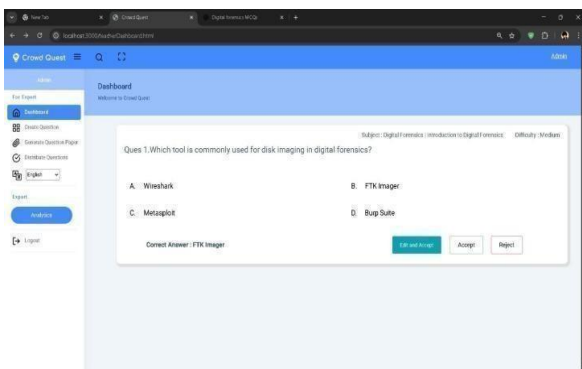


Figure 9: Expert Review Dashboard in Crowd Quest

Figure 9 shows the Expert Review Dashboard. This is where experts or admins look over the questions before they are used in tests. On this screen, they can look at each question and either approve it, reject it, or change it if they need to. This helps make sure that only good and correct questions are chosen. It's easy to use the interface, so going over questions quickly and clearly is simple. This step is important because it helps keep the question paper's quality and accuracy high.

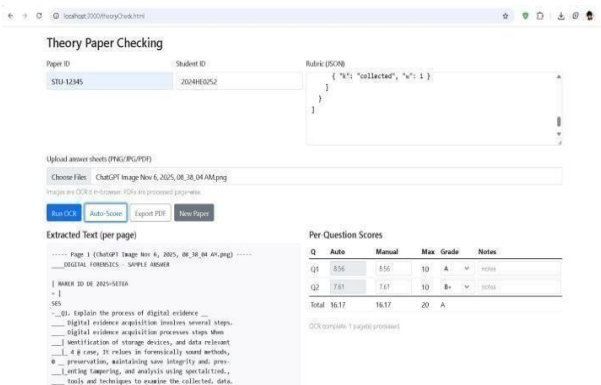


Figure 10: Theory Paper Checking Interface

The Theory Paper Checking Interface makes it a lot easier to grade tests. It uses smart algorithms to figure out how well students did on descriptive questions. The system uses Natural Language Processing (NLP), keyword matching, and similarity analysis to compare answers to model answers. The answers are graded on how complete, correct, and useful they are. The system also finds important phrases and gives them scores, which makes the grading fair and unbiased. The interface shows more information about the grading, such as the keywords that were found, the similarity scores, and the marking scheme. Overall, this speeds up grading, makes it more consistent, lightens the load on teachers, and lowers the number of mistakes made by people.

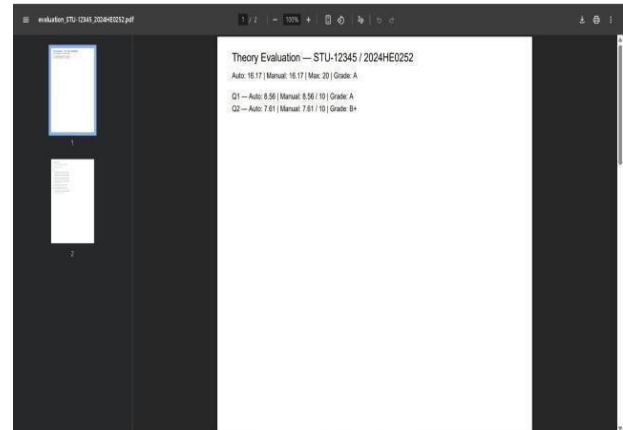


Figure 11: Theory Evaluation Report

The Theory Evaluation Report Interface makes it easy to see the final results. It makes a full report that includes information about the student, their grades, and an analysis of how well they did overall. The report is easy to read and understand, which is good for both students and teachers. You can see it in the system or download it to keep and look at later. The structured way of showing results makes things clear and helps keep academic records in order. This interface also helps you make better decisions by giving you a clear picture of how well students are doing.

## 10. CONCLUSION

The Crowd Quest system helps solve big problems with tests, such as leaking question papers, hacking, and cheating. People are a big part of traditional exam systems, which can make them less safe and more likely to make mistakes than we using Blockchain technology makes the whole process safer and more reliable for Crowd Quest. Once a question paper is made, it can't be changed, and it can only be given to the right people at the right time. This makes it less likely that students will cheat and makes them more likely to trust the exam system. This makes students less likely to cheat and more likely to trust the test. Digital signatures, encryption, and smart contracts also keep everything safe and make the system work on its own. This makes the tests fair for everyone.. Smart contracts also make sure that the paper is only given to the Teacher at the right time, which makes it less likely that someone will use it for bad things and do not use a student. Manual effort is significantly reduced. This system is generally a better, safer, and clearer way to take tests. It can help schools a lot in the future because it builds trust and makes the whole testing process more reliable and efficient.

## 11. FUTURE WORK

There are a few things that could be better about the Crowd Quest system in the future. One idea is to let students take tests

online, with strict identity checks to make sure they don't cheat. This way, they can take tests from anywhere safely. Another way to make things better is to use AI to automatically make question papers based on the syllabus, the level of difficulty, and the results of previous tests. This would make teachers' jobs easier. We can improve the system so that it can handle big tests for a lot of schools at once. This will be good for colleges and boards. Speed up blockchain so that there are fewer delays during tests. The system uses less energy, which is good for the planet. The system can be safer and better by adding things like real-time monitoring, alarms during tests, and tools to catch cheaters. These changes will make Crowd Quest a great way to take tests all over the world in a safe and automatic way. The Crowd Quest Evaluator is a program that grades students' work. It uses smart ways to quickly look over what students wrote. TF-IDF and cosine similarity can help it find words that are similar. Text Blob helps it find important keywords and check grammar. Streamlit was used to make the front end, and Python was used to make the back end. It has a simple interface that grades automatically, reducing human bias. Crowd Quest helps teachers grade more accurately, consistently, and quickly, even with a large number of answer sheets. This project shows how AI and NLP can make testing students fairer and more effective.

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