A

PROJECT REPORT

ON

"SMART CONTRACT ENABLED ONLINE EXAMINATION SYSTEM BASED ON BLOCKCHAIN NETWORK "

SUBMITTED TO
SAVITRIBAI PHULE PUNE UNIVERSITY
IN FULFILLMENT OF THE REQUIREMENTS
FOR THE AWARD OF DEGREE
BACHELOR OF ENGINEERING
(INFORMATION TECHNOLOGY)

BY

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Under the Guidance of
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PUNE VIDYARTHI GRIHA's COLLEGE OF ENGINEERING AND SHRIKRUSHNA S. DHAMANKAR INSTITUTE OF MANAGEMENT, NASHIK

2023-2024

CERTIFICATE

This is certify that the project entitled

"SMART CONTRACT ENABLED ONLINE EXAMINATION SYSTEM BASED ON BLOCKCHAIN NETWORK "

SUBMITTED BY

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Certificate of other student of this institute and the work has been carried out by under the supervision of **Prof.A.S.PINGLE** and it is approved for the partial fulfillment of the requirement of Savitribai Phule Pune University, for the award of the degree of **Bachelor of Engineering** (Information Technology).

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_____
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Place : Nashik

Date : 28-05-2024

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Mr.Jadhav Vivek
Mr.Pawar Anurag
Mr.Sabale Sainath
Mr.Vaidya Bhaskar

ABSTRACT

Data is one of the most essential assets in the world today. All users desire Blockchain to protect their data from the outside world. Blockchain is a well-known technology that offers data security and loyalty. Initially, blockchain was used for cryptocurrencies, and the public distributed ledger contained all of the data. Data may be exchanged and received via the network securely and effectively thanks to decentralised platforms created by blockchain technology. The most successful industries in the world, like Walmart, IBM, Google, and others, are implementing blockchain technology to create decentralized applications (DApps). The intelligent systems that are implemented on a distributed computer network are known as "decentralized applications. Smart Contracts, one of the most secure applications, are made possible by blockchain. Smart Contracts are the computerized, secure distributed ledgers that permit transactions that are safe, open, and unchangeable. Hashing is used by smart contracts to create and validate data. It is a mathematical process that employs SHA-256, the strongest cryptographic hash algorithm. For the input text, a 256-bit signature is produced. Ethereum A popular platform for developing DApps is the blockchain. Every industry, including marketing, business, education, and supply chain management, has adopted blockchain technology. With the help of the blockchain and Ethereum platform, we have created an application for the online examination system that includes smart contract capabilities that enable server runtime environments with NodeJS and the MongoDB database system. The security of a blockchain-based system surpasses that of any cloud-based system. Additionally, we have examined why blockchain-based online examination is more reliable than other systems.

Keyword : Blockchain , NodeJS , SHA-256 , Ethereum.

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Chapter 1

INTRODUCTION

In today everything is accessed through the Internet, so anyone can do so from any location. It brings up fresh issues like data security, openness, and confidence in the global network. The exam is being administered online by a number of academic institutions and independent organisations, including the National Testing Agency (NTA), and it can be taken anywhere in the world. COVID-19 will likely be widely used in the near future. The main limitations of such online testing methods are trust and security. Private network lockers, passwords, one-time passwords (OTPs), and strong security passwords are among the services provided by a number of global market companies. Security of information is one of the keys. difficulties with current solutions brought on by third parties. With blockchain, a new technology that kickstarts the privatisation revolution, users always have access to their data. Blockchain doesn't involve any outside parties. network for processing the services and facilitating access. Data blocks are used to store and manage data in blockchain networks. Blockchain protects the integrity of its data by cryptographically validating each data block each data. The blockchain network's blocks are connected by cryptographic hash codes. Each data block has a distinct hash code that is produced by using the potent cryptographic method SHA-256. These hash codes are verified by validators, who apply various consensus mechanisms to provide each data block with a valid signature code. It serves as evidence that the work was produced independently of a third-party system. The use of blockchain is widespread, with applications in industries like business, medicine, supply chains, and education. In this article, we conducted a reliable examination using the blockchain education system. We provide an online examination system that supports blockchain in this study. Candidates register for the exam through this application, and they also pay

the exam price. It ensures that only people who have provided proof of identity may take part in the test. They log in and insert the transaction hash to begin the examination in the second process. The entire exam's data is sent directly and securely via a smart contract on the blockchain network to the testing facility after it is finished. Four sections make up the remainder of the review.

1.1 MOTIVATION

- In 2010 onwards, the involvement of clouds in the education system totally redefined the examination system.
- There are lots of courses and examinations being started to happen in this system.
- The cloud-based system is the best to access the data and information at any time and at any place. These systems are widely adopted by many educational organizations.
- But there are lots of challenges that are generated, like connectivity, the security of data, and the authentication of a candidate.
- The connectivity issues always create failure if transactions, exchange of data through the network, and many others more.
- One of the biggest challenges is the security of data. Know there are lots of hackers present on the network, steals the data, for which we use the firewalls for security Reasons, but this is not enough.
- Due to the many Firewalls and anti-virus systems increase costs. And expenditure.

1.2 PROBLEM DEFINITION

Smart contract enabled online examination system based on blockchain network is a system where, we're attempting to create a cost-effective online exam system by integrating blockchain technology into an already-existing system, which will improve the security of administering such exams.

1.3 GOALS AND OBJECTIVE

- To conduct a secure and smooth online examination.
- To shift the cloud-based examination system to blockchain for better security.
- To make the online examination system cost-efficient and easy to maintain.

1.4 MAJOR CONSTRAINTS

- Constant internet connection.
- Building costs are high.

Chapter 2

LITERATURE SURVEY

2.1 Literature Review

A Blockchain-Based Smart Contract Towards Developing Secured University Examination System

Author: Ashis Kumar Samanta , Bidyut Biman Sarkar, Nabendu Chaki

The emergence of online examination systems has brought many advantages to the education sector, including convenience, flexibility, and cost-effectiveness. However, these systems face various security threats, including hacking, impersonation, and cheating. Blockchain technology can offer a potential solution to these challenges by providing a transparent, decentralized, and tamper-proof platform for conducting online exams. This research paper proposes a blockchain-based smart contract solution for developing a secured university examination system. The proposed system utilizes the Ethereum blockchain and smart contracts to provide a decentralized and transparent platform for conducting exams. The system's design and implementation are discussed in detail, along with an analysis of its performance and security features. The use of blockchain technology ensures data immutability, transparency, and decentralization, providing a reliable platform for conducting exams. The research paper evaluates the proposed system's performance and security features, including scalability, data privacy, and resistance to hacking and cheating. The analysis shows that the proposed system can provide a secure and reliable platform for conducting university exams.[1]

An advanced and secure framework for conducting online examinations using the blockchain method

Author: Md Rahat Ibne Sattar, Taiyaba Shadaka Rafa, Tusar Das a, Md Sharif Samad, Md Thowhid Bin Hossain Efty

Online examination systems have become increasingly popular due to their numerous benefits, such as convenience, flexibility, and cost-effectiveness. However, these systems face significant security threats, including cheating, hacking, and impersonation. Blockchain technology can provide a potential solution to these challenges by providing a transparent, decentralized, and tamper-proof platform for conducting online exams. This research paper proposes an advanced and secure framework for conducting online examinations using the blockchain method. The proposed system utilizes the Ethereum blockchain and smart contracts to provide a secure and reliable platform for conducting online exams. The system's design and implementation are discussed in detail, along with an evaluation of its performance and security features. The proposed framework can be applied to various educational contexts, including schools, universities, and professional certification exams. It offers a practical and innovative solution to the challenges posed by online examination systems, ensuring the integrity and security of the examination process. Overall, this research paper provides a valuable contribution to the ongoing efforts to develop more reliable and secure online examination systems. The proposed advanced and secure framework utilizing blockchain technology offers a promising approach to addressing the security challenges posed by online examination systems. It can be of significant interest to educators, policymakers, and researchers in the field of education and technology.[2]

BSSSQS: A Blockchain-Based Smart and Secured Scheme for Question Sharing in the Smart Education System

Author: Anik Islam, .Md.Fazlul Kader, Soo Young Shin

In recent years, smart education systems have become increasingly popular due to their ability to provide flexible, convenient, and efficient learning experiences. However, these systems face various challenges, including the secure sharing of educational resources, such as questions and quizzes. Blockchain technology can provide a potential solution to these challenges by providing a transparent, decentralized, and tamper-proof platform for sharing educational resources. This research paper proposes a blockchain-based smart and secured scheme, called BSSSQS, for question sharing in the smart education system. The proposed scheme utilizes the Ethereum blockchain and smart contracts to provide a secure and efficient platform for sharing questions among educators and students. The system's design and implementation are discussed in detail, along with an analysis of its performance and security features. The proposed scheme offers several advantages over traditional question-sharing systems, including increased transparency, decentralization, and data immutability. The use of smart contracts automates the question-sharing process, ensuring the reliability and efficiency of the system. The research paper evaluates the proposed scheme's performance and security features, including scalability, data privacy, and resistance to hacking and cheating. Overall, this research paper provides a valuable contribution to the ongoing efforts to develop more reliable and secure smart education systems. The proposed blockchain-based smart and secured scheme for question sharing offers a promising approach to addressing the security challenges posed by smart education systems. It can be of significant interest to educators, policymakers, and researchers in the field of education and technology.[3]

An Innovative and Secure Platform for Leveraging the Blockchain Approach for Online Exams

Author: Albert Manawar

Online exams have become increasingly popular in recent years, offering benefits such as flexibility, convenience, and cost-effectiveness. However, these exams face significant security challenges, including cheating, hacking, and impersonation. Blockchain technology provides a potential solution to these challenges by offering a transparent, decentralized, and tamper-proof platform for conducting online exams. This research paper proposes an innovative and secure platform for leveraging the blockchain approach for online exams. The proposed platform utilizes the Ethereum blockchain and smart contracts to provide a secure and reliable platform for conducting online exams. The paper presents the design and implementation of the platform, as well as an evaluation of its performance and security features. The proposed platform offers several advantages over traditional online exam systems, including increased transparency, decentralization, and data immutability. The use of smart contracts automates the exam process, ensuring a secure and efficient system. The paper discusses the platform's scalability, data privacy, and resistance to hacking and cheating. Overall, this research paper provides a valuable contribution to the ongoing efforts to develop more reliable and secure online exam systems. The proposed innovative and secure platform utilizing blockchain technology offers a promising approach to addressing the security challenges posed by online exams. It can be of significant interest to educators, policymakers, and researchers in the field of education and technology.[4]

Chapter 3

SOFTWARE REQUIREMENT SPECIFICATION

3.1 Introduction

This section deals with an overview of smart contract applications, adoption, and usage in educational enterprises. Furthermore, we provide a basic introduction to application-building tools in blockchain technologies such as smart contracts, Node.JS, MongoDB, Ethereum, Solidity, Meta Mask, etc., used to design the transaction system. In this system, we will work on platforms related to blockchain and web application-related software.

3.1.1 Project Scope

1. Developing a user-friendly online examination system integrated with smart contracts and blockchain technology.

2. Automating exam processes such as exam creation, participant enrolment, answer submission, and result calculation through smart contracts.

3. Enhancing transparency, security, and efficiency in the examination process while providing immediate result notifications and comprehensive reporting.

3.2 FUNCTIONAL REQUIREMENTS

These are the specifications that the system must meet in order to satisfy the end user's basic needs. As a requirement of the contract, all of these functionalities must be built into the system. These are shown or described as the input to

be provided to the system, the operation carried out, and the intended outcome. In contrast to non-functional needs, they are essentially the user-stated criteria that are visible in the finished product.

In our project, the different system features required under the functional requirements are:

3.2.1 Ease for use

Easy to adapt with the system architecture and user interface.

3.2.2 Accurate results

In system Blockchain is used as a tamper proof storage for unchanged, accurate results.

3.3 EXTERNAL INTERFACE REQUIREMENTS

3.3.1 User Interfaces

For user interaction, users will spend most of the time in the learning interface while using the platform. The model will be deployed using a website which will handle user interactions and results.

3.3.2 Hardware Interfaces

RAM – 8GB or higher
Hard Disk – Minimum 40 GB HDD/SSD
Processor – Intel i3 8th Generation or Equivalent (Better Efficiency if Higher)
32-bit System

3.4 NON-FUNCTIONAL REQUIREMENTS

The limitations or requirements placed on the system are known as non-functional requirements. They outline the software's quality feature. Scalability, maintainability, performance, portability, security, dependability, and many more challenges are covered by non-functional requirements. Non-functional requirements focus on critical quality issues for software systems. If NFRs are not adequately addressed.

3.4.1 Performance Requirements :

Performance requirements specify how effectively a software system completes a task under particular circumstances. Performance of the system depends on following:

1. Scalability

Scalability refers to the system's capacity to handle an increase in workload.

2. Workload

Workload is simply defined as the system should be able to handle uneven traffic at unexpected time. Let's consider that our requirement is to handle the visitors with a handsome response time, whether the website traffic is less or high. This will be considered as a workload requirement and in general, it can be referred to as a performance requirement.

3. Platform

The system must be housed on a platform, which includes the underlying hardware and software.

3.4.2 Software Quality Attributes :

The following variables are used to gauge the quality of software development. The performance of a product can be evaluated using each attribute. Both Quality control and Quality assurance can make use of these characteristics.

1. Reliability

Check to see if the product is durable enough to withstand any situation. should dependably produce the right results. Product dependability is evaluated based on how well a project performs in various working environments and conditions.

2. Maintainability

The product's various iterations should be simple to maintain. It should be simple to add code to an existing system and to upgrade for new features and technologies as they become available.

3. Usability

The degree of usability is used to gauge this. The software should be simple to use. It ought to be simple to learn. It should be easy to navigate. Since the ultimate outcome of our project will have a basic interactiv

4. Portability

If the project or system is portable that is it can be used on other devices too. Since our project will deployed on a website it will be easily accessible through any portable devices like mobile phones soon.

5. Correctness

In terms of functionality, internal computations, and navigation, the application should be correct. This proves that the program complies with all necessary functional requirements.

6. Reusability

Reusing existing software is an excellent time and money-saving development strategy. Classes from various code libraries are sufficiently general to be used in various application modules with ease. In our case the predefined libraries used were created utilising reusable functions for efficiency.

3.5 SOFTWARE REQUIREMENTS

3.5.1 PHP

PHP, an acronym for "Hypertext Preprocessor," is a server-side scripting language specifically designed for web development. Created in 1995, PHP has undergone significant enhancements and has become a robust and versatile tool for building dynamic and interactive websites. One of PHP's notable strengths lies in its simplicity and straightforward syntax. Drawing inspiration from C and Java, PHP offers developers a familiar programming paradigm. Its seamless integration with HTML allows for effortless embedding of PHP code within web pages, enabling dynamic content generation. Moreover, PHP boasts extensive support for various databases, including MySQL, Oracle, and PostgreSQL, making it an excellent choice for developing database-driven applications. PHP's feature-rich nature is primarily attributed to its extensive set of built-in functions and libraries.

3.5.2 MongoDB (NoSQL)

MongoDB is a NoSQL database system that is specially designed for Server-Side applications. MongoDB is a database program that uses JSON format structured data with high schema logic. In MongoDB, all the data and information are stored in any procedure, avoiding data formats like field type and data structures, etc. In our application, all the login and registration data are stored in MongoDB, which is under the control of the organizer of the examination. MongoDB doesn't require any logic or SQL queries to handle and fetch data.

3.5.3 MySQL

MySQL is a popular open-source relational database management system. It is widely used in web development for storing structured data, such as user data, login credentials, and other application data. MySQL is known for its ease of use, reliability, and scalability, making it an ideal choice for storing user data in an online examination system.

3.5.4 Blockchain

A blockchain is a distributed ledger technology that contains all the data in a distributed ledger. These data are stored in blocks that are linked with a unique hash. Each block refers to the prior block and is collected in a chain in this manner so that a chain is formed, called the Blockchain. Blockchain is the fastest and most secure technology for exchanging data and information over the network.

3.5.5 Ethereum

Ethereum is the most popular open-source public blockchain platform. Ethereum contains the features of smart, digitized contracts called "smart contracts." A smart contract contains all the transaction records in encrypted form on the blockchain network. Most developers like developing and building applications on this blockchain platform.

3.5.6 Remix-IDE

The remix is a suite of tools to interact with the Ethereum blockchain to debug the whole code and save it in the Git repository. GitHub is an open platform for developers' Git repositories. There, all the codes of the application are saved on the cloud platform. The Remix IDE is an IDE for Solidity app developers. The Remix IDE is shown in Figure 1, and an online version is available at https://remix.ethereum.org. The remix is a browser-based compiler and IDE that enables users to build Ethereum contracts with Solidity and debug transactions. We have used this IDE for executing our Solidity language code with the extension .sol, which deploys our Contract for transactions

3.5.7 Solidity

Solidity is a Contract oriented high-level programming language. This language is specially designed for writing and handling computerized distributed ledgers called smart contracts. This language supports both blockchain networks, private as

well as public. The public blockchain platform is highly compatible with this contract language to design and implement the smart Contract in the DApps. A smart contract in the Solidity language is a gathering of code (its functions) and state that resides at a specific address on the Ethereum blockchain. In this, we write the smart contract of this decentralized application, where we assign the data such as addresses, transaction hash, timestamp, questions and answers, college, and date of examination.

3.5.8 MetaMask

A MetaMask is an Ethereum Wallet in your Browser. MetaMask is an extension for accessing Ethereum-enabled decentralized applications, or "Dapps," in your browser. The extension injects the Ethereum web3 API into every website's JavaScript context so that apps can read from the blockchain. MetaMask also lets the user create and manage their own identities (via private keys, a local client wallet, and hardware wallets like Trezon), so when a Dapp wants to perform a transaction and write to the blockchain, the user gets a secure interface to review the transaction, before approving or rejecting it. Because it adds functionality to the normal browser context, MetaMask requires permission to read and write to any webpage. This provides me with an Ethereum currency for transactions. In this examination system, first, candidates register themselves individually and get their blockchain account addresses. The blockchain account address is a unique address for every participant. This address is of 16-byte code generated by applying the SHA 256 algorithm to the registration data.

3.5.9 Ganache

Ganache is a popular development tool and local blockchain network specifically designed for Ethereum smart contract development and testing. It provides a local, private Ethereum blockchain environment that allows developers to simulate the behaviour of a real Ethereum network without the need for deploying contracts on the live blockchain. One of the key advantages of Ganache is its simplicity and ease of use. It offers a user-friendly interface and can be quickly set up on a developer's machine. Ganache provides a pre configured development blockchain with

built-in accounts and Ether balances, making it convenient for testing and debugging smart contracts during the development process. Ganache offers several features that facilitate smart contract development.

3.6 Hardware requirements

1. RAM – 8GB or higher
2. Hard Disk – Minimum 128 GB HDD/SSD
3.Processor – Intel i3 8th Generation or equivalent. (Better Efficiency if Higher)
4. 64-bit System

Chapter 4

SYSTEM DESING

4.1 SYSTEM ARCHITECTURE

The purpose of this project is to create an Examination system which is powered by blockchain. The test is published by the Faculty and an Exam ID is generated. The student can then login and enter the Exam ID and can attempt the test. After submitting the test a MetaMask wallet will popup Infront of the student in which they have to sign the transaction to save the data to Blockchain.

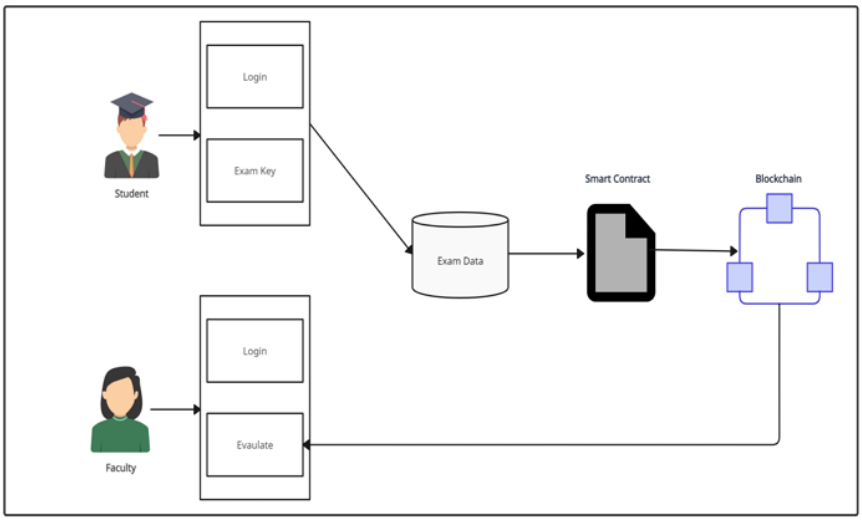

Figure 4.1: System Architecture Diagram

4.2 Data Flow Diagrams

A data flow diagram (DFD) maps out the flow of information for any process or system.

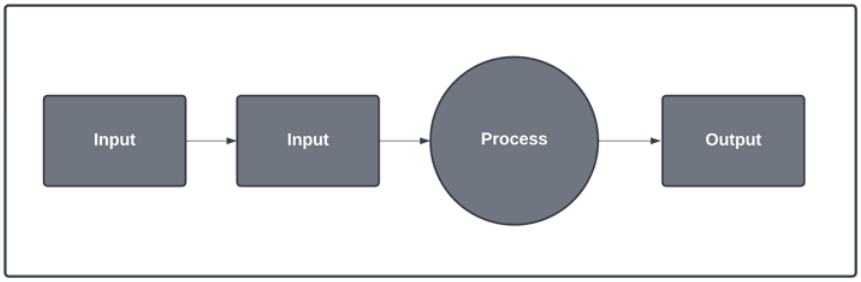

Figure 4.2: DF Diagram 1

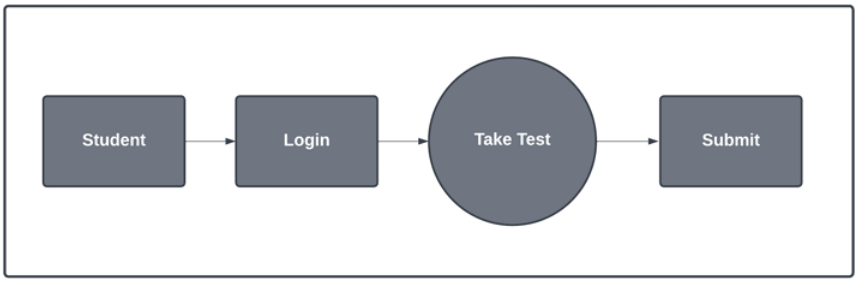

Figure 4.3: DF Diagram 2

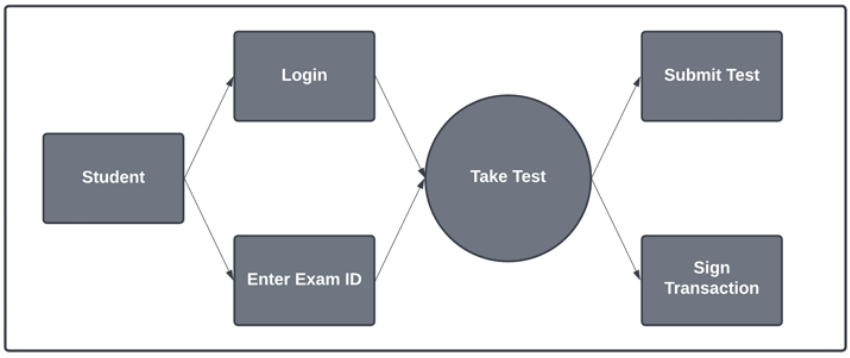

Figure 4.4: DF Diagram 3

4.3 ENTITY RELATIONSHIP DIAGRAMS

An Entity Relationship Diagram (ERD) is a type of diagram that lets you see how different entities.

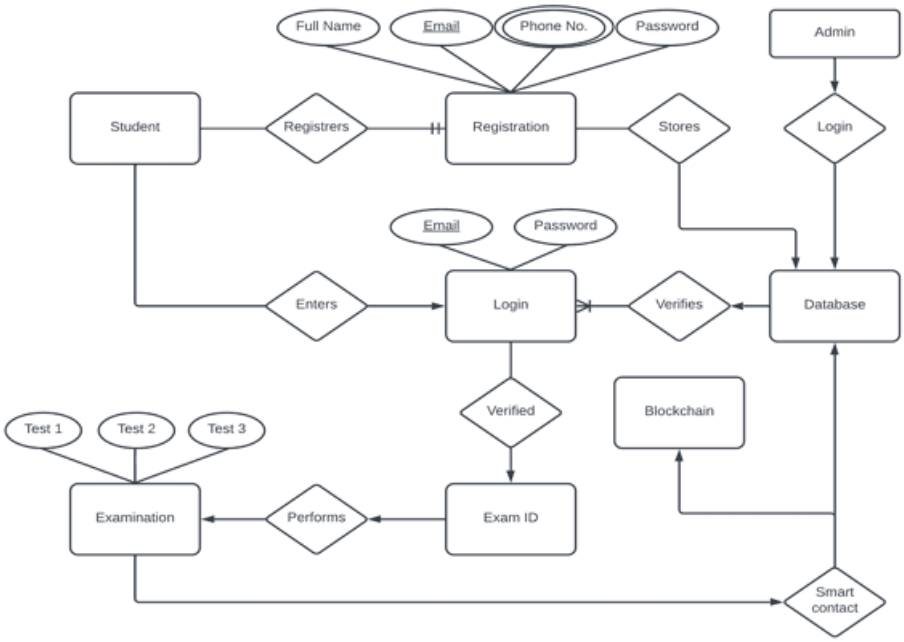

Figure 4.5: Extended ER diagram

4.4 UML Diagrams

Unified Modelling Language, or UML, is a tool for representing the architecture, design, and implementation of complicated software systems visually. When writing code, it can be challenging to remember the relationships and hierarchies inside a software system because there are often thousands of lines in an application. That software system is broken down into components and subcomponents using UML diagrams.

4.4.1 Use Case Diagram

The dynamic behavior of a system is represented by a use case diagram. It incorporates use cases, actors, and their interactions to encapsulate the functionality of

the system. It simulates the duties, services, and operations needed by a system or application subsystem.

Figure 4.6: UML Diagram

4.5 STATE DIAGRAM

A state diagram (also known as a state machine or statechart diagram) is an illustration of all the possible behavioral states a software system component may exhibit and the various state changes it's predicted to undergo over the course of its operations. A state in a statechart is an abstraction of the mode in which the object finds itself. A message triggers a transition from one state to another. A message can be either an event or a triggered operation. An object can receive both kinds of messages when sent from other objects.

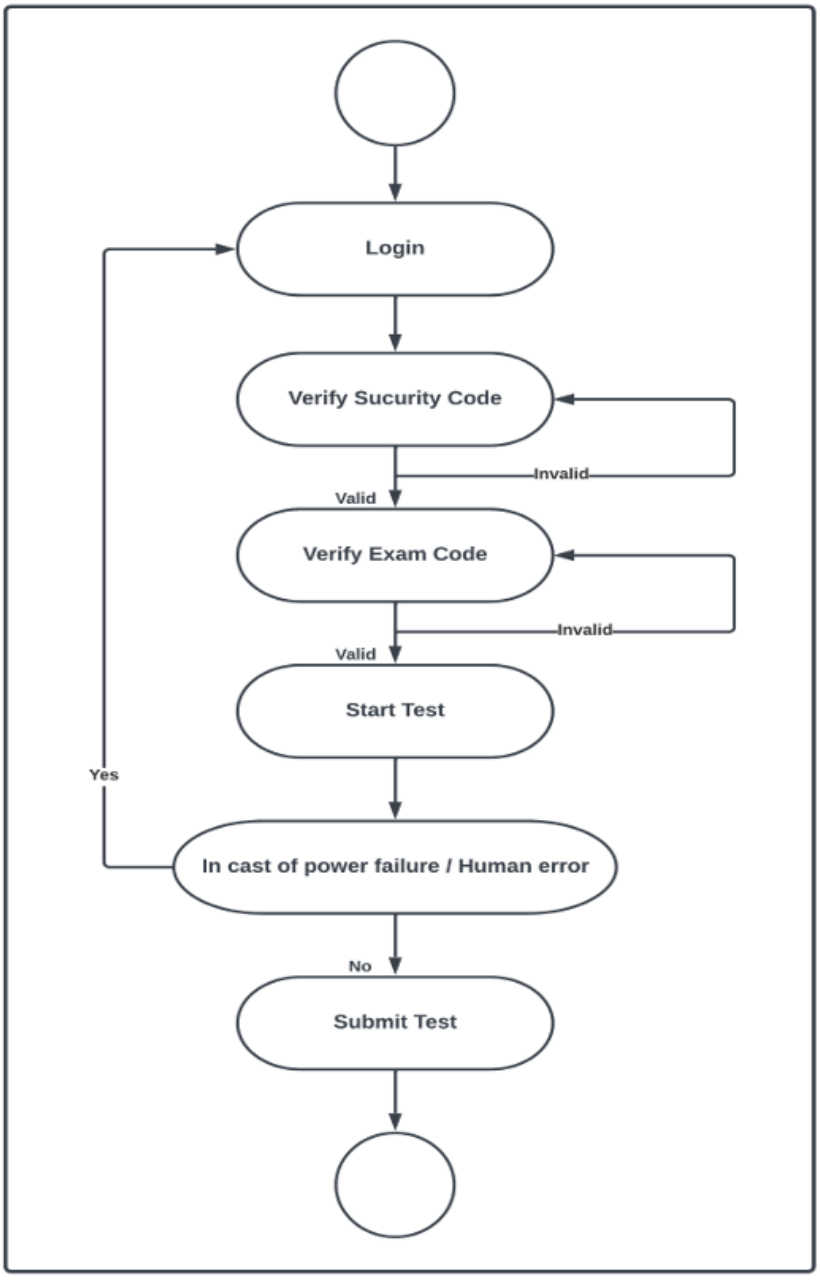

Figure 4.7: State Diagram

4.6 CLASS DIAGRAM

Class diagrams are the most common diagrams used in UML. Class diagram consists of classes, interfaces, associations, and collaboration. Class diagrams basically represent the object-oriented view of a system, which is static in nature. Active

class is used in a class diagram to represent the concurrency of the system. Class diagram represents the object orientation of a system. Hence, it is generally used for development purposes. This is the most widely used diagram at the time of system construction.

Following is the Class Diagram for our project:

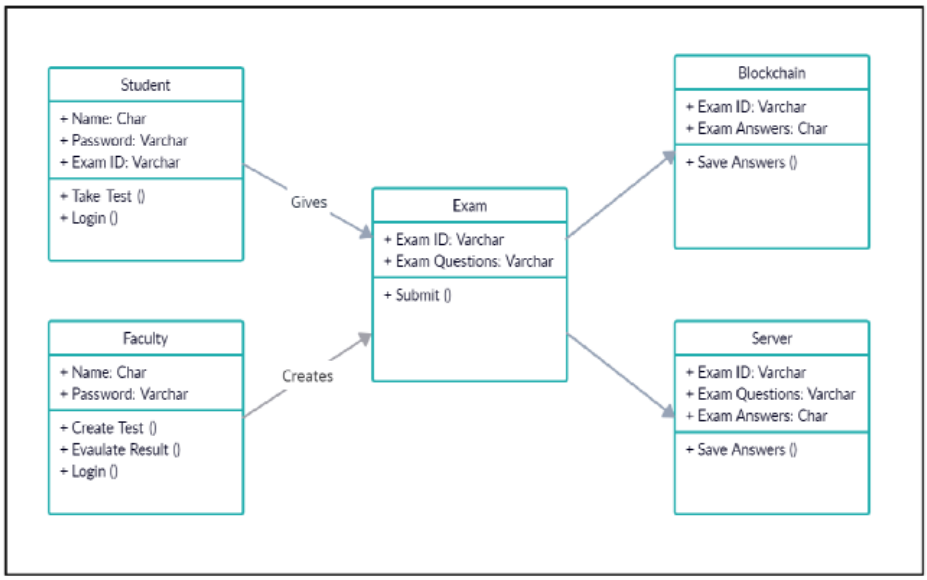

Figure 4.8: Class Diagram

4.7 ACTIVITY DIAGRAM

Activity diagrams show how multiple levels of abstraction of activities are coordinated to produce a service. Typically, an event must be accomplished by some operations, especially when the operation is meant to accomplish several different things that call for coordination. Another common requirement is how the events in a single use case relate to one another, especially in use cases where activities may overlap and require coordination. It can also be used to illustrate how a set of related use cases interact together to reflect business workflows.

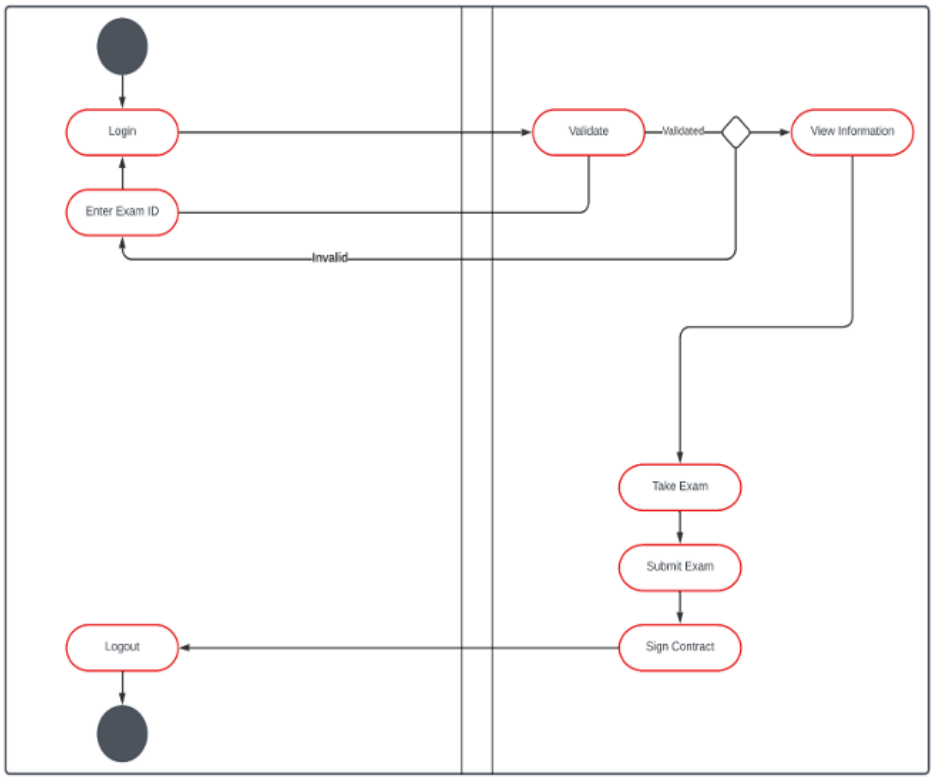

Figure 4.9: Activity Diagram

4.8 AFLOW CHART

A flowchart is a diagram that depicts a process, system or computer algorithm. They are widely used in multiple fields to document, study, plan, improve and communicate often complex processes in clear, easy-to-understand diagrams. These components consist of classes, interfaces, or collaborations. Component diagrams represent the implementation view of a system. During the design phase, software artifacts (classes, interfaces, etc.) of a system are arranged in different groups depending upon their relationship.Flowcharts, sometimes spelled as flow charts, use rectangles, ovals, diamonds and potentially numerous other shapes to define the type of step, along with connecting arrows to define flow and sequence.

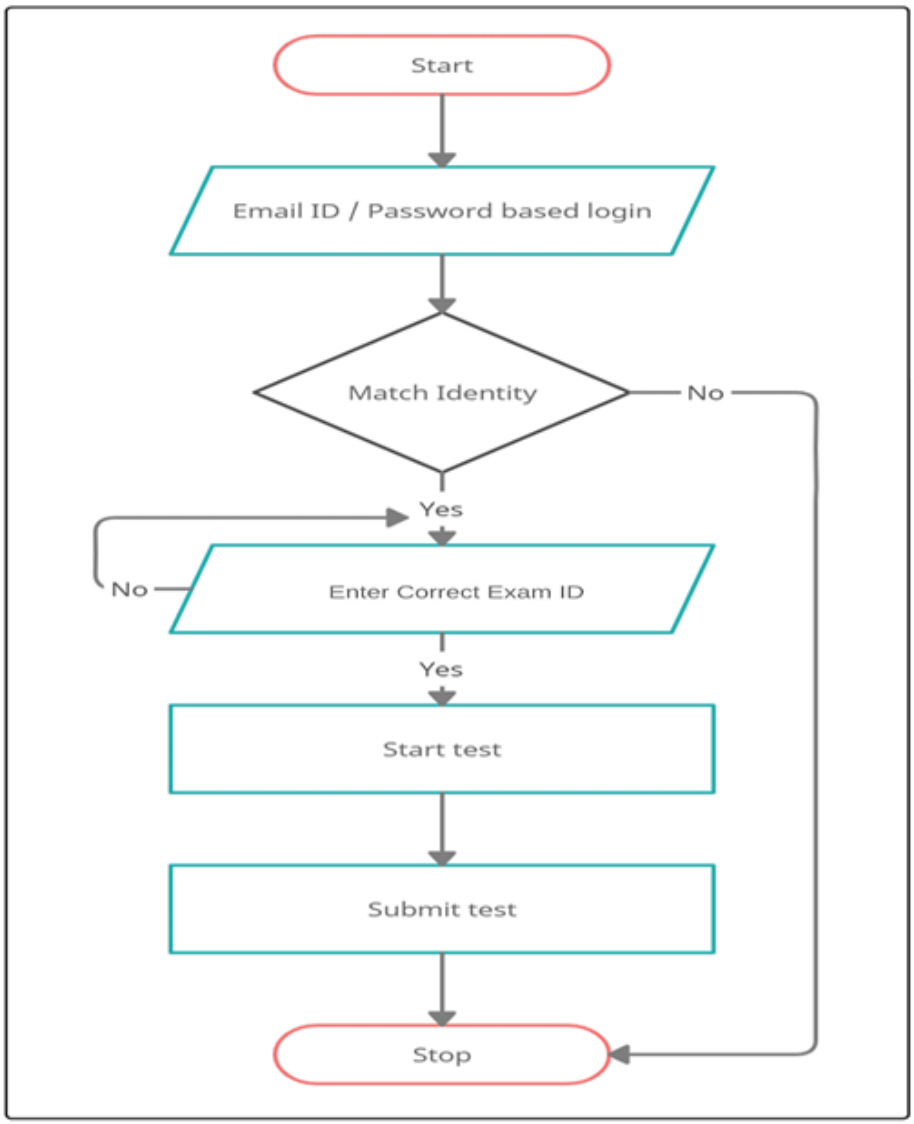

Figure 4.10: Flow Chart

4.9 COMPONENT DIAGRAM

Component diagrams represent a set of components and their relationships. These components consist of classes, interfaces, or collaborations. Component diagrams represent the implementation view of a system. During the design phase, software artifacts (classes, interfaces, etc.) of a system are arranged in different groups depending upon their relationship. Now, these groups are known as components. Finally, it can be said component diagrams are used to visualize the implementation.

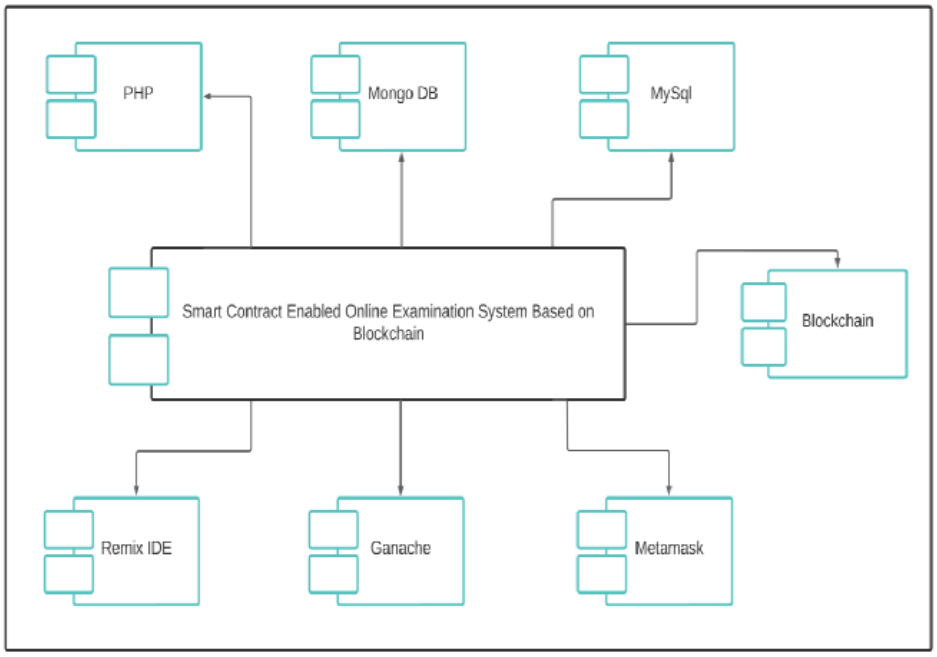

Figure 4.11: Component Diagram

4.10 Deployment Diagram

Deployment diagrams are a set of nodes and their relationships. These nodes are physical entities where the components are deployed. Deployment diagrams are used for visualizing the deployment view of a system. This is generally used by the deployment team.A deployment diagram shows components and artifacts in relation to where they are used in the deployed system.Deployment diagrams are used to visualize the hardware processors/ nodes/ devices of a system, the links of communication between them and the placement of software files on that hardware. A component diagram defines the composition of components and artifacts in the system. Note: Deployment diagrams are distinct from deployment topologies, a different type of model.

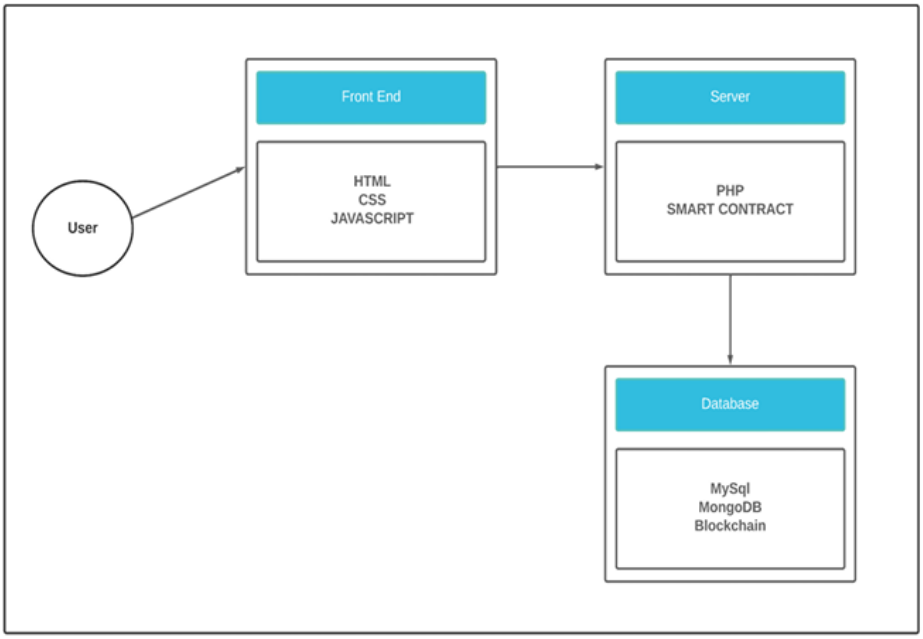

Figure 4.12: Deployment Diagram

Chapter 5

PROJECT PLAN

5.1 PROJECT SCHEDULE

5.1.1 Project Task Set

Research and Familiarisation:

- Study existing online examination systems and blockchain integration.
- Explore smart contract frameworks and blockchain platforms (e.g., Ethereum).
- Investigate security considerations and privacy requirements.

System architecture Design:

- Design the overall system architecture for the online examination system.
- Determine the smart contract structure and functionality.
- Identify data storage requirements and blockchain integration points.
- Define the user interface and user experience (UI/UX) design.

Smart contract development:

- Develop smart contracts to handle exam creation, question management, and result verification.
- Implement functions for participant registration, exam scheduling, and grading.
- Define rules and conditions for exam behaviour, time constraints, and scoring. points.

Blockchain Integration

- Set up a private blockchain network or leverage an existing blockchain platform.
- Configure network parameters and establish consensus mechanisms.
- Deploy smart contracts to the blockchain and ensure their interoperability.

Front- End development:

- Design and develop a user-friendly web interface for the examination system.
- Implement user registration and authentication functionalities.
- Create intuitive interfaces for exam creation, participant enrolment, and exam taking.
- Integrate blockchain functionalities into the user interface.

Back-End development:

- Build the necessary APIs and services for data handling and communication.
- Develop server-side logic for exam management, result processing, and reporting.
- Implement secure data storage mechanisms and encryption techniques.
- Integrate with external systems, if required (e.g., payment gateways).

Testing and Quality assurance:

- Conduct unit testing of smart contracts, focusing on functionality and edge cases.
- Perform integration testing to ensure seamless interaction between components.
- Carry out system testing to validate end-to-end functionality and user flows.

Deployment and Maintenance:

- Prepare the production environment and deploy the online examination system.
- Monitor system performance, scalability, and user feedback.
- Perform regular maintenance and updates to ensure system stability and security.
- Address any post-deployment issues and provide ongoing support.

5.2 TIMELINE CHART

TIMELINE	TASKS
AUGUST 2023	Topic Finalization for the project
SEPTEMBER 2023	Extensive Literature Survey to identify the related work
OCTOBER 2023	Identification of the appropriate Software Requirements Specification, and System Designing
NOVEMBER 2023	Evaluation of different Blockchain Technologies and and development of the Preliminary Report
DECEMBER 2023	Project Planning and Identification of the different components to be built
JANUARY 2024	Implementation of the Examination Platform as an Web Application
FEBRUARY 2024	Identification of points of improvement for the System and modifying the developed Web App.
MARCH 2024	Developing and Testing various functionalities of the Examination Platform
MAY 2024	Publishing research paper in the IJEAST Journal
MAY 2024	Making of Final Project Report.

Figure 5.1: Table

5.3 TEAM ORGANIZATION

5.3.1 Team structure

Our project focused on developing a Smart contract enabled online examination system that utilized both Smart contract and Ethereum blockchain. The objective was

to create a comprehensive Examination system that would provide users with ease of conducting secure examinations and make the data tamper proof.

5.3.2 Team Members:

Team Member 1: As the project leader, Team Member 1 was responsible for overseeing the overall project management, coordinating team efforts, and ensuring the project's successful completion. They also contributed to the algorithm design and implementation of the Examination system.

Team Member 2: Team Member 2 played a key role in developing the Examination system. They were responsible for studying and gathering information about existing online examination systems and conducting thorough research on blockchain integration.

Team Member 3: With expertise in PHP, they made significant contributions to the development of the smart contract-enabled online examination system. They played a pivotal role in developing the backend infrastructure of the system. Leveraging their proficiency in PHP, designed and implemented the server-side logic responsible for exam management. They collaborated closely with the front end development team to establish smooth communication between the user interface and the backend services. They developed robust APIs and services, ensuring seamless data handling and efficient communication between the various system components.

Team Member 4: Team Member 4 took on the responsibility of developing the front end of the smart contract-enabled online examination system, focusing on creating a user-friendly and intuitive user interface (UI). With their expertise in front-end development technologies, such as HTML, CSS, and JavaScript, they played a vital role in enhancing the user experience.

Chapter 6

SYSTEM IMPLEMENTATION

6.1 PROJECT MODULE

6.1.1 User Management:

Access control and permissions management for different user roles.

6.1.2 Exam Creation and Management:

Ability for instructors or administrators to create and manage exams. Define exam details such as duration, question format, and passing criteria.

6.1.3 Smart Contract Integration:

Development and deployment of smart contracts for exam-related functions. Interaction with smart contracts to handle exam creation. Verification of exam results and authenticity using smart contract functionality.

6.1.4 Online Exam Taking:

User-friendly interface for participants to take exams online. Timer and progress indicators to track remaining time and completed questions. Question navigation and submission functionalities during the exam.

6.1.5 Result Processing and Analysis:

Automated grading using smart contracts. Statistical analysis manually by teachers of exam performance and reporting.

6.1.6 Blockchain Integration and Security:

Integration with a blockchain network for data immutability and transparency. Secure storage of exam data and cryptographic protection of sensitive information. Implementation of necessary security measures to prevent tampering and unauthorized access.

6.1.7 Deployment:

In the deployment module, the Examination system system can be deployed on a local server or machine, such as the user's personal computer or a company's internal server.

6.2 TOOLS AND TECHNOLOGIES USED

6.2.1 Tools

- VS Code
- Remix IDE
- MetaMask
- Ganache

6.2.2 Technologies

- PHP
- MongoDB
- MySQL
- Solidity
- Smart Contract

Chapter 7

SOFTWARE TESTING

7.1 TYPE OF TESTING

The type of testing for "Chrome Extension for Detection and Prevention of Phishing Websites and Related Attacks by Using Machine Learning" can include various categories of testing which is essential to ensure that the system is functioning correctly.

Here are some types of testing that would typically be applicable to this project:

1.Functional Testing:
This involves testing the functional aspects of the Chrome extension to ensure that it performs its intended tasks correctly. It includes verifying features such as website detection, prevention of phishing attacks, and related security measures.

2.Usability Testing:
This type of testing focuses on evaluating the user experience and interface of the Chrome extension. It aims to ensure that the extension is intuitive, easy to navigate, and provides a seamless experience for users.

3.Security Testing:
Given the nature of the project, security testing is crucial. It involves evaluating the extension's ability to detect and prevent phishing attacks effectively, as well as assessing its resistance to various security vulnerabilities and potential exploits.

4.Performance Testing:
This type of testing assesses the performance of the Chrome extension, including its

speed, responsiveness, and resource usage. It helps ensure that the extension functions efficiently without significant impact on the user's browsing experience.

5.Compatibility Testing:
Compatibility testing ensures that the extension works correctly across different versions of the Chrome browser and on various operating systems. It involves verifying compatibility with different browser configurations, extensions, and related environments.

6.Regression Testing:
Regression testing is performed to validate that new features or bug fixes have not introduced any new issues or negatively impacted existing functionality.

7.2 TEST CASES AND RESULTS

The different test cases along with their results are tabulate in the following table:

Sr. No.	Test case ID	Test case name	Actions	Required data	Expected output	Actual output	Status	Comments
1	TC_001	Student Take Exam	1.Enter student login details. 2. Enter the Exam key. 3.	Login details and Exam key	Upon submitting the test the MetaMask wallet should popup to submit the exam	After submit ting the test the Meta Mask wallet poppe	PASS	NIL

Figure 7.1: Test Cases

			Submit the exam		through smart contract	d up to submit the exam throug h smart contra ct		
2.	TC_002	Faculty create exam	1.Enter teacher login details 2. Create exam with schedule d time and publish it.	Faculty login details	Exam created successfull y	Exam created succes sfully	PASS	NIL

Figure 7.2: Test Cases

Chapter 8

RESULTS

8.1 RESULT OUTCOME

The MetaMask pops up upon submitting the answer :

- Participants experience a seamless integration between the online examination system and their MetaMask wallet.
- The MetaMask wallet pops up automatically when participants click the "Submit" button to submit their answers.
- This integration ensures a secure and transparent transaction process, enhancing the overall user experience.

Upon successfully submitting the test, the transaction is logged in MetaMask:

- After participants submit their answers, the transaction details are logged in the MetaMask wallet.
- Participants can review the transaction history within MetaMask, providing them with a transparent record of their exam submission.
- The logged transaction serves as proof of submission, adding an extra layer of trust and accountability to the examination process.
- After participants submit their answers, the transaction details are logged in the MetaMask wallet.

The faculty is successfully able to create the exam and evaluate student's answer sheet:

- Faculty members or exam administrators can create exams seamlessly within the online examination system.
- They have access to intuitive and user-friendly interfaces that allow them to define exam details, such as question formats, duration, and passing criteria.
- Upon exam completion, the faculty can easily access and evaluate students' answer sheets through a dedicated interface.
- The system provides tools for efficient grading, allowing faculty members to review and assess answers accurately and promptly.

Overall, the integration of MetaMask ensures a secure and transparent transaction process for submitting exam answers. The faculty members benefit from a user-friendly interface that enables easy exam creation and efficient evaluation of students' answer sheets.

8.2 SCREENSHOTS

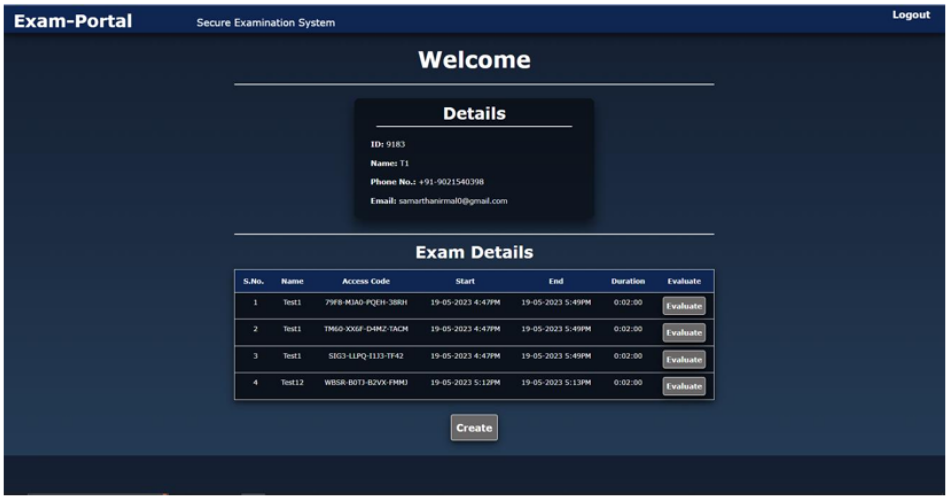

Figure 8.1: Faculty Create / Manage exam Dashboard

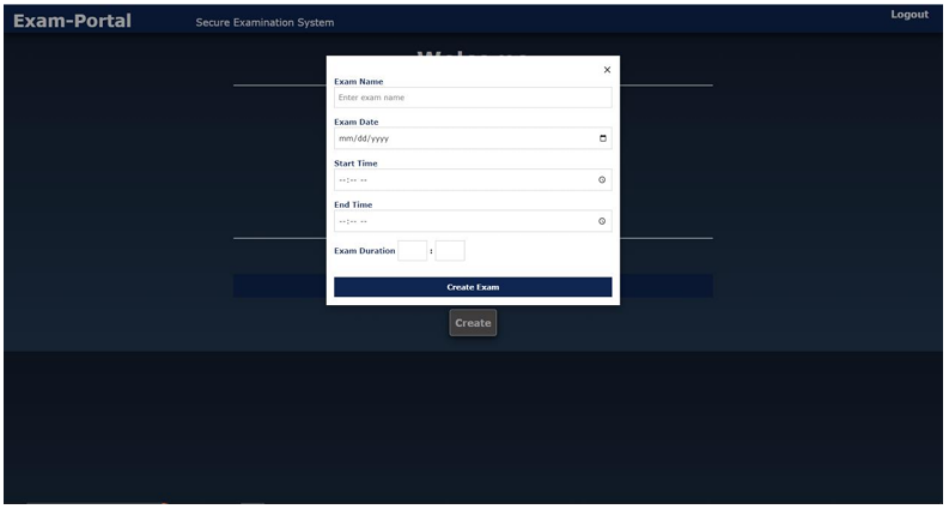

Figure 8.2: Faculty create exam page

Figure 8.3: Faculty Answer evaluation screen (Answered question)

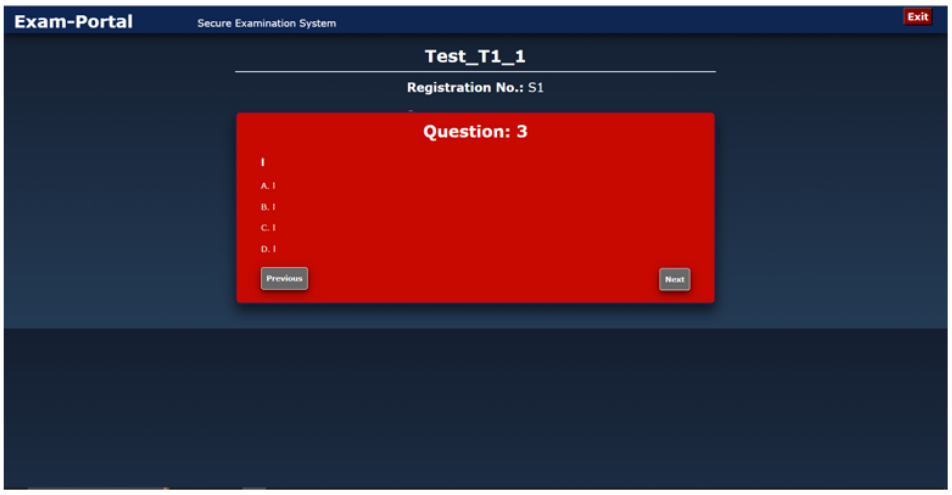

Figure 8.4: Faculty Answer evaluation screen (Skipped question)

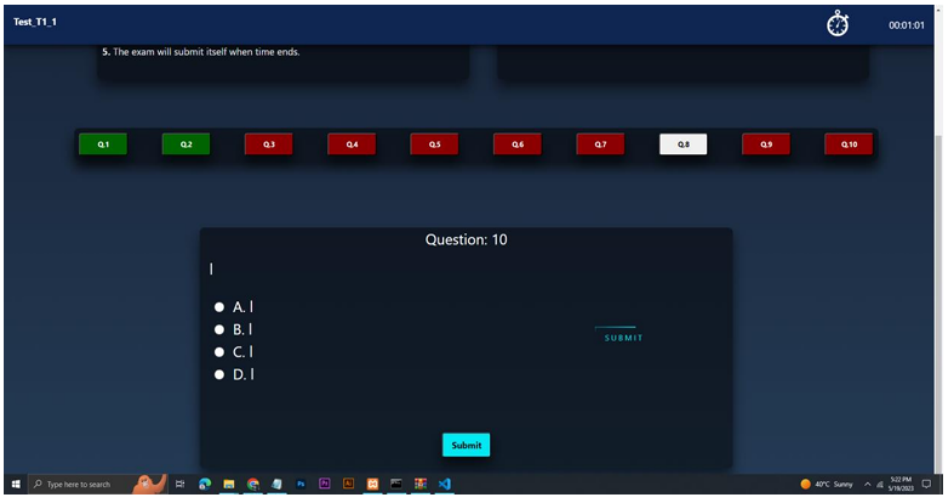

Figure 8.5: Student Submit Exam screen

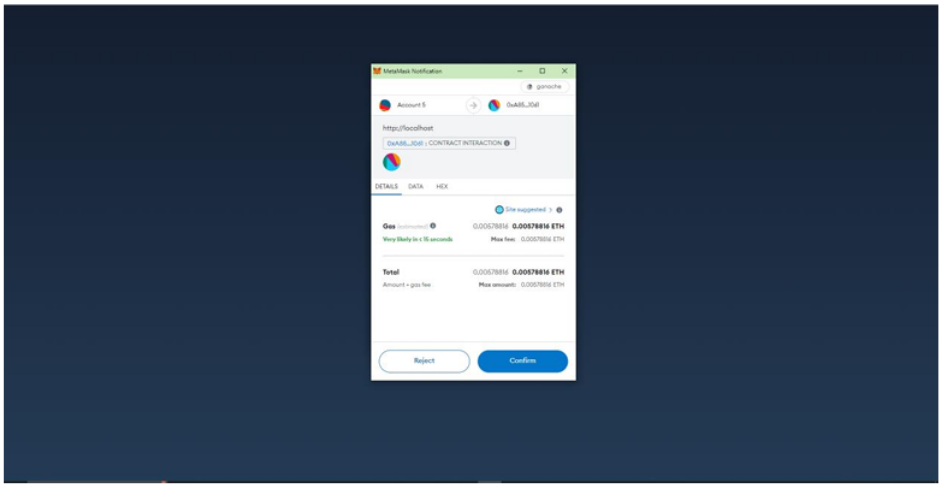

Figure 8.6: Student Transaction Sign popup (MetaMask)

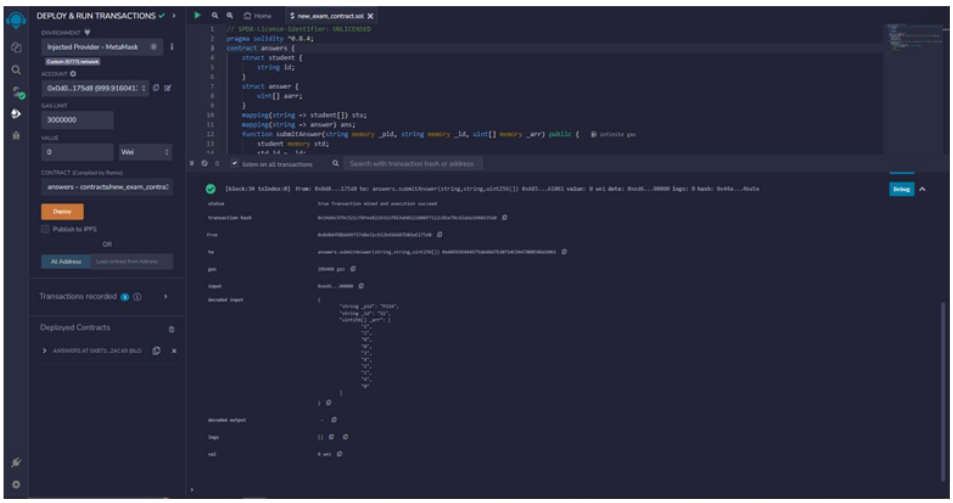

Figure 8.7: Answer Data Saved to Blockchain

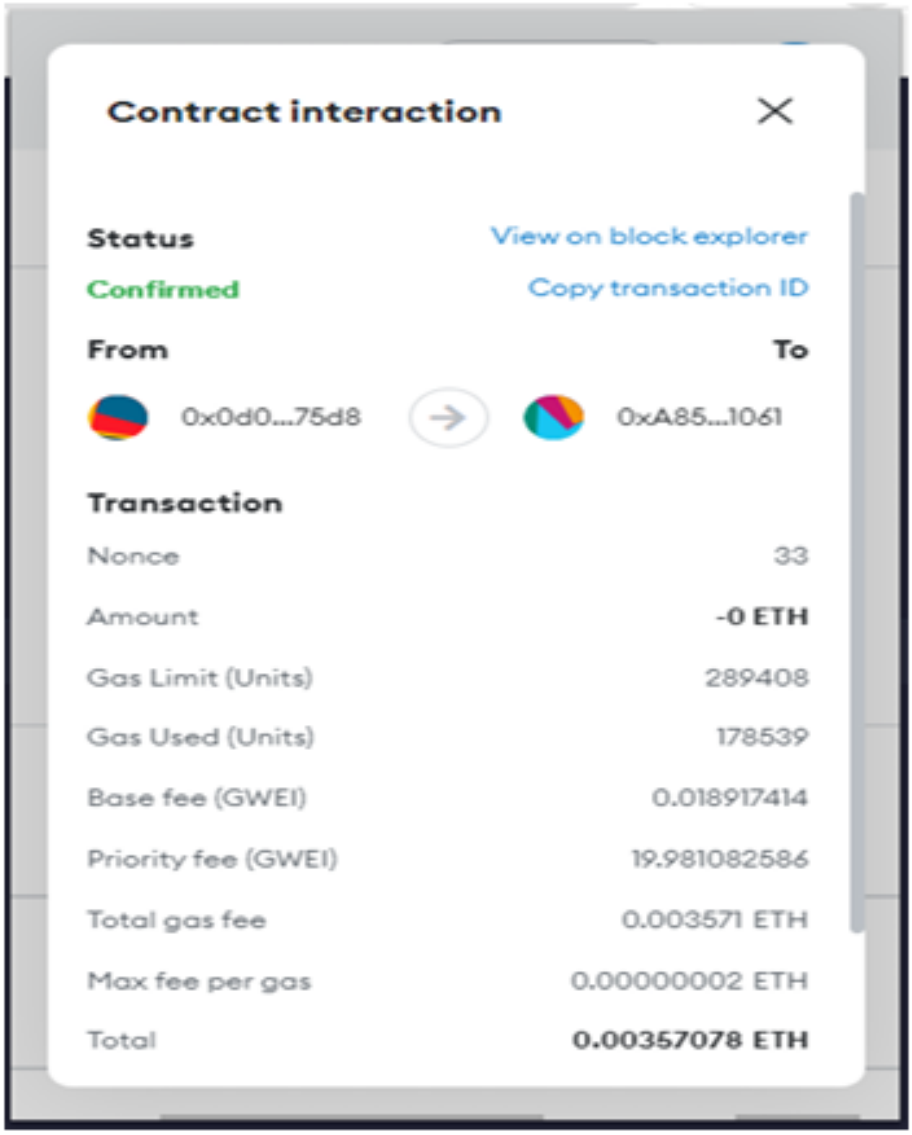

Figure 8.8: Transaction Confirmation screen

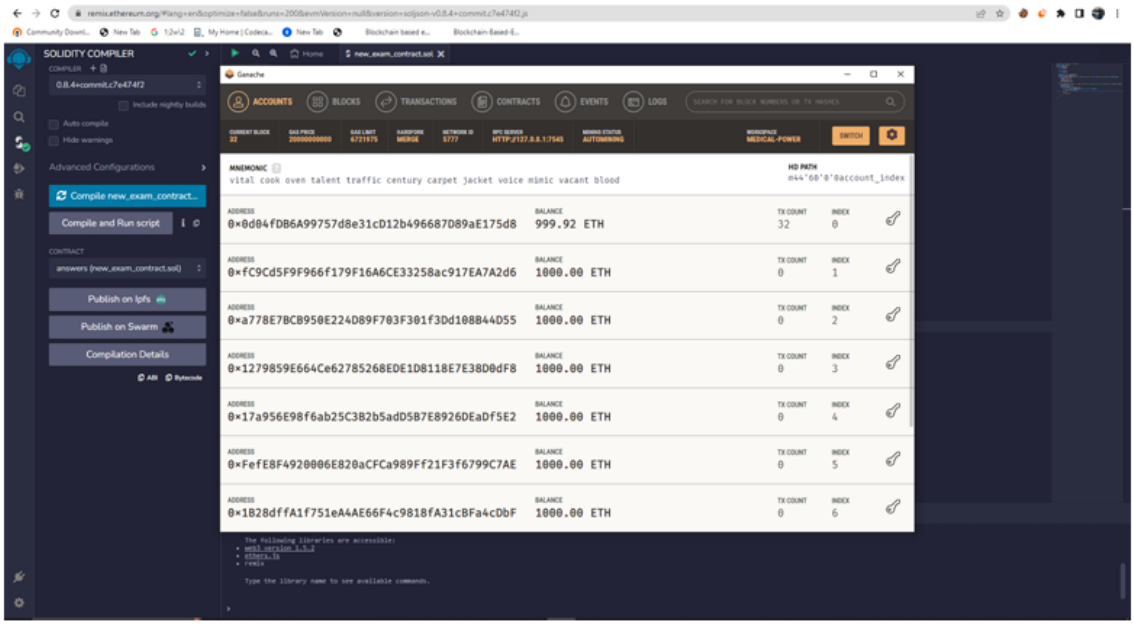

Figure 8.9: Ganache Local Blockchain

Chapter 9

FUTURE SCOPE

9.1 ADVANTAGES

- The biggest advantage of blockchain is its decentralised ledger application, which is proof of work, in which all the things are present in ledger form, which is generated automatically without the need of any third parties.
- In the blockchain-based system, there is no need for external equipment requirements like data centres, Data warehouses or firewall extensions like cloud-based systems.
- Blockchain technology overcomes and solves all these cloud-based system issues.
- Blockchain is a highly secured, transparent, and authenticated blockchain network.
- In the blockchain-based system, there is no need for external equipment requirements like data centres, Data warehouses or firewall extensions like cloud-based systems.

9.2 LIMITATIONS

- It can become an impediment to students' personal, inviolable information if the system faces any major breakdown.
- This system requires a stable internet connection but most households in Bangladesh have no internet access.
- The internet outage can become the reason for an imbalance in the learning management system of individual students while attending the exam.

9.3 APPLICATIONS

- Online university examinations.
- Online entrance tests.
- Company recruitment tests.

Chapter 10

CONCLUSION

The development of a smart contract-enabled online examination system based on blockchain brings numerous benefits and advancements to the field of education and assessment. This project successfully combines the power of blockchain technology, smart contracts, and user-friendly interfaces to create a secure, transparent, and efficient examination process. The integration of smart contracts automates various examination functions, such as exam creation, participant enrolment, result verification, and grading. By leveraging blockchain technology, the system ensures data immutability, transparency, and integrity. The seamless integration with MetaMask adds an extra layer of security and trust by leveraging the user's personal wallet for transaction logging and verification. This provides participants with a transparent record of their exam submissions and instils confidence in the system's integrity. It offers increased security, transparency, automation, and reliability, revolutionizing the way examinations are conducted and assessed.

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Appendix A

Paper Publication

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Paper Name : Decentralized Assess: Enhancing Online Assessment Security With Secure Examchain

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DECENTRALIZED ASSESS: ENHANCING ONLINE ASSESSMENT SECURITY WITH SECURE EXAMCHAIN

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Abstract -**In the cutting-edge era, records stands proud as one of the maximum important assets, surpassing other commodities. Users are increasingly willing in the direction of safeguarding their records from outside threats. Blockchain era emerges as a distinguished answer, providing remarkable safety and integrity for information. Initially synonymous with cryptocurrency, blockchain has developed to discover significant use in personal settings within businesses, ensuring records security. The essence of blockchain lies in creating decentralized systems, facilitating stable and green records transmission inside a network. This manner that statistics remains hid from outside entities, with authorized users maintaining extraordinary rights for analyzing and writing facts. Leading international industries which includes Walmart, IBM, and Google are actively embracing blockchain era to assemble Decentralized Applications (DApps). DApps constitute smart structures achieved on a distributed laptop network. Notably, blockchain facilitates the introduction of Smart Contracts, which are automated and secure disbursed ledgers allowing tamper-proof transactions with transparency. Smart contracts utilize hashing, a sturdy mathematical system employing the effective cryptographic algorithm SHA-256, producing a 256-bit signature for input textual content. The Ethereum Blockchain Platform serves as a widely adopted platform for DApps, working as a public community accessible to excited by stable transaction exchanges. Blockchain generation extends its influence throughout numerous sectors, consisting of advertising and marketing, business, education, and deliver chain control. This examine delves into the exam of the Ethereum Blockchain Platform in the academic machine. An application has been developed for the Online Examination System making use of the Ethereum Blockchain Platform, incorporating Smart Contracts, NodeJS for server runtime, and MongoDB because the database system. The blockchain-primarily based device exhibits advanced protection in comparison to cloud-based options. Furthermore, the analysis underscores the heightened trustworthiness of blockchain-based online examinations relative to different systems.**

KeyWords: **Blockchain, NodeJS, SHA-256, Ethereum.**

I. INTRODUCTION

In the cutting-edge generation, the transition of numerous sports to the net has facilitated substantial accessibility to statistics from any place. However, this shift has added new demanding situations, consisting of worries about facts protection, transparency, and trust across the global community. Many academic institutions and impartial organizations, which include the National Testing Agency (NTA), have embraced online exam structures, a fashion increased via the COVID-19 pandemic. The primary obstacles confronted with the aid of such structures are ensuring agree with and protection.

Numerous international marketplace gamers offer solutions inclusive of personal network lockers, passwords, One-Time Passwords (OTPs), and sturdy security measures. The present solutions, often reliant on third-birthday party involvement, gift a key assignment in phrases of data safety. Blockchain era, an emerging paradigm, addresses these challenges by way of beginning a revolution in privatization, ensuring that records stays below the consumer's manipulate without the need for 1/3-birthday celebration intervention.

In blockchain networks, records blocks are utilized for storing and dealing with statistics. The integrity of the information is maintained thru cryptographic validation of every facts block. Each block is connected with a completely unique cryptographic hash code generated through the effective SHA-256 set of rules. Validators play a essential function within the network, making use of diverse consensus mechanisms to provide a legitimate signature code for every statistics block.

Blockchain is synonymous with decentralized ledgers, which intelligently encapsulate entire datasets generated automatically after assignment completion, often referred to as clever contracts. These smart contracts function evidence of settlement for paintings executed without reliance on any 0.33-celebration device. Blockchain reveals applications in various domain names, inclusive of commercial enterprise, fitness, supply chain, and schooling systems.

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This paper focuses on leveraging blockchain era within the schooling area, specially in accomplishing straightforward examinations. The proposed online examination device the usage of blockchain ensures authentication by requiring candidates to check in and pay the exam charge. Only authenticated users are granted participation rights. Upon login, candidates insert the transaction hash to provoke the exam. Post-exam, all data, along with questions, solutions, transaction info, and timestamps, is securely transmitted to the exam center through a smart agreement at the blockchain community. This smart settlement serves as verifiable evidence for both the consumer and the exam middle.

The rest of the paper is established into four sections. The 2nd segment compares the blockchain-based totally examination system with cloud-primarily based alternatives. The third section presents a review of the technological historical past supporting the blockchain-based examination system. The fourth phase info the device's structure and operation, whilst the very last phase outlines capacity destiny enhancements.

II. LITURATURE SURVEY

From 2010 onwards, the creation of cloud era revolutionized the education machine, main to the emergence of online publications and examinations. The convenience of getting access to facts from everywhere and at any time made cloud-primarily based systems extensively adopted by using educational corporations, consisting of for authorities examinations. However, this shift added about challenges along with connectivity problems, records security concerns, and the need for sturdy consumer authentication [4,5].

Connectivity troubles caused transaction disasters and hindered easy information change across networks. Data safety became a large fear because of the prevalence of hackers, prompting the use of firewalls and antivirus structures. However, these solutions have been deemed inadequate and high-priced. Additionally, making sure the legitimacy of applicants inside the exam gadget posed a substantial project.

Enter blockchain generation, providing a technique to the demanding situations faced via cloud-primarily based systems. Known for its more desirable safety, transparency, and authentication features, blockchain presents a singular technique to maintaining network integrity. In a blockchain, statistics is based into blocks, every related by way of a completely unique 256-bit hash code [6]. Unlike cloud-based totally systems, there is no want for external additives like Data Centers or firewall extensions. The blockchain community operates as a incredibly stable and licensed environment, minimizing statistics trade and transaction screw ups. In the rare case of a failure, the system halts and eradicates all related statistics.

Blockchain's Decentralized Ledger Application, performing as proof of labor, mechanically facts all relevant data without counting on 0.33-birthday party interventions. This decentralized nature guarantees the reliability, protection, and transparency of the entire examination technique. As cloud-based systems grapple with connectivity, security, and authentication challenges, the integration of blockchain era emerges as a transformative answer, reshaping the panorama of educational tests.

III. PROPOSED SYSTEM

In this examination system, first candidates register themselves individually and get their blockchain account address. The blockchain account address is a unique address for every participant. This address is of 16-byte code which is generated by applying the SHA 256 algorithm on the registration data. This has code save into the database system of the university portal where the administrator/examination cell identified easily. For the student database, we use the MongoDB database which is easy to run and control.

MongoDB is a NoSQL database tool, where the direct data interaction is possible without any need for the query call as well as for the registrations and backend services we use Node.JS JavaScript framework, which compatible with GUI and database system. In the node.js write the procedure of the all APIs which are created the endpoints to connect the server of network and running the application service on the network

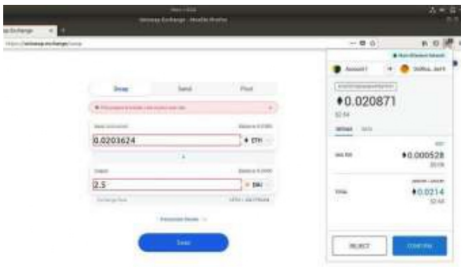

Figure: 1 Proposed System

For the GUI we use the React.JS. It is a JavaScript library that is used to create and build User Interfaces for server-side applications. This is specially used for single-pages applications to handle the view on the web or mobile-based decentralized applications. The special feature of this library is to develop the reusability UI components of the application.

For the contracts design and deploy the smart contract we use the solidity contract oriented high-level language which interacts with the application by the Web3.JS Blockchain libraries. This contract invokes all the data into it and generated both end of the system candidate as well as an examination enter. The generation of the contract is proof of work on bothends. The transaction fee of the examination is deducted through the Ethereum public token wallet MetaMask. After the transaction, there is a contract is

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generated which has a hash of transaction present. So, this application has too much secure and transparent.

The Proposed Method

This research proposes a blockchain-based online examination system designed to enhance security, transparency, and student privacy while ensuring a robust and reliable assessment process.

Key Components:

- Student registration and login modules.
- Fee payment integration with MetaMask blockchain wallet.
- Secure question delivery and answer submission using smart contracts.
- Tamper-proof storage of examination data on blockchain

Process Flow:

1. Registration

Students register by providing personal details (name, course, gender, and contact information), creating a password, and generating a unique blockchain account address.
Registration data is stored securely in a NoSQL database at the examination center.

2. Login and Fee Payment

Students log in using their registered email and password.
They initiate fee payment via the MetaMask Ethereum blockchain wallet.
Upon successful transaction, a unique transaction hash is generated and verified.

3. Examination

Students access the examination page and begin the test.
Questions are delivered securely through smart contracts, ensuring integrity and confidentiality.
Student answers are encrypted and stored locally.
Upon completion, a smart contract is created,containing student answers, transaction hash, and timestamp.
The smart contract is deployed to the Ethereum blockchain, guaranteeing immutability and transparency.

4. Evaluation and Results

Examiners retrieve student answers from the blockchain using the smart contract. Grading is performed manually or through automated mechanisms within the smart contract.
Results are stored on the blockchain and shared with students, ensuring authenticity and accessibility.
Benefits:Enhanced Security: Blockchain technology prevents unauthorized access, modification, or deletion of examination data.
Transparency: All transactions and actions are recorded on the blockchain, providing an auditable trail for verification and dispute resolution.
Student Privacy: Encryption and secure storage of answers protect student information and prevent unauthorized access.
Decentralization: Elimination of a central authority reduces the risk of data manipulation or corruption.
Immutability:Blockchain records cannot be retroactively altered, ensuring the integrity of examination results.
Future Research Directions:
Integration of Biometric Authentication: Further strengthen student identity verification and prevent cheating.
Exploration of Zero-Knowledge Proofs: Enhance student privacy by concealing sensitive information while maintaining verification capabilities.
Development of Scalability Solutions: Address the potential challenges of handling large-scale examinations on blockchain networks.
Establishment of Standards and Protocols: Ensure interoperability and security across blockchain-based examination systems.
Conclusion:

This proposed method demonstrates a promising approach to leveraging blockchain technology to address security, transparency, and privacy concerns in online examinations. Further research and development are crucial to fully realize its potential and establish blockchain-based examination systems as a secure and reliable alternative for educational assessment.

MOTIVATION

The Blockchain-based online examination systems are motivated by a desire to address several fundamental flaws plaguing traditional methods. These flaws include:
Security: Centralized servers are vulnerable to hacking and data breaches, potentially compromising sensitive student information and exam content. Blockchain's distributed ledger technology creates an immutable record of all transactions, preventing alterations and ensuring data integrity.
Transparency: Traditional systems lack transparency in question selection, exam scoring, and grade allocation, leading to potential bias and distrust. Blockchain enables full transparency, allowing students to verify every step of the process, building trust and fostering a fairer academic environment.
Efficiency: Paper-based and centralized online exams require significant resource allocation for printing, administration, and logistics. Blockchain streamlines the process, automating tasks, reducing costs, and increasing efficiency.
Plagiarism: Traditional systems struggle to effectively detect and prevent cheating. Blockchain can be programmed to identify suspicious patterns and flag potential plagiarism, upholding academic integrity.
Accessibility: Blockchain-based systems can operate independently of centralized authorities, potentially making examinations more accessible for remote students and those in areas with limited infrastructure.

Decentralization: Blockchain removes the reliance on single entities to control and oversee exams, preventing manipulation and promoting a more equitable system. Ultimately, the motivation for blockchain-based online examinations lies in the desire to create a more secure, transparent, efficient, and accessible platform for testing and assessment, fostering a fair and trustworthy environment for both students and institutions.

SYSTEM ARCHITECTURE

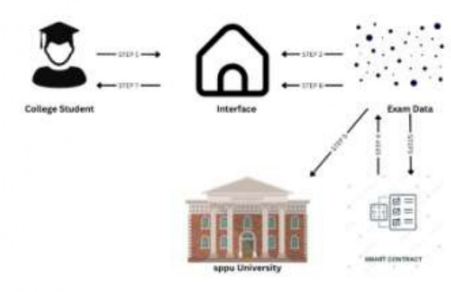

Fig -1: System Architecture Diagram

IV. CONCLUSION

This research paper isto demonstrates the significant potential of blockchain technology to revolutionize online examinations in the education system. Our proposed system built on the Ethereum platform and utilizing smart contracts offers remarkable advantages over traditional cloud-based approaches. Through enhanced transparency, data security, and tamper-proof record-keeping, blockchain promotes trust and fairness in the assessment process. This study not only successfully implements smart contracts for online examinations but also paves the way for further exploration of decentralized applications in education. Future research can refine existing blockchain-based systems and delve deeper into areas like resource management and improved decision-making for academic institutions. The integration of blockchain technology holds immense promise for shaping a more secure, efficient, and accessible future for online education and examinations.

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Appendix B

Certificate


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