Department of Computer Science and Engineering

SOUTHEAST UNIVERSITY

CSE459: Research Methodology

Research Report On

Blockchain-based Teaching Evaluation System for Ensuring Data Integrity and Anonymity

SUBMITTED BY

Uttam Kumar Saha
ID: 2019000000028
Batch: 51

Shohedul Islam
ID: 2019000000014
Batch: 51

Sanjida Akter
ID: 2019000000008
Batch: 51

SUPERVISED BY

Md. Mijanur Rahman
Assistant Professor
Department of CSE Southeast University

Letter of Transmittal

October 25, 2023
The Chairman,
Department of Computer Science & Engineering, Southeast University,
Tejgaon, Dhaka.

Through: Supervisor, Md. Mijanur Rahman

Subject: Submission of Research Report

Dear Sir,

It is a great satisfaction to submit our research Report on **"Blockchain-based Teaching Evaluation System for Ensuring Data Integrity and Anonymity"** under the course, Research methodology. We want to propose teaching evaluation system for ensuring data integrity and anonymity based on the user's preference. It was an honor for us to work with this topic. By following your instruction and fulfilling the requirement of the Southeast University, this research has been performed.

We have prepared this report with our absolute sincerity and effort. We request your approval of this research report in partial fulfillment of our degree requirement.

Thank You.
Sincerely Yours,

Name: Uttam Kumar Saha
ID: 2019000000028
Batch: 51
Program: B.Sc. in CSE

Name: Shohedul Islam
ID: 2019000000014
Batch: 51
Program: B.Sc. in CSE

Name: Sanjida Akter
ID: 2019000000008
Batch: 51
Program: B.Sc. in CSE

Supervisor

Md. Mijanur Rahman
Assistant Professor
Department of CSE
Southeast University

CERTIFICATE

This is to certify that the research report on **"Blockchain-based Teaching Evaluation System for Ensuring Data Integrity and Anonymity"** has been submitted to the respected member of the board of examiner of the School of Science and Engineering in partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Science & Engineering by the following students and has been accepted as satisfactory.

This Paper has been carried out under my guidance.

Authors

Uttam Kumar Saha
Undergraduate
Depertment of CSE
Southeast University

Shohedul Islam
Undergraduate
Depertment of CSE
Southeast University

Sanjida Akther
Undergraduate
Depertment of CSE
Southeast University

Supervisor

Md. Mijanur Rahman
Assistant Professor
Department of CSE
Southeast University

ACKNOWLEDGEMENT

Foremost, Thanks to Almighty Allah for whose given strength makes us able to complete our research successfully.

After that, we would like to thank our honorable supervisor **Md. Mijanur Rahman**, Assistant Professor, Department of computer science and engineering in southeast university. This research behind it would not have been possible without the exceptional support of our supervisor. His enthusiasm, knowledge, and exacting attention to detail have been an inspiration and kept us on track from our first encounter with blockchain to the final draft of this paper.

We would also like to thank **Shahriar Manzoor**, Associate Professor & Chairman, Department of Computer Science and Engineering, Southeast University for making Md. Mijanur Rahman, our supervisor.

We also want to thank our whole faculties of the department of Computer Science and Engineering, Southeast university for their encouragement and motivation. Finally, it is true with pleasure and appreciation that we acknowledge our contributions and day after day hard work with proper responsibility.

In addition, we owe a sincere debt of gratitude to each and every one of our great group members for their thought-provoking debates, unwavering commitment, and endless sleepless hours spent together, which were essential to finishing this project ahead of schedule. We were able to finish this report within the allotted time thanks to their unflagging encouragement and assistance. Finally, we want to say that all of those kindnesses were indispensable to complete our research.

ABSTRACT

The significance of student feedback within educational institutions cannot be overstated, as it serves as a pivotal tool for evaluating faculty performance and identifying potential gaps in course content. In light of this, blockchain technology has emerged as an increasingly promising solution for diverse digital applications, owing to its distinctive attributes and robust security features. This study endeavors to explore the use of blockchain technology for secure student feedback systems in education, specifically for analyzing faculty performance in a course. However, a noteworthy challenge that plagues existing feedback systems is their inability to ensure complete anonymity, leading to students' hesitancy in providing candid and honest feedback. Furthermore, these conventional systems often rely on databases for data storage, rendering them susceptible to tampering and data breaches. In response to these pressing concerns, the present paper proffers a comprehensive and innovative solution. The crux of the proposed approach revolves around the implementation of a blockchain-based student feedback system, artfully designed to guarantee both student anonymity and tamper-proof data storage, thereby facilitating the evaluation of teaching effectiveness. By leveraging the potential of an Ethereum-based blockchain, a secure and trusted platform is meticulously established, catering to the sensitive realm of student feedback in an impervious and confidential manner. Concomitantly, a user-friendly web application is deftly developed to complement the proposed system, meticulously documenting the implementation process and project code. It is noteworthy that this cutting-edge feedback system provides an invaluable layer of security, fostering heightened user trust and engendering an environment conducive to genuine and authentic evaluations.

TABLE OF CONTENTS

LIST OF FIGURES

Figures

CHAPTER 1

INTRODUCTION

In the contemporary landscape of education, student feedback assumes paramount importance, serving as an indispensable component for educational institutions aiming to meticulously analyze and address an array of pertinent issues. This invaluable trove of information holds the key to making informed and consequential decisions within the organization, enabling a comprehensive assessment of faculty performance in specific courses, pinpointing areas of concern, and charting a course for future enhancements. The discerning value attributed to feedback within the educational realm is underscored by its multifaceted role in assessing student achievement, nurturing skill development, enriching comprehension, and kindling student motivation and self-assurance[1]. Moreover, it stands as a pivotal instrument in gauging the activities and accomplishments of faculty members in the hallowed halls of colleges and universities. The evaluation of faculty performance constitutes one of the most imperative undertakings within an educational institution, acquiring heightened significance on a global scale[2]. As the educational landscape evolves, the diligent scrutiny of faculty competence becomes an inexorable priority.

In contemporary organizational practices, the prevailing reliance on databases to administer feedback systems raises pertinent concerns. This reliance bestows a disproportionate authority upon the system administrator, endowing them with the power to manipulate, alter, or even remove the furnished feedback[3]. Consequently, the foundational principle of anonymity, crucial in fostering candid and unbiased feedback, becomes compromised within the database management system[4]. As corroborated by a published report[5], a notable incident involved the imposition of a substantial $2.2 million fine on an Australian hotel business, citing the deletion of unfavorable reviews from their website. This incident illuminates the vulnerability of conventional feedback systems to fraudulent and manipulated interventions.

However, the advent of blockchain technology offers a paradigm shift in this domain. With its inherent characteristics of decentralization, immutability, and transparency, blockchain presents an inherently suited solution to counter the challenges posed by conventional systems[6].

Blockchain technology marks the advent of a transformative era in decentralized information technology, epitomizing a significant leap forward[7]. Its integration into the education evaluation process promises a multitude of advantages, ranging from decentralization to secure data storage and classification. Embracing the intrinsic security features of blockchain, such as immutability and tamper-resistance, confers enhanced data confidentiality while thwarting unauthorized access or manipulation[8]. The preservation of anonymity assumes paramount importance in feedback systems, especially in shielding faculty members from potential repercussions if negative feedback is disclosed, or in safeguarding students who have expressed critical evaluations. Conventional feedback systems, with administrators wielding access to databases, face inherent vulnerabilities wherein feedback authenticity may be compromised, and anonymity is rendered precarious[9]. In contrast, the immutable and transparent nature of blockchain technology offers an alluring solution to establish a robust and fully anonymous feedback mechanism. By harnessing blockchain's

features of anonymity, validation, and seamless integration, an efficacious feedback system can be constructed, fostering a safe environment wherein students can provide candid feedback without fear of retribution, and faculty members can engage constructively with evaluative insights.

In 2008, Satoshi Nakamoto presented the pioneering concept of blockchain technology through the publication of a seminal paper on Bitcoin[10][11]. As a decentralized ledger system, blockchain harnesses the power of a distributed network of nodes to engender a highly reliable ledger devoid of reliance on intermediaries or third-party verifiers. The inherent structure of blockchain is underpinned by attributes such as data protection, anonymity, transparency, and data integrity[12]. With a steadfast commitment to achieving decentralized consensus among network nodes, blockchain ensures that data is shared across the network, eliminating the concentration of control in any single node[13]. Fundamentally, blockchain constitutes a decentralized database that stores records in the form of interconnected blocks[14]. Each block comprises a hash value, timestamp, and transaction details. The transformative role of a hash function is evident, as it transforms a collection of data into a concise and fixed-sized data structure, commonly referred to as a hash value[15][16]. This cryptographic process plays a pivotal role in securing the immutability and authenticity of data stored within the blockchain.

Upon a thorough examination of the research papers pertaining to feedback systems based on blockchain, our investigation centered on identifying the prevailing gaps within this domain. Through meticulous scrutiny, we found a collection of research papers that illuminated promising prospects for mitigating the extant challenges in this field. Notably, among the existing Ethereum blockchain-based feedback systems, a notable opportunity for improvement was unveiled concerning the conspicuous absence of encryption and decryption processes during login/registration and the storage of passwords on the blockchain. In response to this critical lacuna, the present paper takes a pioneering stride towards addressing this vulnerability by integrating the robust bcrypt algorithm to govern the encryption and decryption of user passwords during login, registration, and subsequent storage on the blockchain. By deploying the bcrypt algorithm, an enhanced layer of security is engendered, offering fortified safeguards against potential threats and breaches.

In light of the discerned deficiencies in existing feedback systems, our study posits an innovative and robust solution: a secure student feedback system meticulously crafted to evaluate faculty performance by harnessing the transformative potential of blockchain technology. This pioneering system is underpinned by a steadfast commitment to accentuating user anonymity and engendering tamper-proof attributes. Through astute utilization of blockchain technology, the proposed system ensures the indelible preservation of data, rendering it impervious to unauthorized alterations. By availing this heightened level of data security, the system efficaciously restricts the access of both administrators and faculty members to the identities of students who have contributed valuable feedback. Consequently, this system delivers enhanced security and anonymity, empowering students to provide feedback with confidence.

The subsequent sections of this paper are thoughtfully structured to ensure a coherent presentation of our research findings. Section II provides a comprehensive overview of the relevant literature pertaining to blockchain-based feedback systems, thus offering insightful context to our study. In Section III, we explicate the intricacies of the methodology and elucidate the meticulous implementation of our groundbreaking blockchain-based teaching evaluation system. Section IV

is dedicated to the comprehensive presentation of our results and in-depth discussion, fostering a nuanced understanding of the implications and implications of our findings. Lastly, Section V serves as the culminating segment of our paper, encapsulating the key takeaways and conclusions drawn from our investigation.

CHAPTER 2

LITERATURE REVIEW

The existence of blockchain predates its introduction by Satoshi Nakamoto with the advent of Bitcoin[17][18]. Its influence has been profound and all-encompassing, witnessing widespread adoption across various industries and sectors, driven by its potential to enhance security, efficiency, and transparency. In recent times, blockchain technology has emerged as a frontrunner in the realm of innovation, garnering substantial attention from the global public and academic communities[19]. Attributed largely to its association with Bitcoin, blockchain technology attained remarkable prominence, establishing itself as a leading technological breakthrough on a global scale. Consequently, an array of comprehensive research endeavors have been undertaken to delve into the intricacies of this system, culminating in proposed advancements and revisions to existing studies. This surge in interest underscores the profound significance of blockchain technology as an enabler of progressive and transformative solutions across various domains.

In the study conducted by the authors [20], a comprehensive examination of the underlying structure of blockchain and the intricate algorithms responsible for achieving consensus among participants is presented, offering invaluable insights into the functionality and robustness of this technology. Additionally, the study delves into a critical analysis of the limitations inherent in blockchain systems, proposing prospective solutions to address these challenges effectively. Through their meticulous investigation, the researchers undertake a comparative assessment of diverse consensus algorithms, with the ultimate objective of discerning the most suitable algorithm tailored to specific purposes.

In the scholarly work presented in [21], the authors present a pioneering blockchain-based feedback system, meticulously engineered to uphold and safeguard user anonymity, constituting the focal tenet of this innovative framework. The primary goal of this cutting-edge system is to enable users to freely and candidly provide feedback without any apprehensions regarding potential breaches of their privacy. To bolster the integrity of the feedback mechanism, the system is ingeniously designed to render any submitted feedback immutable and impervious to alterations, thereby assuring the authenticity and reliability of the received evaluations. Furthermore, the system has been meticulously crafted to permit feedback submission solely from registered users, effectively curtailing any unwarranted or spurious feedback submissions. Nonetheless, the anonymized nature of user identities entails the potential risk of malicious intentions, whereby

intentional negative feedback might be submitted with the aim of tarnishing the reputation of the recipient.

Authors of [22], introduced an innovative blockchain-powered course feedback system, ingeniously harnessed through the application of Ethereum blockchain technology. The system is meticulously designed and implemented with the overarching goal of elevating permanence and trackability, underpinned by a comprehensive survey management infrastructure. The feedback process is methodically delineated into distinct phases, commencing with the administrator's pivotal role in crafting the survey form, thereby laying the foundation for the ensuing feedback aggregation process. Subsequently, students are actively engaged in providing their invaluable feedback, fostering a culture of candid and participatory evaluation. The culminating phase entails the secure and impregnable storage of the solicited feedback on the Ethereum blockchain, thus ensuring integrity of the collated data.

The authors in [23] unveil an innovative online review system ingeniously underpinned by the application of blockchain technology. The authors adeptly employ the Solidity programming language and the Remix IDE (Integrated Development Environment) to meticulously implement and rigorously test the system, paving the way for a robust and secure online review ecosystem. The system allows genuine reviewers to receive tokens and payment in Ether upon completing reviews. The authors further augment the system's integrity by seamlessly integrating the InterPlanetary File System (IPFS), a distributed and decentralized storage solution. Through this integration, verified reviews are meticulously preserved, ensuring their immutability and reliability over time. As a future step, the authors plan to develop user-friendly decentralized applications for reviewers.

The main goal of this paper [24] is to increase transparency on business platforms by addressing fake or unreliable reviews. The system utilizes the Ethereum blockchain to store review information securely, preventing data manipulation. Additionally, the system ensures public traceability of actions, significantly improving the transparency of the online review system through blockchain technology. Using blockchain in this system may have drawbacks such as higher costs and slower response times.

The research papers previously mentioned delve into the development of student feedback systems that prioritize anonymity and data integrity. However, our innovative approach takes a step further, encompassing a performance-based evaluation system that serves as both a feedback mechanism and a valuable resource for identifying effective solutions to similar challenges. Diverging from some existing feedback systems, where administrators assign students to specific courses eligible for feedback, our proposed system introduces a seamless and automated validation process. By offering students the opportunity for self-registration, they gain access to provide feedback exclusively for the courses in which they are enrolled. Moreover, we introduce a novel rating-based system for evaluating faculty performance, a salient feature that bears immense potential for driving organizational improvement.

CHAPTER 3

METHODOLOGY

The principal aim of our system revolves around the seamless facilitation of anonymous feedback while upholding the inviolable integrity of data, thereby empowering students to express candid opinions without reservation. To achieve this pivotal objective, we judiciously harnessed the potential of blockchain technology, renowned for its remarkable capacity in safeguarding anonymity and preserving the unassailable authenticity of submitted feedback. Our system, thoughtfully designed, imposes stringent measures to guarantee that solely registered users possess the privilege to proffer feedback, assiduously safeguarding the covert identities of students, and diligently ascertaining that the feedback reaches its intended recipient for meticulous review. Fig. 1 below illustrates the system architecture of our proposed system.

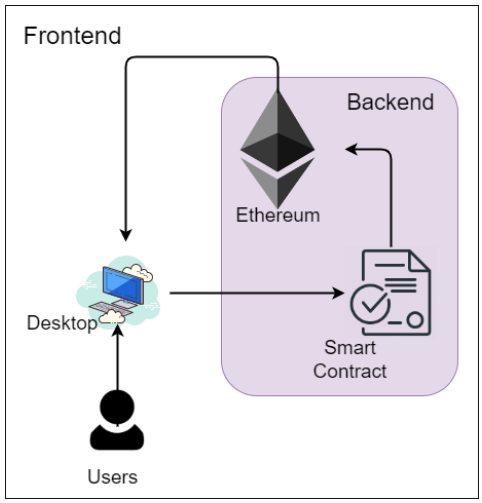

Fig. 1: System Architecture

As depicted in Fig. 1, our system has two distinct parts: front-end and back-end. The front-end is built using React.js and the back-end is developed using the Ethereum blockchain. Our system involves three key actors: the administrator, faculties, and students, each with a unique set of functionality that will be performed from their particular dashboard. To ensure anonymity, students provide feedback through customized forms accessible from the front-end of the system. This feedback is processed through smart contracts and securely stored on the Ethereum blockchain. The administrator and faculties can easily access this feedback through their respective dashboards, which retrieve the data directly from the blockchain.

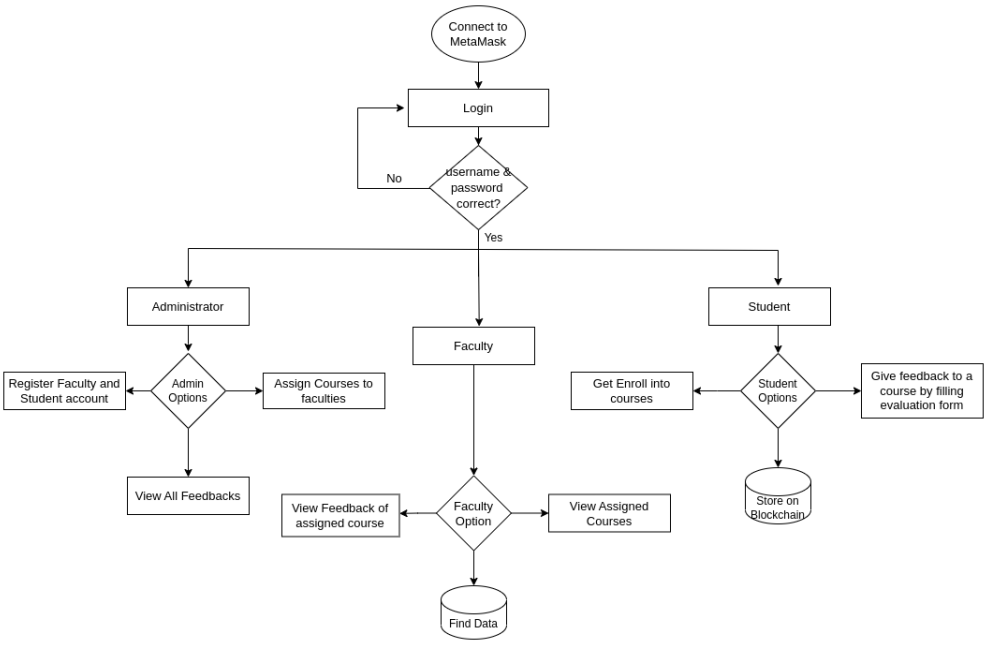

Fig. 2: Diagram of the proposed system

The student feedback system's diagram is clearly illustrated in Fig. 2, which depicts the various actors and their functionality and how the system is working. The student feedback system's diagram is clearly illustrated in Fig. 2, which depicts the various actors and their functionality and how the system is working. To initiate their engagement with the system, users are required to establish a connection to their Metamask wallet, followed by a secure login procedure employing a unique username and password. Once the username and password are validated, the system will identify the user's role, which may be administrator, faculty, or student. Depending on their role, users will be redirected to their corresponding dashboard, where they can perform specific functions tailored to their needs. For the distinguished administrator, the dashboard grants an array of powerful tools, enabling them to effectively manage user accounts, inclusive of the facilitation of new faculty and student account registrations, while also empowering them to create new courses and view all students' feedback. The student, once on their dashboard, can skillfully navigate the enrollment process for their chosen courses, and thereafter, leverage the platform to articulate and send their feedback to specific faculty members. Students are only able to submit feedback once in a course and cannot modify their responses afterward. Finally, faculties can access and view all feedback directed to them via their dashboard.

Working procedure:

We have developed a student feedback web application using blockchain technology. The whole procedure is divided into five phases described below.

Registration Phase: In this phase, the administrator registers new student and faculty accounts by accessing create account option from the dashboard. Once created, these accounts can be used by students and faculties to log in to the system. The user password will be encrypted and stored on the blockchain. Also, the administrator orchestrates a harmonious interplay of user registration and

course enrollment by the institution, culminating in an exceptional educational ecosystem fortified by secure blockchain foundations. The students can enroll in these courses later, and validation is done during the registration of user accounts and courses.

Login Phase: Our web application begins with a login page where users are required to seamlessly connect their Metamask wallets, an essential conduit for interaction with our blockchain-based ecosystem. The system verifies the password against the encrypted hash stored in the blockchain. In the event of a successful password match, a harmonious symphony of digital dexterity ensues, enabling users to gain access to their accounts and are redirected to their respective dashboards based on their roles (administrator, faculty, or student).

Course Enrollment Phase: During this phase, students will self-register for courses by accessing the enrollment option on their dashboard. They can view the institution's course list and enroll in a specific course by clicking on it.

Submit Feedback Phase: During this phase, the students will engage in the process of furnishing feedback on the courses and instructors by accessing the "give feedback" option conveniently positioned on their personalized dashboard. They select the course and faculty member for evaluation and fill out a feedback form with questions about the course and instructor.

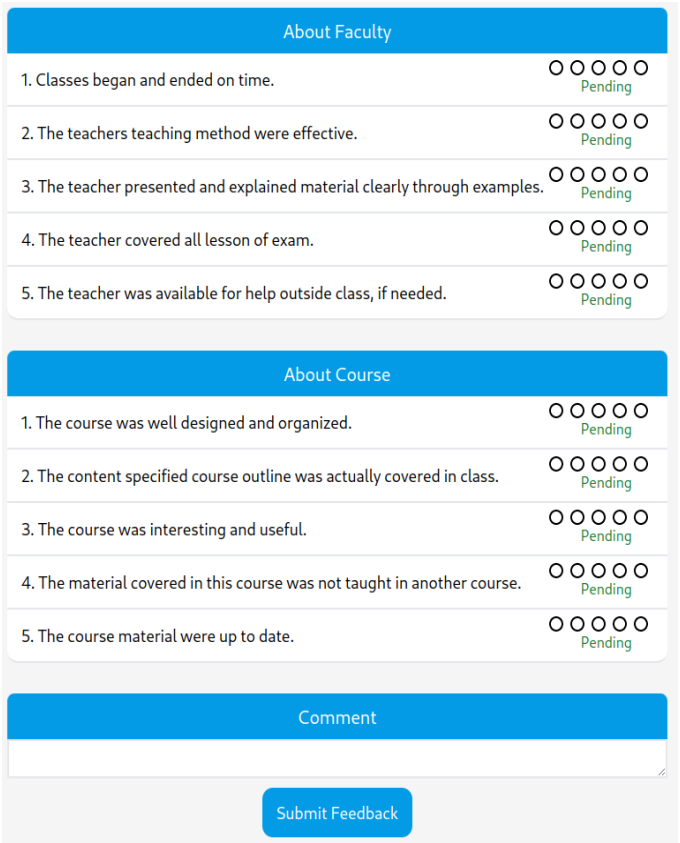

Fig. 3: Student feedback form

Our application's feedback evaluation form is illustrated in Fig. 3. The evaluation form consists of ten questions collected from the teaching evaluation system of Southeast University, Bangladesh. These questions help to evaluate the performance of the faculty. Each question carries a weight

between 1 and 5 using a Likert scale from 1 (strongly disagree) to 5 (strongly agree). We have calculated an average rating point out of 10 from the Likert scale responses submitted by students to assess the faculty's performance. Students are also encouraged to provide comments along with their chosen rating.

View Feedback Phase: In this phase, both the administrator and faculty members can access student feedback through their respective dashboards. Administrators have access to all course feedback, while faculty members can only view feedback for their assigned courses. Fig. 4 below shows the feedback page, displaying student ratings and comments. Moreover, we have created a formula to assess faculty performance in each course on a scale of 0 to 100 percent. The formula is the sum of total ratings divided by the number of feedback submissions, then multiplied by 10. Every faculty member will see a performance rating against a course here which is measured by the above formula.

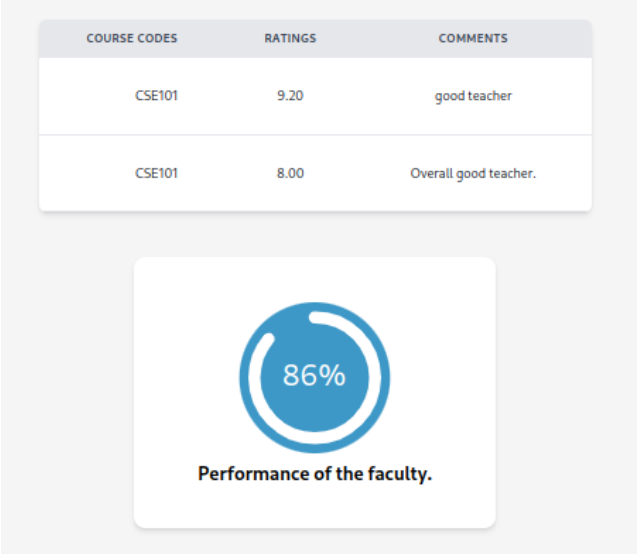

Fig. 4: View feedback page

CHAPTER 4

IMPLEMENTATION

This section focused on the implementation of the project code. We described the pseudocodes of functions and the tools used to build the project.

PSEUDOCODE 1: Function to create a new user account.

```
function createUserAccount(
        Argument username,
        Argument password,
        Argument role
    ) public {
        check If the caller is the contract Owner
                Create new User properties
                Store User Information
        else  return "Caller is not the contract owner"
        end
}
```

The "createUserAccount()" function serves as a pivotal feature, granting administrative personnel the authority to create new student and faculty accounts within the system. As an integral component of the client-side interface, this function necessitates specific parameters, namely the username, password, and role, to effectuate the creation process. When the administrator, duly vested with the requisite privileges, invokes this function, it initiates a series of operations geared towards generating and provisioning fresh user accounts. In essence, this function acts as a gatekeeper, regulating access to the system's resources and ensuring that only duly authenticated individuals can assume the roles of students or faculty members.

PSEUDOCODE 2: Function to submit feedback.

```
function submitFeedback(
        Argument userAddress,
        Argument courseCode,
        Argument rating,
        Argument comment
    ) public {
        check if the user has already submitted feedback
                then return "Your feedback already exists"
        else
                Create a new Feedback object
                Store the feedback
                Update feedbackTrack true for the userAddress and CourseCode
        end
```

```
}
```

submitFeedback() function allows the student to give feedback or do an evaluation against a course. The function validates that a student can submit feedback into a course for once.

PSEUDOCODE 3: Function for view feedback

```
function getFeedback(
        Argument courseCode
   ) public view returns{
        return the list of feedback
        end
}
```

getFeedback() function returns all feedback stored into the blockchain. This function allows the administrator and faculties to view feedback given by the students.

Used Tools:

We utilized a variety of tools to effectively achieve the project objectives. Below, we outline the specific tools used in this project:

Ethereum blockchain: The genesis of this pioneering system traces back to the year 2014, wherein its inception can be attributed to the esteemed individual, Vitalik Buterin[26]. Distinctive in its nature, Ethereum operates devoid of centralized governance, effectively evading the dominion of any singular authoritative entity[27].

Solidity: It is a powerful, user-friendly, and object-oriented language used to write smart contracts that operate on the Ethereum Virtual Machine.

MetaMask: It links users to the Ethereum blockchain and allows them to use the Ethereum wallet through a browser extension or mobile app. This allows them to interact effortlessly with decentralized or web3 applications[28].

Remix: Remix is an open-source online Ethereum IDE. It is the smartest way to write contracts using the Remix IDE[29]. We can use it to write, compile and debug code. We can write and deploy smart contracts from here.

ReactJS: It is a JavaScript library created specifically for constructing dynamic and interactive user interfaces using a component-based approach[30]. It is used to develop front-end of our web application.

CHAPTER 5

RESULT AND DISCUSSION

For the development and experimental validation of our proposed system, the Remix Integrated Development Environment (IDE) serves as the primary tool for composing and assessing the smart contract. Subsequently, to facilitate thorough testing procedures, the smart contract is deployed onto the Remix virtual network, effectively replicating a decentralized environment for examination. Within the context of our smart contract design, a singular entity, known as the "smart contract deployer," assumes the authoritative role of the system's administrator.

The existing system allows students to give feedback, whereas the proposed system introduces an advanced framework for evaluating faculty performance in courses, complemented by the option to provide feedback. In the existing system, the process of generating a permission list, which governs feedback privileges for specific courses, relies heavily on manual intervention. However, within the scope of this research, we have implemented an automated mechanism to handle this task seamlessly. Instead of conventional username-password pairs, the proposed system leverages the innovative approach of mapping user information based on their unique Metamask wallet addresses. Consequently, this approach enhances the overall security posture of the system significantly.

In our system, we implemented a robust encryption mechanism to safeguard user passwords during storage within the blockchain. Subsequently, when the user's login function is invoked, the stored password is decrypted securely. This encryption-decryption process serves as an integral aspect of our security infrastructure, augmenting the overall protection of user credentials and sensitive data. Furthermore, we devised a comprehensive performance evaluation approach for faculty members, quantifying their performance in courses through a percentage-based assessment. This evaluative metric empowers the academic authority to gain valuable insights into a faculty's instructional efficacy and effectiveness within the classroom setting. To uphold the integrity of the feedback process, we meticulously designed the system to ensure that each student is limited to providing feedback to a faculty member once and also ensured students can get enrolled in a course once. Once the smart contract passed the testing phase, we proceeded to deploy it on the Goerli test network. Metamask wallet wanted confirmation during deployment. Upon successful deployment of our smart contract, the contract was created and its address was returned to the Remix IDE. We collected this smart contract address and ABI(Application Binary Interface) from Remix IDE. This contract address and ABI were used to make communication between front-end and blockchain. Our newly deployed smart contract address is 0x6F04207829759752079DEE48136fd447c3F6198f. The source code of our feedback system is made accessible through the following link: https://github.com/uttamsaha/Web3-Student-Feedback-System

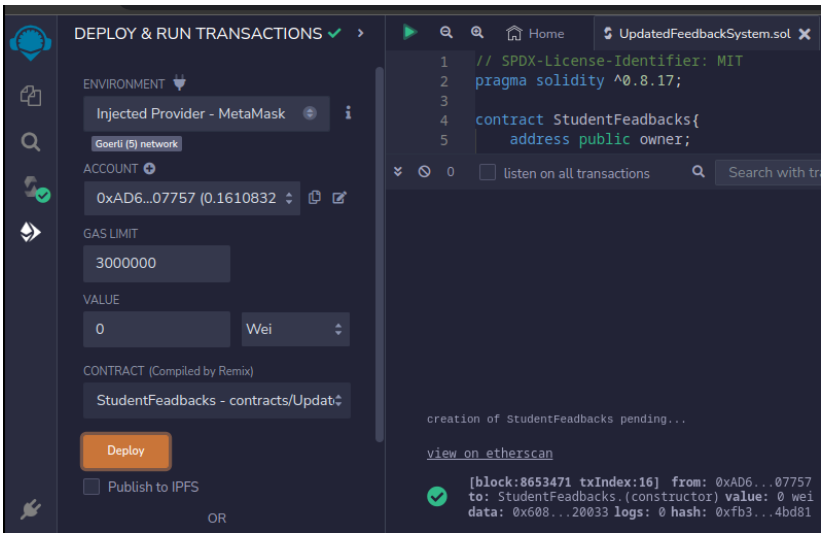

Fig. 5: Deploy smart contract to Goerlitestnet

Fig. 5 shows that we deployed our smart contract on the Goerlitestnet network.

CHAPTER 6

CONCLUSION

In today's digital age, feedback stands as a critical element for organizational enhancement and progress. Nonetheless, parallel to the imperative of obtaining valuable feedback is the need to safeguard the security and anonymity of the contributors. Preserving confidentiality emerges as a substantial challenge for any feedback system, as participants might harbor apprehensions about potential identity exposure. Consequently, feedback systems necessitate meticulously crafted designs that incorporate advanced security measures, effectively addressing these concerns and ensuring robust privacy and confidentiality. The challenges of ensuring confidentiality and security in feedback systems find a compelling resolution through the adoption of blockchain technology. Its inherent attributes, including decentralization, tamper-proofing, enhanced security, and anonymity, make it an ideal fit for addressing these concerns. Recognizing the potential of blockchain, our organization has harnessed its capabilities to construct a cutting-edge student feedback system that prioritizes both anonymity and security for its users. By leveraging blockchain, our system empowers users to freely and honestly express their feedback without the fear of their identity being exposed or facing repercussions. That is how our feedback system becomes more effective, reliable, trustworthy, and secure.

The feedback system does not permit modifications. Consequently, if a student inadvertently submits an incorrect evaluation, there is no opportunity to revise it. In our system, where user

anonymity is maintained, someone may purposefully provide negative feedback with the intention of harming a candidate's reputation. As the system will rely on blockchain technology for maintenance, the transaction rate is expected to be relatively slow.

The knowledge we've gained through this experience can be applied to other feedback systems or adapted for different applications in the future. Companies that rely on rating mechanisms can seamlessly integrate our feedback system into their operational framework, leveraging its robust features to enhance their feedback collection and analysis processes.

CHAPTER 7

REFERENCES

[1] T. Hatziapostolou and I. Paraskakis, “Enhancing the Impact of Formative Feedback on Student Learning Through an Online Feedback System,” vol. 8, no. 2, pp. 111–122, 2010.

[2] S. Bai, Q. Rajput, S. Hussain, and S. A. Khoja, “Faculty performance evaluation system: An ontological approach,” *Proc. IEEE/ACS Int. Conf. Comput. Syst. Appl. AICCSA*, vol. 2014, no. September 2015, pp. 117–124, 2014, https://doi.org/10.1109/AICCSA.2014.7073187

[3] M. Shaker, F. Shams Aliee, and R. Fotohi, “Online rating system development using blockchain-based distributed ledger technology,” *Wirel. Networks*, vol. 27, no. 3, pp. 1715–1737, 2021, doi: 10.1007/s11276-020-02514-w.

[4] Chandra and Billy “ Teaching feedback using blockchain and blind signature”, Nanyang Technological University, SCSE19-0196, 2020.

[5] D. Williams, “Australian hotel chain fined $2.2 million for manipulating TripAdvisor reviews.” cnn.com. https://edition.cnn.com/travel/article/australia-tripadvisor-hotel-fined-trnd/index.html (Accessed: 18 Apr 2023).

[6] K. Wang, Z. Zhang, and H. S. Kim, “ReviewChain: Smart Contract Based Review System with Multi-Blockchain Gateway,” *Proc. - IEEE 2018 Int. Congr. Cybermatics 2018 IEEE Conf. Internet Things, Green Comput. Commun. Cyber, Phys. Soc. Comput. Smart Data, Blockchain, Comput. Inf. Technol. iThings/GreenCom/CPSCom/SmartData/Blockchain/CIT 2018*, pp. 1521–1526, 2018, doi: 10.1109/Cybermatics_2018.2018.00256.

[7] Q. Feng, D. He, S. Zeadally, M. K. Khan, and N. Kumar, “A Survey on Privacy Protection in Blockchain AC,” *J. Netw. Comput. Appl.*, 2018, doi: 10.1016/j.jnca.2018.10.020.

[8] S. Ouyang and X. Huang, “Education Evaluation Management Based on Blockchain Technology,” *Mob. Inf. Syst.*, vol. 2022, 2022, doi: 10.1155/2022/7513365.

[9] M. M. Rahman, M. S. Uddin Siddiqe, and A. Uddin, “Headhunting System Using Blockchain Technology,” in HORA 2022 - 4th International Congress on Human-Computer Interaction, Optimization and Robotic Applications, Proceedings, 2022. doi: 10.1109/HORA55278.2022.9799851.

[10] X. Wang, L. Feng, H. Zhang, C. Lyu, L. Wang, and Y. You, “Human Resource Information Management Model based on Blockchain Technology,” *Proc. - 11th IEEE Int. Symp. Serv. Syst. Eng. SOSE 2017*, pp. 168–173, 2017, doi: 10.1109/SOSE.2017.34.

[11] M. Rahman, M. Azam, and F. S. Chowdhury, “Secure Complaint Management System against Women Harassment at Workplace Using Blockchain Technology,” *Int. J. Electr. Comput. Eng. Syst.*, vol. 13, no. 3, pp. 209–217, 2022, doi: 10.32985/IJECES.13.3.6.

[12] J. Yli-Huumo, D. Ko, S. Choi, S. Park, and K. Smolander, “Where is current research on Blockchain technology? - A systematic review,” *PLoS One*, vol. 11, no. 10, pp. 1–27, 2016, doi: 10.1371/journal.pone.0163477.

[13] N. O. Nawari and S. Ravindran, “Blockchain and the built environment : Potentials and limitations,” vol. 25, no. October 2018, 2019, doi: 10.1016/j.jobe.2019.100832.

[14] A. B. Ayed, “A CONCEPTUAL SECURE BLOCKCHAIN - BASED ELECTRONIC VOTING SYSTEM,” no. May, 2020, doi: 10.5121/ijnsa.2017.9301.

[15] M. M. Rahman, M. T. K. Tonmoy, S. R. Shihab, and R. Farhana, “Blockchain-based certificate authentication system with enabling correction,” 2023, [Online]. Available: http://arxiv.org/abs/2302.03877.

[16] F. Mollik, M. Rahman, M. Hasan, and M. Akter, “Blockchain in Human Resource Management System” no. February, 2023, doi: 10.13140/RG.2.2.34817.53609.

[17] S. Nakamoto, “Bitcoin: A peer-to-peer electronic cash system,” Decentralized business review, p. 21260, 2008.

[18] S. Haber and W. S. Stornetta, “How to time-stamp a digital document,” *J. Cryptol.*, vol. 3, no. 2, pp. 99–111, 1991, doi: 10.1007/BF00196791.

[19] N. R. Al Hamrani and A. R. Al Hamrani, “People of Determination (Disabilities) Recruitment Model Based on Blockchain and Smart Contract Technology,” *Technol. Invest.*, vol. 12, no. 03, pp. 136–150, 2021, doi: 10.4236/ti.2021.123008.

[20] Z. Zheng, S. Xie, H. Dai, X. Chen, and H. Wang, “An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends,” *Proc. - 2017 IEEE 6th Int. Congr. Big Data, BigData Congr. 2017*, pp. 557–564, 2017, doi: 10.1109/BigDataCongress.2017.85.

[21] M. M. Rahman, M. M. H. Rifat, M. Y. Tanin, and N. Hossain, “A feedback system using blockchain technology,” *Proc. 3rd Int. Conf. Intell. Sustain. Syst. ICISS 2020*, pp. 1114–1118, 2020, doi: 10.1109/ICISS49785.2020.9315989.

[22] A. Chandratre and S. Garg, “Blockchain Based Course Feedback System,” *SSRN Electron. J.*, 2021, doi: 10.2139/ssrn.3762332.

[23] K. Salah, A. Alfalasi, and M. Alfalasi, “A Blockchain-based System for Online Consumer Reviews,” *INFOCOM 2019 - IEEE Conf. Comput. Commun. Work. INFOCOM WKSHPS 2019*, pp. 853–858, 2019, doi: 10.1109/INFCOMW.2019.8845186.

[24] T. Karode and W. Werapun, “Performance Analysis of Trustworthy Online Review System using Blockchain,” *17th Int. Conf. Electr. Eng. Comput. Telecommun. Inf. Technol. ECTI-CON 2020*, pp. 510–513, 2020, doi: 10.1109/ECTI-CON49241.2020.9158212.

[25] J. Frankenfield, “What Is Ethereum and How Does It Work?.” investopedia.com. https://www.investopedia.com/terms/e/ethereum.asp (accessed Apr. 12, 2023).

[26] D. Martens and W. Maalej, “ReviewChain: Untampered product reviews on the blockchain,” *Proc. - Int. Conf. Softw. Eng.*, pp. 40–43, 2018, doi: 10.1145/3194113.3194120.

[27] K. Kelley, “What is Ethereum? Explained With Features and Applications.” simplilearn.com. https://www.simplilearn.com/tutorials/blockchain-tutorial/what-is-ethereum (accessed Feb. 17, 2023).

[28] D. Pramulia, “Implementation and evaluation of blockchain based e-voting system with Ethereum and Metamask,” pp. 18–23, 2021.

[29] R. M. A. Latif, K. Hussain, N. Z. Jhanjhi, and A. Nayyar, “A remix IDE : smart contract-based framework for the healthcare sector by using Blockchain technology,” 2020.

[30] S. Aggarwal, “Modern Web-Development using ReactJS,” vol. 5, no. 1, pp. 133–137, 2018.