BLOCKCHAIN-BASED FRAMEWORK FOR IT SKILL VALIDATION THROUGH ANNUAL HUMAN RESOURCE APPRAISALS

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Master of Science in Computer Science and Engineering

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APPROVAL

This Thesis titled **"Blockchain-based Framework for IT Skill Validation Through Annual Human Resource Appraisals"**, submitted by **Md. Rakib Hasan**, ID No: **163-25-545** to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of M.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation was held on **11-01-2025**.

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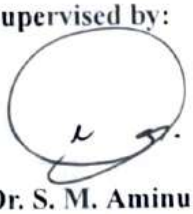

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ABSTRACT

Inefficiencies may arise from a mismatch between the workforce's experience and what companies actually require. To satisfy the industry's need for experienced IT professionals, organizations are currently facing challenges in finding them. An effective HR framework can resolve this issue. Due to the risk of single points of failure and the potential for data manipulation by managers or employers to favor specific employees, centralized systems are not suitable for this purpose. A decentralized system based on blockchain technology is necessary to ensure accountability, transparency, tamper-resistance, and security when addressing these concerns. The goal of this research was to develop a blockchain-based human resource (HR) framework for efficiently evaluating the skills of IT professionals and recording those data in a decentralized database. This database will be used for future job placements by matching the professionals' skills with company requirements. The implementation of this blockchain-based framework has successfully demonstrated the practical application of cutting-edge technology to create a secure, transparent, and efficient decentralized application, highlighting significant advancements in addressing potential shortcomings when recruiting an experienced IT professional.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The IT sector is a constantly evolving industry due to technological advancements and the increasing use of technology in various fields. There is a high demand for quality IT personnel following the emphasis on innovation as organizations seek to improve on their competitiveness. Nevertheless, a significant problem remains: there is a significant gap that separates the qualified labor force and the complicated task requirements of the firms. This inefficiency not only slows down the growth of the organization but also impacts the professional development of specialists in the IT sector. There are numerous problems in the current state of talent acquisition and management in the context of the IT business. These challenges include the issue of rating candidate's performance and experience, the prevalence of bias or distortion of information, and risks associated with centralized HR systems. Traditional HR enshrinement processes often rely on central databases and qualitative evaluations and thus are actually a single-thread model. Also, the threat of data manipulation by managers or employers poses a significant threat to the integrity of HR processes. This normally happens when there is no good fit between the workforce and the demands of the business. Consequently, the distribution of talent and resources is not optimal.

1.2 Significance of the Study

Finding ways to fix the current inefficiencies in the IT recruiting process caused by a mismatch between the abilities of the current workforce and the needs of the organization is the main significance of this study. Even when IT staff members are becoming more important to an organization, choosing and locating qualified applicants can be challenging. Traditional, centralized HR systems have been shown to be ineffective because they can be hacked easily, have a single point of failure, allow data manipulation or injection, or because managers or employers inject their biases into the process, which makes talent acquisition less fair and efficient. This research presents a novel context-aware blockchain framework for HR that is capable of transforming the

assessment and mapping of IT talent and organizational needs. Since blockchain technology has elements of transparency, security, and tamper-proof, this framework guarantees that skills validation is credible, unaltered, and efficient. The introduction of a decentralized database for storing and verifying the skill data not only improves the credibility of the recruiting process but also offers a sound model to the future job matching, making the talent acquisition more relevant to the actual requirements of target fields. This innovation is expected to enhance the effectiveness and accuracy of hiring practices within the IT industry making the solution a much-needed overhaul of the current status quo.

1.3 Research Question

1. What mechanisms can be implemented in a decentralized system to facilitate anonymous yet effective interactions between job seekers and employers?
2. How can blockchain technology enhance the transparency and reliability of data in the HR sector, specifically in the context of skill evaluation for IT professionals?

1.4 Research Objective

This research work aims at developing and deploying a blockchain-based HR solution that would help to assess the skills highlighted in the resume of the IT employees. With the help of this framework and applying the blockchain technology, it is provided an opportunity to develop a decentralized database connected with documenting skills and experience. With this kind of database, it would be easier to match the abilities of the professionals to the needs of organizations to increase the competency level of job placements. The research will focus on the following objectives:

1. **Developing a Decentralized Skill Assessment Record:** Creating mechanisms using the blockchain framework to keep the record of skill assessment appraisal of an IT Professional.
2. **Designing a Tamper-Resistant Database:** Design an immutable system to safely store relevant skill related information.

3. **Utilizing Data in Future Recruitment:** The information that will be documented will help in any future recruitment exercise by matching the skills of the professional with the job.

1.5 Report Layout

The report has six chapters as follows:

- **Chapter 1: Introduction**

  This chapter introduces the study by highlighting its significance and relevance. It presents the research question and objectives, outlining the specific goals of the investigation. Additionally, it provides a brief overview of the report's structure, guiding readers through the subsequent chapters and content.

- **Chapter 2: Background**

  This chapter explores various papers that were geared towards examining the role of blockchain technology in human resource (HR) processes, including recruitment, payroll, and performance management. The discussion highlights the applicability of blockchain in addressing typical HR problems such as fake certificates and ineffective workflows.

- **Chapter 3: Blockchain Technology Concept**

  This chapter delves into the concept of blockchain technology, starting with its history and development. It explains blockchain as a decentralized system, outlines different types of blockchain, and highlights key characteristics of the technology. The chapter also discusses the evolution of blockchain technology, tracing its growth and advancements over time.

- **Chapter 4: Research Methodology**

  This chapter details the research methodology, starting with an introduction to the approach. It covers the research subject and instrumentation, describes the data, and explains the statistical analysis used. The proposed methodology and model workflow are also outlined to provide a clear understanding of the study's framework and processes.

- **Chapter 5: Result and Discussion**

  This chapter presents and analyzes the findings of the study. It begins with an introduction to the results, followed by a detailed explanation of the experimental implementation. The tools used in the study are also discussed to provide context and support for the results.

- **Chapter 6: Conclusion and Future Work**

  This chapter summarizes the key findings of the study, drawing important conclusions from the research. It discusses the implications of these findings and suggests areas for further study, providing a roadmap for future research endeavors.

CHAPTER 2

BACKGROUND

2.1 Related Works

The authors in reference [2] have suggested the creation of a blockchain-based human resource (HR) framework designed to align a company's requirements with workforce competencies. This framework will support the Corporate Training Center in standardizing competencies, allowing the HR Department to develop training materials.

The authors in [10] discussed the use of blockchain in recruitment, payroll and performance management systems highlighting enhanced transparency, security and efficiency. The use of Blockchain-based Recruitment Management Systems (BcRMS) and Blockchain-based Human Resource Management Systems (BcHRMS) is demonstrated to be more effective in terms of costs and accountability than the use of traditional HRM systems. However, the paper has some restrictions, such as limited description of how it can be incorporated into HRM and other enterprise systems. The authors in [9] explain that blockchain can help reduce risks in the recruitment process, including fake documents and lengthy background checks, by leveraging decentralization, immutability, and transparency. They suggest that the use of blockchain can eliminate inefficiency and, consequently, the costs and bureaucratic measures while enhancing transparency and compliance. Consequences are also considered from the application level, that is, how the blockchain can ensure the proper and legal transfer of employee information from the time of their employment to the time of termination of work in an organization. Some of the challenges that have been observed include; it is not easy to adopt blockchain technology with the current HR systems.

The authors in [8] explain how blockchain can be used in other areas including cross border payment systems, trade and smart contract all of which presents new business models and sharpens operational performance. However, the research also recognizes the areas that require further exploration and development relative to the practical use, massive adoption, legal compliance, and data management.

The authors in [7] use a block chain to solve typical HR problems such as fake employee information and unfair assessment. On the other hand, this paper is highly theoretical and needs further practical confirmation of the stated hypotheses. It both discusses how blockchain can transform HR practices and underlines the importance of future research for confirming and enhancing the effectiveness of these suggested concepts.

The authors in [3] suggested a decentralized system to evaluate employees in Smart Government System, using blockchain technology. They mainly used Hyperledger Fabric as the blockchain platform, creating a decentralized structure for reliability and transparency. Government employees often don't trust centralized systems because they can have issues and be controlled by higher-ups, leading to favoritism. The proposed system aims to address these concerns. Employees are crucial for any organization, and a proper performance assessment gives a clear picture of how they're doing. These evaluations help not only in recognizing and improving poor performance but also in motivating employees to do well. Many research studies show that a good appraisal system is linked to increased motivation and productivity. Traditional manual assessment systems, where managers assess employees, can be biased due to human nature or lack of proper training, resulting in incomplete feedback.

2.2 Scope of the problem

Although there is a significant amount of research dedicated to examining how blockchain might be applied to handle payroll, HR and other systems, there are less studies that have investigated its potential use in the field of skill appraisal analysis. My findings indicate that while numerous companies presently utilize blockchain technology to verify documents in the hiring process for IT candidates, both new and experienced, there exists a notable potential to further improve this aspect, specifically in the recruitment of experienced IT professionals by validating their previous appraisal. Given these findings, we have chosen to concentrate our efforts on creating a performance appraisal recording and reviewing system for the IT employees. This system will assist HR departments in making better-informed recruitment choices by evaluating potential IT candidates based on their established records of skills and assessments.

2.3 Challenges

Following challenges can be identified associated with this proposed framework:

1. **Accuracy and Verification of Skill Assessments:** Verifying the accuracy of skill assessments and ensuring the credibility of the data recorded.
2. **Integration with Existing HR Systems:** Integrating the blockchain-based solution with existing HR systems and processes.
3. **Scalability and Performance:** Ensuring the blockchain system can handle large volumes of data and transactions efficiently.
4. **Cost and Resource Management:** Managing the costs associated with deploying and maintaining a blockchain infrastructure.
5. **User Adoption and Training:** Encouraging adoption among HR professionals and training them to use the new system effectively.

However to overcome the mentioned challenges we may consider followings:

- Integrating automated assessment tools and cross-verify with professional credentials.
- Developing APIs and middleware for seamless integration.
- Optimized smart contract and database design for efficiency.
- Evaluate cost-effective blockchain platforms (e.g., proof-of-stake networks).
- Providing user-friendly interfaces and extensive training programs.
- Developing detailed documentation and support resources.

CHAPTER 3

BLOCKCHAIN TECHNOLOGY CONCEPTS

3.1 Introduction

Usually an author in a centralized system may alter or update any information stored in the system, those authors have the ability to remove information. However, no central author exists in a blockchain based system and for this no one can delete or modify any information in a distributed ledger. Every individual who participates in the blockchain system has authority over the system. Furthermore, a distributed ledger almost eliminates the danger of losing information because it has many duplicates of all pieces of information. Any attempt to alter the information will result in the chain being considered illegitimate. As a result, this compromised update request will not be accepted by other nodes on the network.

3.2 Types of Blockchain

The main purpose of the blockchain is to facilitate transfers of information or dealings over a distributed, decentralized system. However each kind of blockchain has a different set of fundamentals of operation and applications. The particular kind of network utilized for creation, the intended audience, the type of deals, accessibility, and privacy concerns all influence a blockchain's structure. Based on these features of the development and architecture, the blockchains are divided into the following four types:

- **Public Blockchain:** Public Blockchains are the earliest kind of blockchains that are always exposed to any individual with an internet connection. The public blockchain system operates independently and decentralized, with no central authority. This kind of blockchain typically doesn't require advance approval in order to enter or operate it. Whenever an individual owns an account on a public blockchain, they are permitted to view previous transaction information, can validate newest transactions, conduct proof-of-work, and act as miners by contributing the record of transactions to the worldwide immutable database.

Each deal or operation generates a block, which is subsequently verified and appended to the preceding block. [6] For instance, Ethereum, Bitcoin etc.

- **Private Blockchain:** Users who participate in this kind of blockchain system have controlled entry to private blockchains, which are permissioned and restricted distributed ledger. The responsibility for controlling participant access to the network and upholding its high level of protection collapses on one or more central authorities. The use of private blockchains to eliminate the need for middlemen in deals or transfer of information is limited by their reliance on third parties for management and operation, despite the utmost security of their transactions. Additional characteristic of private blockchains is the fact that the transaction information is visible to those who are engaged in that deal, but not to other individuals in the chain. The banks and other economic organizations typically use private blockchains inside. [6] For instance, Multichain, Hyperledger Fabric, etc.

- **Consortium Blockchain:** This kind of blockchains are established and operated based on the shared platform and assets concepts. Consortium blockchains, as compared to public or private blockchains, are managed by multiple entities. Companies with identical commercial operations come to an agreement on blockchain platforms and pool their resources—finance, skills, and other—to create a consortium blockchain. Consortium blockchain's primary positive aspect is that it allows companies to take advantage of economies of scale. [6] For example: Corda, R3

- **Hybrid Blockchain:** This type of blockchain system integrates the best elements from both private and public blockchain. All users worldwide have access to public blockchains, but using them takes time because a lot of data must be computed for each node in order to modify the ledger. Moreover, because they are open to the public, users' security is compromised as well. Private blockchains, on

the other hand, are only accessible by users with a permit. Private blockchains have high security and speed due to their small user base, but they are managed by a central authority that can add or change information. The benefits of both public and private blockchains are combined in hybrid blockchains, which allow anyone to access and use the ledger with open permissions while maintaining a central monitoring system to keep an eye on any updates or modifications to information. [6]

It is clear from the explanation above that there are two basic types of blockchain technology that have developed over time: public and private. Extended versions of these types of blockchains, known as consortium and hybrid blockchains, were created to improve service levels.

Table: 3.1 Types of Blockchain Technology

Type of Blockchain	**Accessibility**	**Authorization**		
		Read	**Write**	**Example**
Public	Global	Anyone	Anyone	Ethereum
Private	Restricted	Authorized Users	Network Users	Hyperledger Fabric
Consortium	Restricted	Authorized Users	Authorized Users	Corda
Hybrid	Global	Anyone	Authorized Users	Ripple

3.3 Characteristics of Blockchain Technology

As blockchain technology was first used in practice, mostly as a substitute for traditional peer to peer transfers of money, it has drastically changed the mode of transactions in terms of trust, authentication and functional procedure. As a result, a number of industries are quickly implementing blockchain technology to carry out a variety of tasks. [5]

- **Decentralized Database:** The core concept of the technology behind blockchain is the idea of a peer-to-peer network, in which individual terminals are connected without the need for a centralized governing body. All engaged nodes' computational capacity can be used in operations, and information is circulated

between blockchain users, lowering the likelihood of a single point of breakdown and operations latency while boosting the system's scalability and resilience.

- **Transparency:** A block in blockchain technology is generated using an end-to-end encoding mechanism. Trust between individuals is insignificant because all involved parties are aware of the open and transparent processing of information methods. The individuals involved can confirm the most recent ledger information, and they must authenticate the transactions. This removes the possibility of transactional fraud.
- **Unanimous Agreement:** The process of confirming and validating a transaction in the system based on consent from every individual involved is known as the consensus mechanism, and it is essential to the operation of any blockchain network. Before a transaction takes place, everyone involved must agree on the rules of the process of consensus, which might be adjusted following transaction requirements. It reduces or eradicates the necessity to rely on a third party to confirm the validity of the transactions.
- **Immutable and Encryption-protected:** One of blockchain technology's key characteristics is immutability, which reflects the technology's capacity to maintain transaction information's trustworthiness. The block generation hash algorithm effectively accomplishes this. A newly generated block contains both the hash from the previous block and the current one. It is paired with the previous block once it has been confirmed and approved by both parties. Due to this feature, it is highly unlikely for an attacker to alter any block's contents because doing so requires obtaining the hash information of every block that came before it.
- **Auditable:** Every transaction that takes place on the blockchain is preserved as evidence. Every transaction becomes permanent and irreversible because it is the result of the parties' mutual agreement. Additionally, all network participants or a subset of them are given access to the transaction information, allowing them to verify the legitimacy of the transactions.

3.4 Evolution of Blockchain Technology

Blockchain technology can be divided into several eras, starting with the Bitcoin Era that spans between the years 2008 and 2012. All started in 2008 with the release of the Bitcoin whitepaper by an unknown person or group under the pseudonym Satoshi Nakamoto calling for the creation of a peer-to-peer electronic cash system. Officially, the creation of the first decentralized cryptocurrency occurred with the launch of Bitcoin in 2009. This period revolved mainly around the introduction and early days of Bitcoin as a Currency that can work autonomously from the central authorities and as a new form of Currency based on the principles of the blockchain .

Moving to Altcoin and Smart Contract Era (2013-2017), blockchain technology has shown diversification and development. The year 2015 was also significant for the appearance of Ethereum, which promoted the idea of a programmable blockchain with the ability to perform intelligent contracts. This made it possible for developers to develop decentralized applications (DApps) and led to the emergence of other types of cryptocurrencies such as Litecoin and Ripple, which came up in an endeavor to fix some of the perceived flaws of Bitcoin or to try out new uses for the blockchain technology. The ERC-20 token standard established by Ethereum became the foundation for many emerging projects, and during this time, ICOs became even more widespread as a way for start-ups to fund their projects but quickly attracted the attention of regulators.

The third epoch, the Enterprise and DeFi Era (2018-2020), saw a transition from user-oriented blockchain development to enterprise solutions and decentralized finance or DeFi. Larger companies and tech behemoths such as IBM and Microsoft started experimenting with blockchain solutions for a variety of uses such as, but not limited to supply chains, identity, and payments across borders. At the same time, decentralized finance or DeFi started to emerge, using blockchain technology to redesign centralized activities like lending, borrowing, and trading with no middlemen and thus extend the financial opportunities for everyone. Another product that also appeared at the same time is stablecoins that are cryptocurrencies backed by more stable assets such as the US dollar.

Moving on to the NFT and Scaling Era, which is from 2021 to 2024, the application of blockchain technology remained active and gained significant traction. Blockchain became mainstream popular culture when Non-Fungible Tokens (NFTs) started which allowed digital art, collectibles and other assets to be bought and sold through blockchain marketplaces. At the same time, major improvements were made on scalability and connection of blockchains to overcome shortcomings of the previous networks. Layer 2 solutions such as Optimism and Arbitrum aimed at increasing the speed and decreasing the cost of transactions while cross-chain solutions focused on the seamless interaction between different blocks within the network. Another major shift was in Ethereum's change from Proof of Work (PoW) to Proof of Stake (PoS) in "The Merge", highlighting another step towards sustainable and efficient functioning of blockchains.

Table: 3.2 Evolution of Blockchain Technology

SL	Years	Blockchain Technology Progress	Description
1	2008-2012	Bitcoin Era	Introduction and early adoption of Bitcoin.
2	2013-2017	Altcoin and Smart Contract Era	Emergence of Ethereum and alternative cryptocurrencies.
3	2018-2020	Enterprise and DeFi Era	Focus shifts to enterprise use and decentralized finance.
4	2021-2024	NFT and Scaling Era	Mainstream adoption of NFTs and advancements in blockchain scalability and interoperability.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 Introduction

In the traditional recruiting process of experienced IT professionals, the human resource department typically reviews the candidates' CVs to evaluate their skills and expertise. Based on this information, interview questions are asked. Sometimes, candidates are also given small tasks relevant to their work during the interview.

Recently, a new trend in hiring experienced IT professionals has emerged where shortlisted candidates are given an assignment with a deadline of submission. This approach creates the possibility that candidates might seek help from others to complete their assignments.

4.2 Proposed Framework

Typically, one organization does not share its internal HR-related information with another organization unless there is a formal collaboration between them. Therefore, during the recruitment process, it is often difficult and time-consuming to gather necessary information about a candidate's skill appraisal. Such information is important because the recruitment board usually lacks insights into the candidate's performance in their previous organization. Simultaneously, the organization losing the employee will face similar challenges when recruiting a replacement. The traditional system has a gap: appraisal reports for the mentioned skills cannot be found during recruitment. Different organizations naturally have their own mechanisms and appraisal systems for evaluating employee skills. However, if we could establish a uniform platform for appraising these skills, particularly for IT professionals, it would benefit the entire IT industry.

This study proposes a portal where different organizations can register as employers. Through this portal, they can evaluate and record their IT professionals' skills and appraisals. This data will then be accessible to other registered employers.

In the proposed portal, a particular employee's data will be available to employers whenever that employee is available for hire. During the recruitment process, employers will be able to retrieve an applicant's skill appraisal data using their unique Employee ID from this portal. At this point, the applicant will be notified that their appraisal data has been reviewed by the concerned employer.

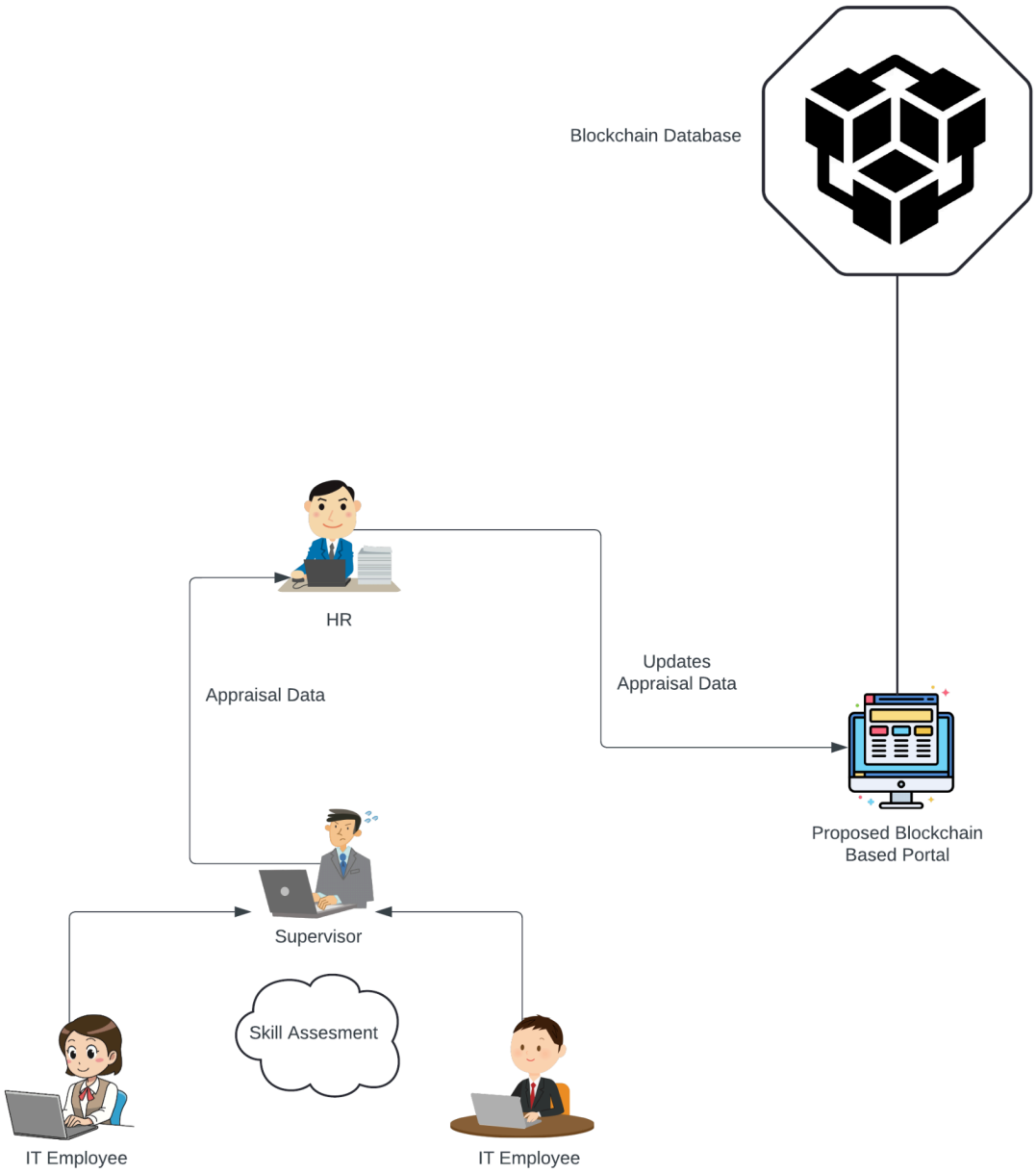

Figure 4.1: IT Employee Appraisal Data Updated in Blockchain Based Portal

In the figure 4.1 above, it is demonstrated that the IT employees' skills are being assessed under the supervision of their supervisor. After the assessment is completed, the results are sent to HR for updating in the blockchain-based portal to keep a record, which can be utilized later during the employees' next recruitment.

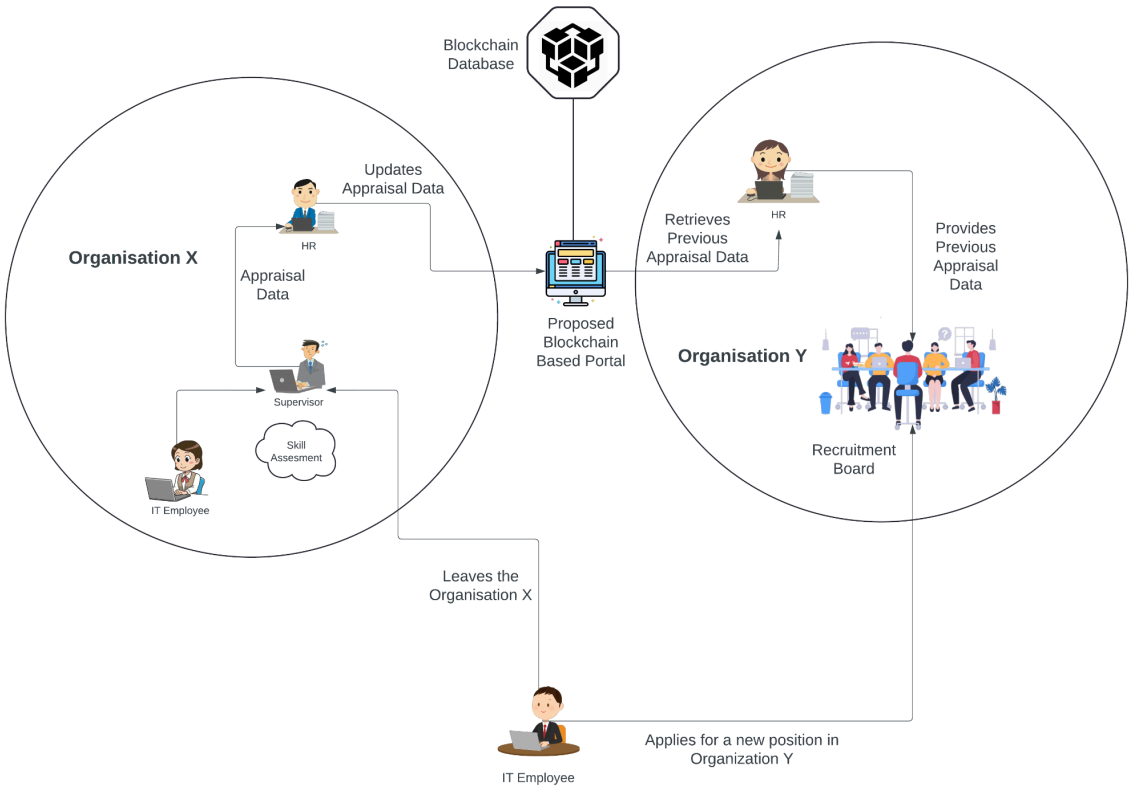

Figure 4.2: IT Employee Leaves an Organization and Applies for Another

In the figure above, it is demonstrated that an IT employee has left “Organisation X” and applied for a new position in “Organisation Y.” Since the appraisal data of that particular employee was updated in the blockchain-based portal during his tenure at Organisation X, it is now available to Organisation Y as he applies for a position there.

In this research work we will develop a blockchain based framework in which following two key functionalities will be implemented.

- **Create Employee:**

  Whenever someone enters the job market and finds a position in a company or organization as a fresher, the company will create an account for this employee for the first time. During this process, the employee must confirm the account opening via an OTP sent to his/her mobile number. The information provided

during this account setup must be very precise and accurate. The employer must cross-check the data provided by the employee to ensure its correctness. Once the data is verified by the employee, the employer will submit this information to open the account.

This new employee will start working at this organization and will be tasked with responsibilities that require specific skills. However, the employee will gradually learn new things and become proficient. After a certain period, the company will perform an appraisal of his skills and expertise and store this data in their system. The study we have conducted suggests that the company should also update this data in the proposed blockchain system.

This appraisal system may vary from organization to organization, which is very natural. However, we have proposed a unified parameter and mechanism to evaluate skills and expertise.

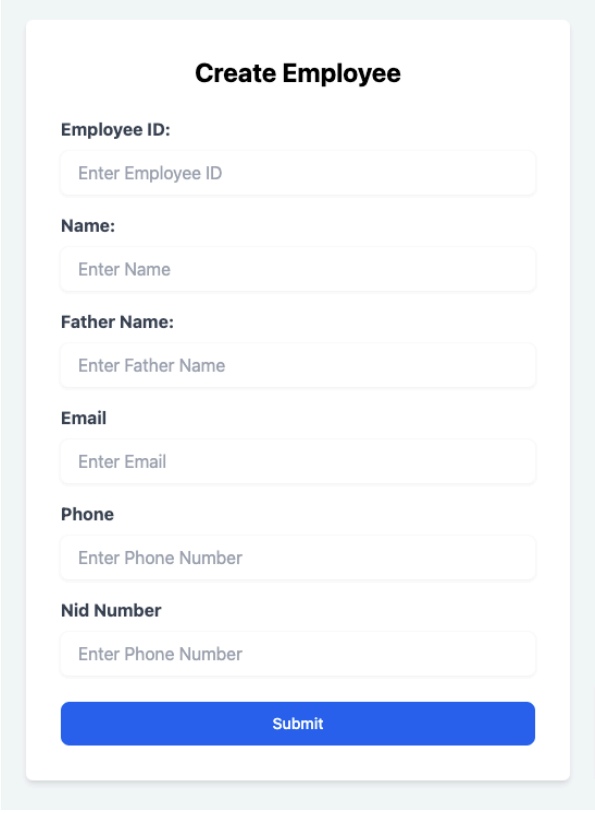

Figure 4.3: Create Employee

- **Employee Appraisal Form:**

  Most companies evaluate their employees after they have worked for a certain period. This evaluation system is not uniform and can be easily manipulated. We propose a basic form to evaluate employees' skills. This form consists of several questions and ratings, including:

  Questions:

  1. Unique Employee ID
  2. Appraisal Time Period
  3. Major duties and responsibilities performed during this time period
  4. Skill Required for the Tasks He Performed

  Ratings:

  - Overall Skill Assessment
  - Precision & Accuracy of Work
  - Cooperation, Team- Spirit, Manners & Etiquette
  - Attendance & Discipline

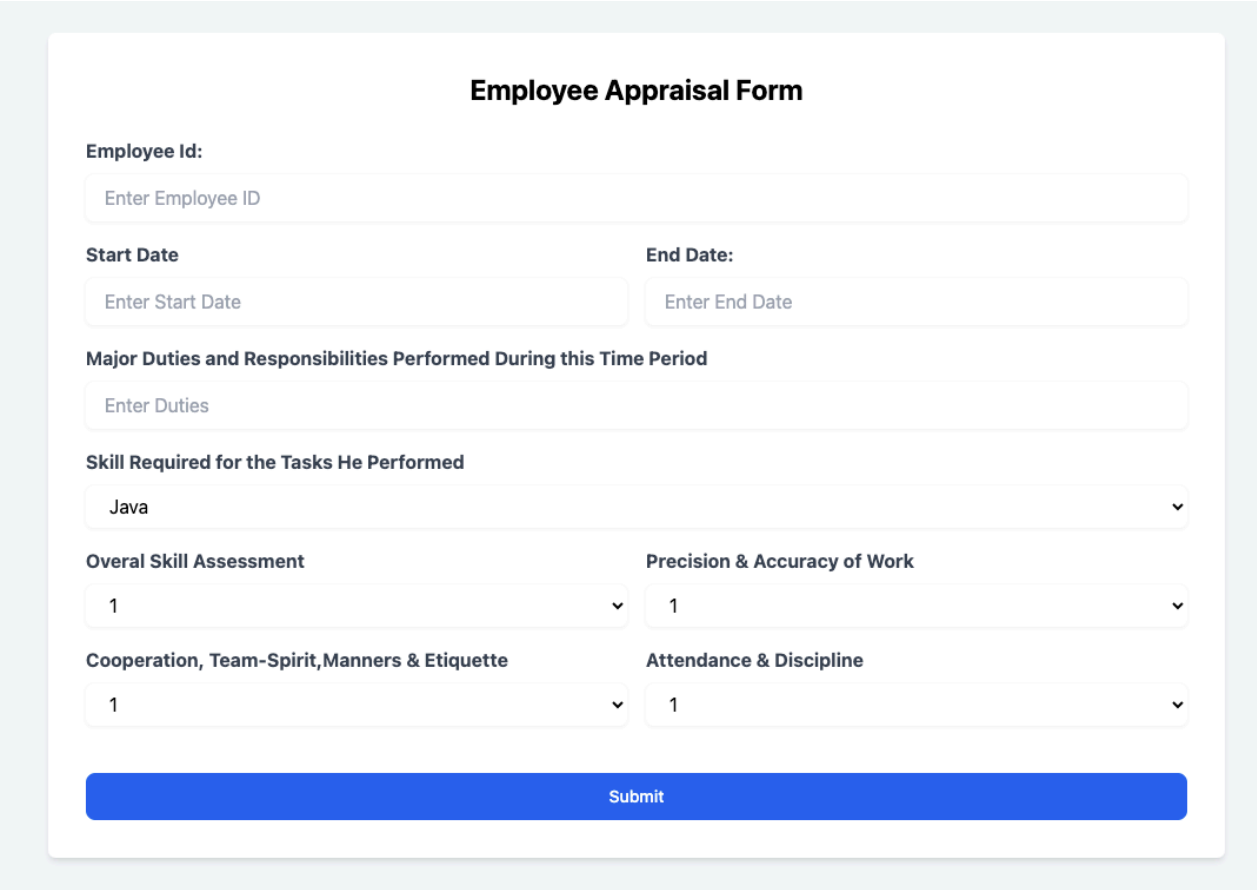

Figure 4.4: Employee Appraisal Form

CHAPTER 5

RESULTS AND DISCUSSION

5.1 Introduction

In this chapter we will find the experimental implementation of the concept. I have focused on creating a secure and efficient decentralized application using blockchain technology. The core of the system is built on the Ethereum Testnet, specifically the Sepolia Testnet, which provides a safe environment for testing. Smart contracts, which are self-executing agreements with the terms directly written into code, are developed using Solidity and managed through the MetaMask wallet. MetaMask ensures the secure storage and transfer of digital assets.

For developing and deploying these smart contracts, we use Remix IDE, a user-friendly tool that makes the process easier. The frontend of the application is designed with Tailwind CSS, which helps in creating a clean and user-friendly interface. This combination of technologies demonstrates how blockchain can be practically applied to develop reliable and decentralized applications.

5.2 Experimental Implementation

The diagram in Figure 5.1 illustrates a blockchain-based framework integrating an Ethereum Testnet backend with a user-friendly frontend. The backend features a smart contract deployed on the Ethereum Testnet, accessible via MetaMask Wallet, which manages transactions and digital assets. The Application Binary Interface (ABI) facilitates communication between the smart contract and the frontend. End users interact with the application through the frontend, enabling secure, transparent, and efficient transactions within the blockchain environment.

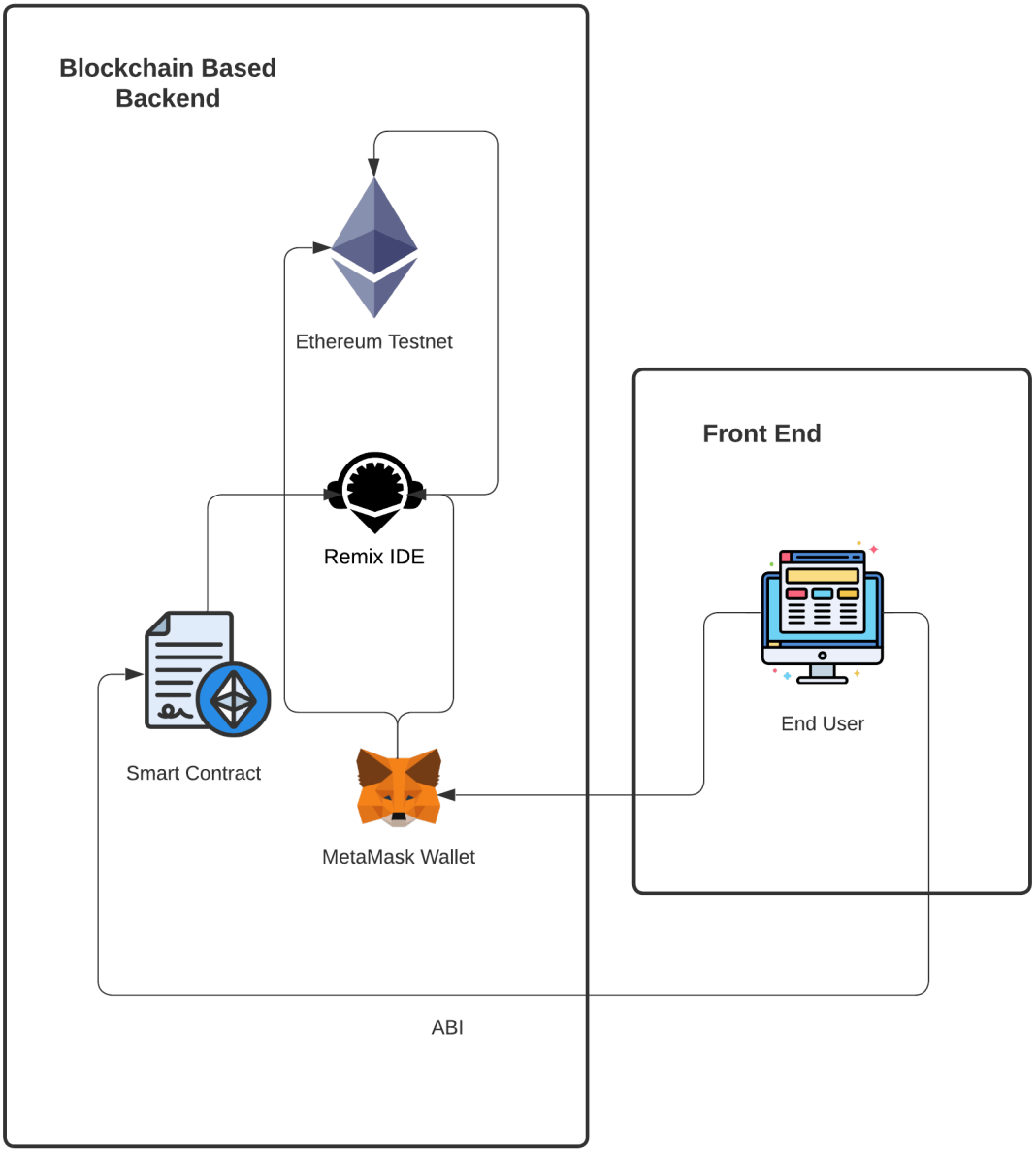

Figure 5.1: Experimental Implementation

5.3 Tools Used

In this section, we delve into the essential tools utilized in developing our blockchain-based framework. Each section highlights a specific tool and its contribution to the overall implementation:

- **MetaMask**

  MetaMask is Ethereum-based browser extension that enables users to safely store, transfer and interact with dApps via Ethereum blockchain. As a Chrome extension and an Android app, MetaMask ensures the safe storage and smooth command over your cryptocurrency and allows users to freely navigate through the decentralized internet. It serves as a go-between for your browser and Ethereum, allowing you to store, transfer, and receive Ethereum as well as ERC-20 tokens, and even purchase NFTs. MetaMask gives the possibility to manage private keys, which means that no one else will have access to your funds and tokens.

- **Sepolia Ethereum Testnet**

  Sepolia Ethereum Testnet is a testnet that can be used by developers dealing with the Ethereum blockchain. It enables developers to test smart contracts, decentralized applications to be built using Ethereum and blockchain protocols generally to be deployed on the main network of Ethereum without any risks. Sepolia offers a separate testing ground to check the code's health and performance issues before deploying apps on the live Ethereum network. Being as close to Ethereum mainnet conditions as possible, this testnet allows developers to work or test their creations under relatively real life conditions, which makes this tool invaluable for the Ethereum developer community.

- **Remix IDE**

  Remix IDE is an efficient integrated development environment for smart contract development intended for the Ethereum blockchain system. It is very easy to use and enables one to write, compile, and deploy smart contracts using Solidity, which is Ethereum's programming language. Some of the capabilities of Remix IDE include the integrated compiler, the debugging amenities, and the robust plugin system that make it suitable for all levels of developers. It provides instant analysis of the code and makes it very convenient to work with the Ethereum

system being used for the creation, testing, as well as deployment of DApps. The Remix IDE is uniquely positioned for enhancing the Ethereum smart contract creation process whether you are a newbie in blockchain development or a proficient developer.

- **Solidity Language**

  Ethereum is a blockchain platform, while Solidity is a high-level programming language used to build smart contracts. Originally designed to help construct self-governing contracts with predetermined action sets and conditions, Solidity allows programming of highly sophisticated contractual algorithms right in the blockchain. It has a syntax that relates to JavaScript, and as such, programmers who are already experienced with other languages will find it relatively easy to use. It supports both object-oriented and contract-oriented programmers and is statically typed so that he or she is informed of any mistake when compiling the code. Some of the main features of Solidity are its applicability to dApps, modular nature, provisions for transactions, and responsibility for user and blockchain interactions. Ethereum is among the most popular platforms for building DeFi applications, Non-Fungible Tokens, and many other innovations based on the principles of decentralization, making it the backbone of many present-day decentralized platforms.

- **Tailwind CSS**

  Tailwind CSS is a contemporary utility-first CSS framework that can help to envision web applications in a different way. Unlike other CSS frameworks which offer ready-made elements, Tailwind gives the developers the ability to create their own designs by applying element specific classes to their HTML. These utility classes encompass a variety of styles including but not limited to margins, paddings, colors, and fonts making it easier and more versatile for the development. Tailwind encourages designing into reusable style components

which are then built up as necessary, making for more sustainable and extensible code. Styling unleverages the utility-first design approach in enhancing efficiency and order, which is an advantage for developers who want a neat and effective designing system.

5.4 Pseudocode

Pseudocode: Create Employee

```
Define Structure Employee:
    id: string
    name: string
    father: string
    email: string
    phone: string
    nid: string

Initialize Mapping employees: string -> Array of Employee
Initialize Array allEmployees: Array of Employee

Procedure Create(id, name, father, email, phone, nid):
    Create new Employee object emp with given details
    Append emp to employees[id]
    Append emp to allEmployees

Procedure GetEmployee(id):
    Return employees[id]

Procedure GetAllEmployees():
    Return allEmployees
```

Pseudocode: Employee Appraisal

```
START

DEFINE STRUCTURE Appraisal:

    id: STRING

    start: STRING

    end: STRING

    duties: STRING

    skills: STRING

    skillpoint: STRING

    accuracypoint: STRING

    spiritpoint: STRING

    attendancepoint: STRING


DEFINE MAPPING appraisals (STRING => LIST OF Appraisal)

DEFINE LIST allAppraisals


FUNCTION create(_id: STRING, _start: STRING, _end: STRING,
_duties: STRING, _skills: STRING, _skillpoint: STRING,
_accuracypoint: STRING, _spiritpoint: STRING, _attendancepoint:
STRING):

      INITIALIZE newAppraisal AS Appraisal WITH (_id, _start,
_end,    _duties,    _skills,    _skillpoint,    _accuracypoint,
_spiritpoint, _attendancepoint)

    ADD newAppraisal TO appraisals[_id]

    APPEND newAppraisal TO allAppraisals


FUNCTION getAppraisal(_id: STRING) RETURNS LIST OF Appraisal:

    RETURN appraisals[_id]


FUNCTION getAllAppraisals() RETURNS LIST OF Appraisal:

    RETURN allAppraisals

END
```

5.5 Implementation Outcome

The implementation of this blockchain-based framework has successfully demonstrated the practical application of various cutting-edge technologies to create a secure, transparent, and efficient decentralized application (dApp). By leveraging the Ethereum Testnet, specifically the Sepolia Testnet, we were able to provide a safe and reliable environment for testing and validating smart contracts before deploying them to the main Ethereum network. This approach mitigated potential risks and ensured the robustness of the smart contracts. Overall, the implementation outcomes demonstrate the feasibility and advantages of using blockchain technology to build decentralized applications. The framework's design ensures secure, transparent, and efficient transactions, highlighting the potential of blockchain in revolutionizing digital interactions and asset management. This successful integration paves the way for future advancements and applications in various domains leveraging blockchain technology.

CHAPTER 6

CONCLUSION AND FUTURE WORK

6.1 Summary of the Study

This study addressed the inefficiencies that arise from mismatches between the experience of the IT workforce and the actual requirements of companies. Recognizing the challenges organizations face in recruiting experienced IT professionals, the research aimed to develop a solution utilizing blockchain technology. The goal was to create a decentralized human resource (HR) framework to efficiently evaluate and record IT professionals' skills. This framework leverages blockchain's inherent properties—accountability, transparency, tamper-resistance, and security—to ensure reliable data management. The implementation successfully demonstrated how cutting-edge technology can overcome the limitations of centralized systems, providing a robust tool for future job placements by matching professionals' skills with company requirements.

6.2 Conclusions

The implementation of a blockchain-based HR framework has proven effective in addressing key challenges in the recruitment and evaluation of IT professionals. By decentralizing the data management process, the framework mitigates risks associated with single points of failure and potential data manipulation. The study highlights significant advancements in ensuring secure, transparent, and efficient evaluation and recording of professionals' skills. This approach not only enhances the reliability of the recruitment process but also aligns professionals' capabilities with organizational needs, thereby addressing a critical industry requirement.

6.3 Implications for Further Study

The successful implementation of this blockchain-based HR framework opens several avenues for future research. Further studies could explore the scalability of the framework across different industries and regions, examining its adaptability to various HR processes beyond IT recruitment. Additionally, research could investigate the integration of advanced technologies such as artificial intelligence and machine learning to enhance skill evaluation and matching processes. Evaluating the long-term impact of blockchain-based HR systems on organizational efficiency and employee satisfaction would also provide valuable insights. Finally, examining regulatory and ethical considerations in deploying decentralized HR frameworks could guide best practices for widespread adoption.

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