

# Blockchain in Human Resource Management System

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**Abstract**—The use of modern technology brings lots of advantages to our lifestyle. Blockchain technology is one of them. It could be used in every sector including health, education, finance, and human resources (HR). With the help of blockchain technology, HR could become more efficient. A blockchain is a complex and secure distributed ledger system that stores data in blocks, along with other information such as timestamps and hash values, and interconnects each block. By using blockchain technology, many problems can be solved. Since the conception of blockchain technology, many fields such as healthcare, education, and business have been transformed, and human resource management (HRM) is one of them. However, there are some gaps in this area, which are addressed in this research. Hiring employees is an important role in human resources (HR) and hiring the right candidate is challenging. To hire the right candidate for the right position, understanding the performance appraisals of their previous organization is a great method to make a better judgment about them. HR departments often need to know performance reviews from a candidate's previous organization, which is not as easy or reliable to get in the traditional way. A performance appraisal is a systematic way to review or evaluate an employee's performance in an organization. In this paper, a blockchain-based performance appraisal system will be used to check the organizational performance of an employee of their previous organization. This system will be trustworthy, secure, and anonymous for the HR of an organization.

**Keywords**—Blockchain, Ethereum, Human Resource Management, Solidity, Smart Contracts, Smart Recruitment System, Performance Check

## I. INTRODUCTION

Hiring employees and more generally the recruitment process is one of the most crucial and important parts of human resource management (HRM), and the performance appraisal check is an important part of the recruitment process [1]. When organizations want to hire employees for the right position, they often need to check their performance appraisals. Performance appraisal is a common management concept used as a way to determine an employee's skill, competence, effectiveness, and efficiency[2][3].

Traditionally, organizations and corporate human resource departments want to hire the right people for the right positions in a variety of ways. They usually only check resumes and letters of recommendation, which can be unreliable and may not be enough to judge experienced job applicants. Additionally, there are several scam techniques, including providing fake experience certificates or letters of recommendation. Another method is to provide incorrect information on the resume [4].

The concept of blockchain technology was established in 2008 when a person called Satoshi Nakamoto published a paper on bitcoin [5][6]. The person behind the blockchain is still unknown. The backbone of ethereum and bitcoin is built on blockchain technology [7]. Blockchain technology is based on a complex distributed ledger system, secured with the help of cryptography [8][9]. Blockchain technology is a method of systematic data storage that makes it challenging to alter or steal data from the system. A blockchain is made up of blocks that are interconnected and responsible for storing information. In the blockchain, every block contains a hash value, timestamp, and the information of the transaction. The previous block is indicated by the hash value. Since the hash value is created automatically, it is impossible to alter any of the information it contains. During this time, the next block enhances the verification and validation of the previous blocks and makes it secure for all blockchains [10]. Blockchain can be classified into several types, which are public, private, and hybrid [11]. Blockchain is growing rapidly because of the insecure nature of the traditional database. People use standard databases to store information, but this is not fully secure, meaning it could be hacked and / or lost [12]. However, this has not happened with blockchain. As a result, nowadays, health, education, human resources management, financial services, agriculture, and other industries or organizations extensively use the blockchain [13].

Blockchain has great potential to improve recruitment in an organization. Sometimes, a company hires a third party to recruit the employee, which is costly and time-consuming. The recruiters have to verify every candidate's documents,

such as resumes, certificates, and recommendation letters before recruiting him or her [14][15]. But now, with the assistance of blockchain technology, it no longer needs to be proven manually, and all the facts about the candidate are already stored in the blockchain. This saves lots of time, and hence, fewer resources of the agency are used.

We looked over some of the research papers on blockchain in HR, and have tried to investigate and establish the gaps. There are many research papers on HR, which are related to employee record management systems, payroll and attendance systems. We found a few research papers that related to the recruitment system which showed there is scope to mitigate the current challenges in this area of recruitment by using blockchain technology. Companies tried to check and verify the document before hiring, both for novice and experienced candidates. But the proposed system will only work for experienced employee recruitment by checking their previous performance. Finally, we decided to work for a performance appraisal checking system that would help an organization's HR to recruit employees by checking their performance.

Consequently, we propose a system to overcome the traditional problems by using blockchain technology that will verify the employee's previous organization or company performance in a secure and anonymous way. With this method, a company's HR department would submit the details and the performance of the employee on a website. The backbone of that website would be based on blockchain technology [16]. Using blockchain technology, our proposed system would play an important role in HR and it would minimize the problems that have happened using traditional systems.

## II. LITERATURE REVIEW

After blockchain technology was conceptualized by Satoshi Nakamoto in 2008 [17], it became part of modern technology. People became interested when blockchain was introduced [18]. There is a lot of research on blockchain technology and human resources. Most of the research papers are related to the benefits, future, and applications of blockchain technology in human resource management [19]. There are some studies based on it. We have researched and analyzed many research papers that related to blockchain in HR. All studies have their pros and cons, and their ideas are different and unique. Our literature review established that no performance appraisal-based feedback systems are based on blockchain technology. Our study shares characteristics with previous research but is also unique.

In 2018, a research paper was published on blockchain titled a recruitment and human resource management technique using blockchain technology for industry 4.0 [20]. This paper proposed a recruitment system using blockchain technology, which profiles from applicants' previous employment record and automatically verifies previous contracts. The system also automatically classifies other profiles and removes profiles that contain useless information, such as behavioral issues, legal issues, or false credentials [20].

In 2019, a research paper was published titled implementation and testing of a blockchain-based recruitment management system [21]. In this case, recruiters can read candidate information stored on the blockchain [22].

The candidate's information is stored there, and the next step in the hiring process is to select verified candidates. It ensures that they are hiring the right candidate so they can move on to the next stage of the recruitment process [21].

In 2020 a paper was published titled blockchain applications in human resources management: opportunities and challenges [12]. The author discussed potential blockchain HRM application areas such as performance evaluation, reference checking, and payroll. The paper also established that there are blockchain challenges in HRM, such as lack of support, security gaps, lack of funding, and the need for proof of success [12].

Researchers are interested in a kind of recruitment method based on blockchain technology. However, the system we propose is quite different from theirs. Our system is also a hiring system, but it is based on performance evaluations and would be an implementation that also helps others find similar solutions to existing problems.

## III. PROPOSED METHOD

The general idea of the proposed system is shown in fig. 1, for web application-based blockchain technology to check the performance appraisals of an employee. This system can be used by an organization or by a company's HR, where HR can create an account to submit employee information. Two types of companies can use the system for their needs. It could be a working (current) company that wants to submit its current employee's information or that wants to hire an employee.

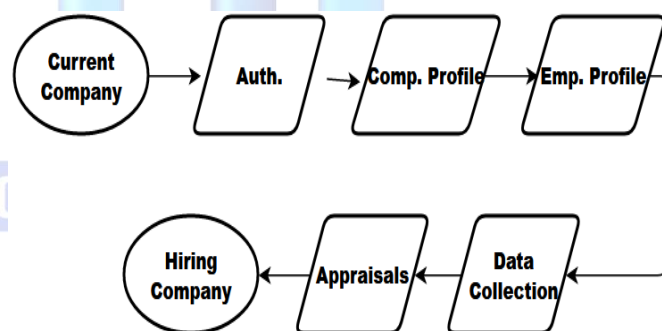


Fig.1. Diagram of the proposed system.

From the above diagram of Fig. 1, we see the following functionalities: authentication, company profile, employee profile, data collection, and appraisals.

### A. Authentication

All the users must create an account to use the system. The verification process of account creation is manual because the users are from any particular company. The authentication credentials will be provided by the system. Users are given authentication credentials to log in to the system.

### B. Company Profile

The company profile contains information about the company and the HR department that uses the system for their recruitment process. As you can see from the authentication, the account creation is manual, so the company profile information is genuine, and fraud is not possible.

### C. Employee Profile

An employee profile contains information about the employees who work for the company. Employee information is provided by the company where the employee works. The information is about the employee's name, date of birth, address, skills, work history, and achievements.

### D. Data Collection

Data collection is an internal function that collects only performance-related data from employee profiles and data submitted by HR.

### E. Appraisals

This is the final output of this system, showing the performance appraisals of an employee. HR could take decisions before hiring by reviewing performance appraisals from his previous organizations.

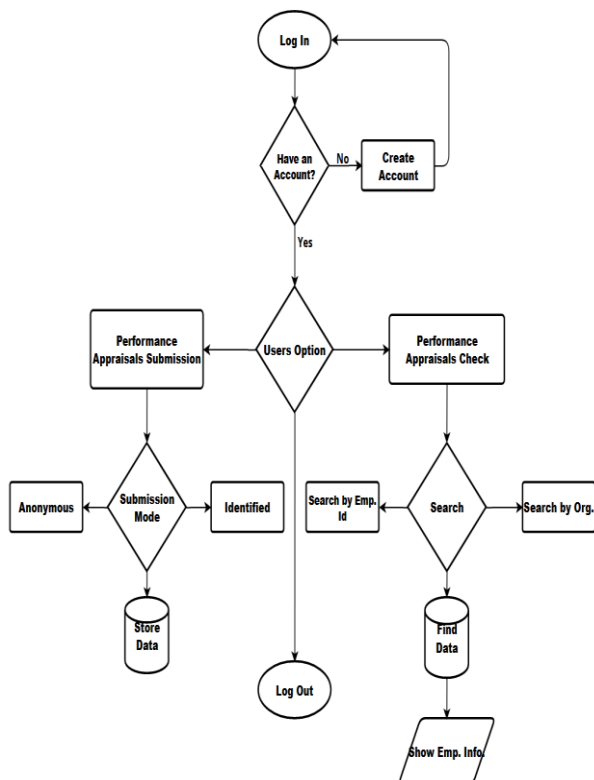


Fig.2. Blockchain-based performance Appraisal checking system.

The overall process of the entire system is shown in fig 2. When a user wants to use the system, it asks about their credentials. If they are already registered, they can log in to the system using their credentials otherwise they have to create an account. If the login is successful, the home page shows a menu. There are three options: user profile, employee performance appraisal submission, and employee performance appraisals check.

It is shown in fig 2 that there are two types of users. One is a current company and the other one is a hiring company. If the user logs in as a current company, they are able to submit their employee's information or performance appraisals. For security reasons, there will be two submission modes, one is an anonymous submission and the other is an

identified submission. If they choose anonymous submission their identity will be hidden, otherwise the identity will be disclosed. Finally, the information would be stored.

On the other hand, if the users log in as a hiring company, they are able to check employee performance appraisals by searching the unique id which is generated by the system when information has been submitted by the current company. After that, the employee information would be shown on a table.

## IV. IMPLEMENTATION

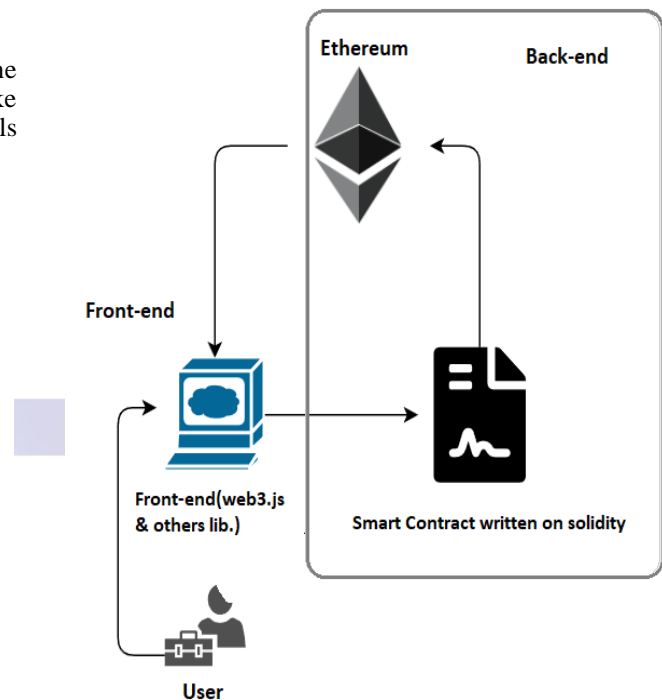


Fig.3. System Architecture.

Fig. 3 shows the system implementation and architecture of our proposed system. Our proposed system is a web application using the Ethereum blockchain, and the smart contract written in the solidity programming language. In Fig. 3, there are two parts in this system, one is the back-end and the other is the front-end. The back-end is mostly on the ethereum blockchain and the smart contract, and the client site or front-end is on web3.js.

### A. Ethereum

Ethereum is a blockchain platform. It is an open-source and decentralized blockchain system that supports smart contract functionality [23]. Anyone can deploy permanent and unchangeable decentralized applications on Ethereum, and it allows users to communicate with them.

### B. Front-End

The front-end part is the client side of this system, where users will be able to interact with the smart contract. Web3.js will be used to communicate between smart contracts and the front-end, which is a JavaScript library.

### C. Smart Contract

The implementation mostly depends on smart contracts, which are computer programs or lines of code that are stored

and executed on a blockchain [24]. Solidity programming language is used to write smart contracts. It is a statically typed object-oriented programming language that runs on an ethereum virtual machine(EVM). As we know, it is a program that contains all the business logic of an application. The smart contracts are written on solidity programming language, and it's run on EVM. There is a javascript library called web3.js that will be used to communicate with the smart contract. The pseudocode of the add employee function in the smart contract is given below.

---

PSEUDOCODE 1: Function to add employee info.

---

```
function addEmployee(
  Argument Employee ID,
  Argument Employee Name,
  Argument Organization Name,
  Argument Starting Date,
  Argument Ending Date,
  Argument Skills,
  Argument Feedback
) public {
  Store Employee Info
end
}
```

addEmployee() is a function in smart contract to store employee details such as employee id, name, organization name, starting and ending date, skills, and feedback in the blockchain. It takes input from the users with the help of the web3.js library. The front end could be a web page or a mobile application. Web3.js library will be used to communicate with smart contract. Another pseudocode of the getEmployee function in the smart contract is given below.

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PSEUDOCODE 2: Function to retrieve employee info.

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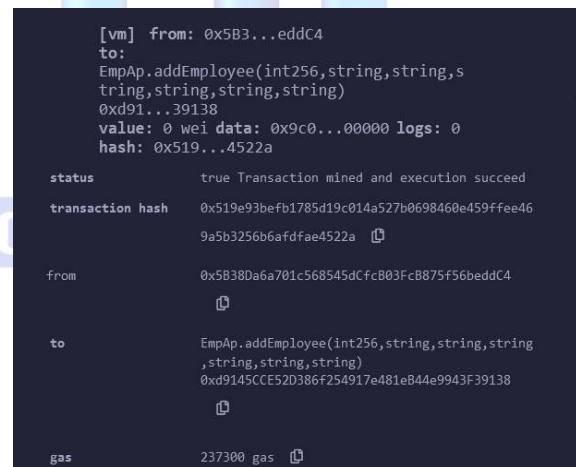
```
function getEmployee(
  Argument Employee ID
) public view returns {
  if the employee ID matches the
  stored database employee ID
  then return employee information.
  if the employee ID not matches
  the stored database employee ID
  then return "Employee not found"
end
}
```

getEmployee() is a function to get employee performance appraisals by searching employee id. It takes the employee id as user input to match the correct employee information from the blockchain. If it does not match, it will show an error message, such as 'employee not found'.

## V. TESTING AND RESULT

When compared to the previous year, employment certificate fraud rates have increased during the ongoing coronavirus pandemic by approximately 30%. According to trueprofile.io, a well-known company for primary source verification (PSV) services, this startling statistic supports the necessity for stricter hiring procedures [25]. Our proposed method would enable stricter hiring procedures to overcome this problem.

We have discussed the feasibility of implementation in the implementation section, which showed there is real-time feasibility for implementation. Ethereum's remix IDE has been used for testing purposes. In our proposed system, the smart contract contains two major functions. These are addEmployee(), getEmployee(). We have tested the smart contract on Remix IDE by ethereum. It allows users to develop, deploy and administer smart contracts for the ethereum platform. After compiling and deploying the smart contract, Remix IDE gives an interface to test the smart contract by entering the necessary information according to the smart contracts. After the transaction, it generates a hash value and stores the information. The output in fig 4. Shows the completion of the transaction of adding employee details to the blockchain.



```
[vm] from: 0x5B3...eddC4
to:
EmpAp.addEmployee(int256, string, string, s
tring, string, string, string)
0xd91...39138
value: 0 wei data: 0x9c0...00000 logs: 0
hash: 0x519...4522a

status      true Transaction mined and execution succeed
transaction hash 0x519e93befb1785d19c014a527b0698460e459ffee46
9a5b3256b6afdfae4522a
from        0x5B380a6a701c568545dCfcB03FcB875f56beddC4
to          EmpAp.addEmployee(int256, string, string, string
, string, string, string)
0xd9145CCCE52D386f254917e481e844e9943F39138
gas         237300 gas
```

Fig.4. Completion of transaction of adding info.



Fig.5. Completion of the transaction after search.

There is an interface to check performance appraisals by searching employee id. After inputting an employee id, it returns the information of the employee. Fig. 5 shows the details of completion and generated hash value. As we know HRM is one of the important parts of an organization, as a result, HRM often needs this type of solution for their hiring process. They can easily recruit the right candidate for the right position by checking their previous organization's performance. In the future, other features could be added like payroll, and employee record management.

## VI. CONCLUSIONS

A credible invention for creating decentralized applications is blockchain technology which makes our lives easier and safer. Day by day it will become more general and sophisticated to solve real problems. Our proposed system is also a decentralized application based on the Ethereum platform. In the HR of an organization some of the problems can be solved by blockchain technology, which we discussed earlier. Primarily we focused on the recruitment system, which is a performance appraisal system for hiring the right candidate. Compared to the traditional performance appraisal checking system in human resource management, our proposed system is simple, saves a lot of time, and is highly secure and unhackable due to its decentralized function.

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