

# **ChainHire: A Privacy-Preserving and Transparent Job Search Portal Using an Enterprise-Level Permissioned Blockchain Framework**

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# Publications



- [1] S. Ghosh, R. Islam, A. Jaman, A. Bose and A. Roy, "ChainHire: A Privacy-Preserving and Transparent Job Search Portal Using an Enterprise-Level Permissioned Blockchain Framework," *2023 International Conference on Advances in Intelligent Computing and Applications (AICAPS)*, Kochi, India, 2023, pp. 1-6, doi: 10.1109/AICAPS57044.2023.10074582. **(Published in IEEE Xplore)**
- [2] S. Ghosh, "CLI API in Hyperledger," *GeeksforGeeks*, 03-Jan-2023. [Online]. Available: <https://www.geeksforgeeks.org/cli-api-in-hyperledger/>. [Accessed: 20-Feb-2023]. **(Peer-reviewed Technical Article)**
- [3] S. Ghosh, A. Bose, A. Jaman, R. Islam, and A. Roy, "Hyperledger Fabric: A Game-Changer for Energy, Education, Healthcare, and Beyond." **(Manuscript Submitted)**

# Agenda



1. Introduction
2. Literature Review
3. Overview of Hyperledger Fabric
4. Proposed Model
5. Implementation
6. Evaluation
7. Conclusion and Future Work

# Introduction

## Background



- Job search portals provides a **platform** for both the **recruiters** and **job seekers**.
- **Sharing personal information** across unsafe channels, increases the **risk of data theft**.
- Blockchain technology is **Transparent, Immutable, Highly available, and Secure**.
- Blockchain is applied on **supply chain management, logistics, and financial applications**.
- **Hyperledger Fabric**, an enterprise-level open-source blockchain framework.
- Earlier **Blockchain is not used for Job Search Portals**.

# Introduction

## Motivation



### Privacy

- Job Seeker Data: No Unauthorized Sharing.
- Exclusive Profile Viewing: Applied Recruiters Only.
- Limited Admin Access.

### Transparency

- Immutable Ledger: Secure Job Records.
- Verifiable Identifier.
- Blockchain-Powered Job History Retrieval.
- Endorsement-Based Tamper Resistance.

# Literature Review

## Existing Work on Job Search Platform

Features	Our Solution	Mathisugan[1], Prodhan et. al.[2], Katariya et. al.[3]	Pinjari et. al.[4]
Blockchain Platform	Yes	No	No
Smart Contract	Yes	No	No
Decentralization	Yes	No	No
Data Privacy	Yes	No	No
Data tempering	No	Yes	Yes
Technology Used	Hyperledger Fabric	MySQL	SQL Server
Implementation	Yes	Yes	Yes
Deployment	Yes	No	Yes

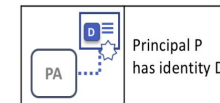
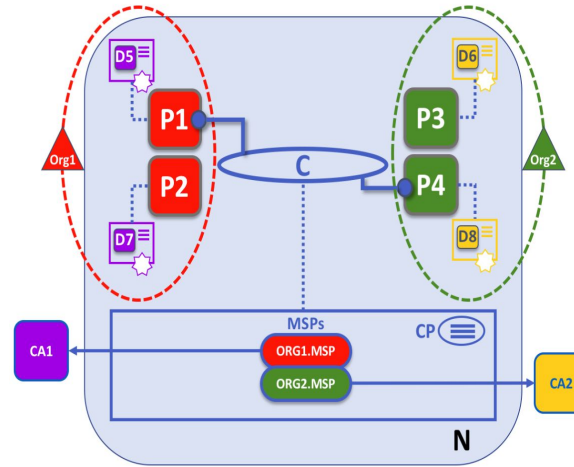
# Literature Review

## Existing Work on Hyperledger Fabric

Sector	Objective	Works
Energy	To trade with local energy producers.	Karandikar et. al. [5], Moon et. al.[6], Kim et al. [7]
Education	To manage student records.	Wai et. al. [8]
Healthcare	To protect patient data and supply chain management.	Amin et. al. [9], Le et. al. [10 ], Tang et. al. [11 ] Kumar et. al. [12]
Diverse Industries		BFSl [13], E-Voting [14 ], KYC [15 ], Personal Data Vaults [16 ], Mobile IoT devices [17], Ride-Sharing Applications [18 ] etc.

# Overview of Hyperledger Fabric

- Channel
- Peers
  - Endorsing peers
  - Committing peers
  - Validating peers
  - Anchor peers
- Membership Service Provider (MSP)
- Certificate Authorities (CA)
- Chaincode
- Ledger = World State + Blockchain

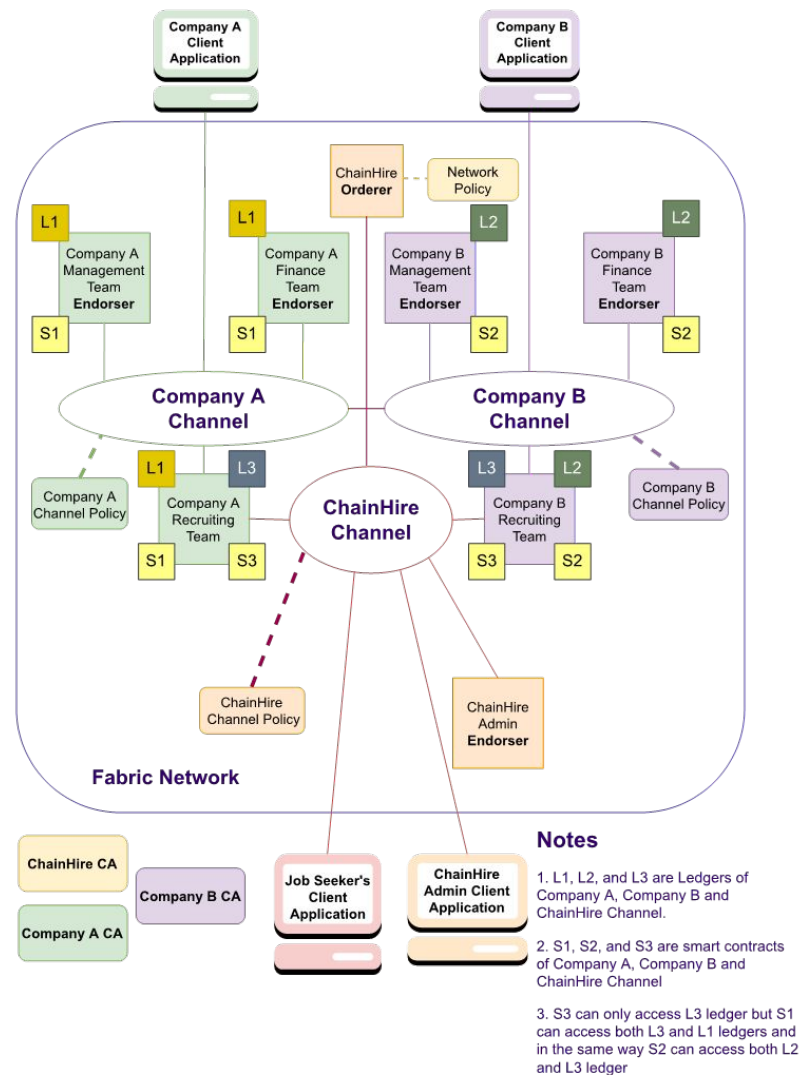


N	Blockchain Network	P	Peer
C	Channel	Org	Organization
I	Identity	PA	Principal PA (e.g. P1,P4) communicates via channel C.
CP	Channel policy	C	
CA	Certificate Authority	MSP	Membership Service Provider
		Organization R owns application A1 and peers P1, P2.	
C	Channel C subject to policy CP.		Channel policy CP contains MSPs: MSP1 and MSP2.
			MSP1 selects the Certificate Authority CA1 to provide certificates for it.

Generic Hyperledger Fabric network



# Proposed Model



# Proposed Model



HR Contract	Admin Contract	Job seeker Contract
<i>createJobposting()</i>	<i>deleteJobseeker()</i>	<i>createJobseeker()</i>
<i>hiredUpdate()</i>	<i>deleteJobposting()</i>	<i>updateJobseeker()</i>
<i>queryMyJobPosting()</i>	<i>queryAllJobposting()</i>	<i>readJobseeker()</i>
<i>readCandidates()</i>	<i>queryAllJobseeker()</i>	<i>deleteJobseeker()</i>
<i>deleteJobposting()</i>		<i>updateJobseekerPassword()</i>
<i>getJobpostHistory()</i>		<i>getJobseekerPassword()</i>
		<i>applyForJob()</i>

Smart Contract Methods

Admin
<b>View</b> and <b>Moderate</b> job postings.
<b>View</b> and <b>Moderate</b> job seekers. (only basic details visible).
Recruiter
<b>Create</b> and <b>Delete</b> job postings.
Provides <b>Updates</b> about the <b>Hired</b> candidates.
<b>View</b> job seeker details (only if he/she applied for a job posted by the Recruiter).
Job seeker
<b>Create, View, Update &amp; Delete</b> his profile.
<b>View &amp; Apply</b> for the Job postings.

Use Case of Different Actors

# Implementation

## Amazon Managed Blockchain Service

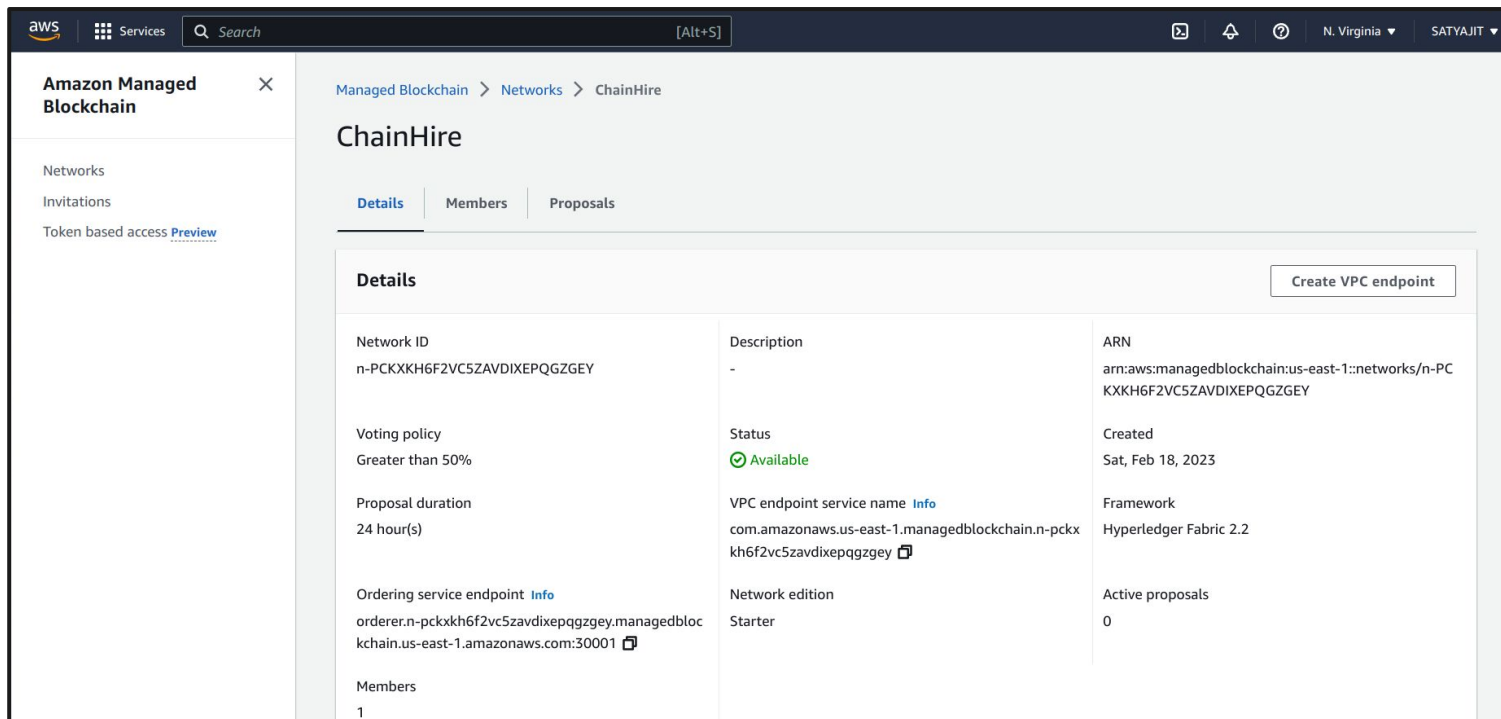


### Steps involved:

- Create an Amazon Managed Blockchain network.
- Configure network settings
- Create a Hyperledger Fabric channel.
- Add members to the network.
- Test and monitor the network.

# Implementation

## Amazon Managed Blockchain Service



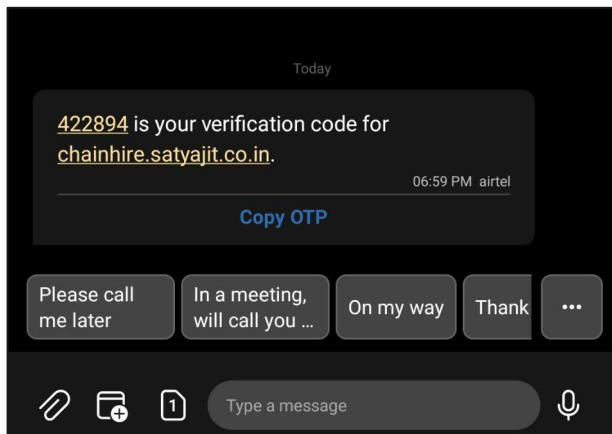
The screenshot displays the Amazon Managed Blockchain console interface. The left sidebar shows the 'Amazon Managed Blockchain' menu with options for 'Networks', 'Invitations', and 'Token based access Preview'. The main content area is titled 'ChainHire' and includes tabs for 'Details', 'Members', and 'Proposals'. The 'Details' tab is active, showing a table of network information. A 'Create VPC endpoint' button is located in the top right corner of the details section. The table lists various attributes of the ChainHire network, including its ID, description, ARN, voting policy, status, proposal duration, VPC endpoint service name, framework, ordering service endpoint, network edition, and the number of members.

Details		
Network ID	Description	ARN
n-PCKXKH6F2VC5ZAVDIXEPQGZGEY	-	arn:aws:managedblockchain:us-east-1::networks/n-PCXKH6F2VC5ZAVDIXEPQGZGEY
Voting policy	Status	Created
Greater than 50%	✓ Available	Sat, Feb 18, 2023
Proposal duration	VPC endpoint service name <a href="#">Info</a>	Framework
24 hour(s)	com.amazonaws.us-east-1.managedblockchain.n-pckxkh6f2vc5zavdixepqgzgey	Hyperledger Fabric 2.2
Ordering service endpoint <a href="#">Info</a>	Network edition	Active proposals
orderer.n-pckxkh6f2vc5zavdixepqgzgey.managedblockchain.us-east-1.amazonaws.com:30001	Starter	0
Members		
1		

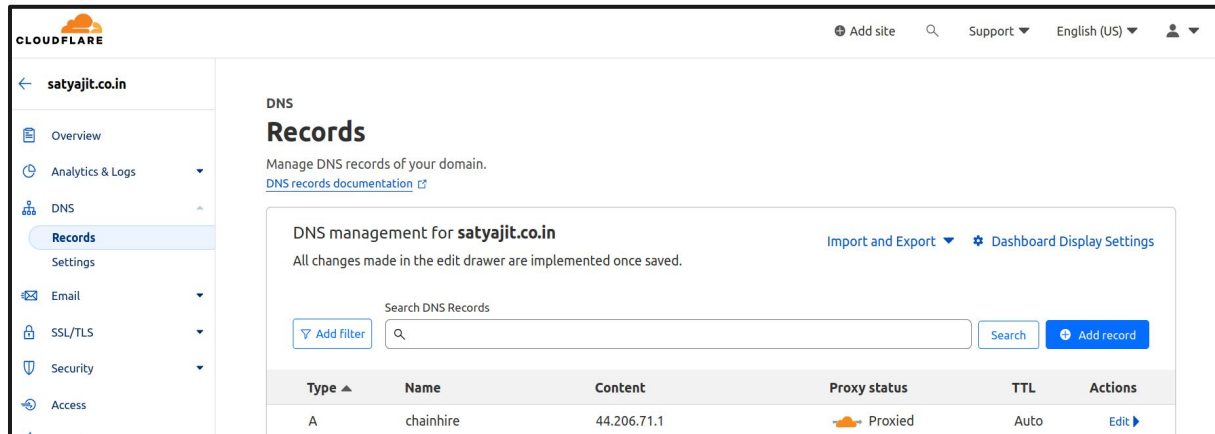
ChainHire network on Amazon Managed Blockchain Service

# Implementation

## Google Firebase & Cloudflare DNS



OTP verification using Google  
Firebase



DNS record configuration on Cloudflare

# Implementation

## Blockchain Ledger

chainhire.satyajit.co.in/jobseeker/history/JOB665416

```
[{"HRId": "hrl",
  "ageLimit": "35",
  "appliedCandidates": "47bf793ea7eb54bd843e0b85c1d0a47b3c3af28b276a73ed9c2aa6dea9573448",
  "companyname": "Bank of America",
  "docType": "jobposting",
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  "location": "Charlotte, NC",
  "profileName": "Financial Analyst",
  "qualification": "Bachelor's in Finance",
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  "skills": "Financial Analysis, Excel",
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```

Theme: GitHub Raw Parsed

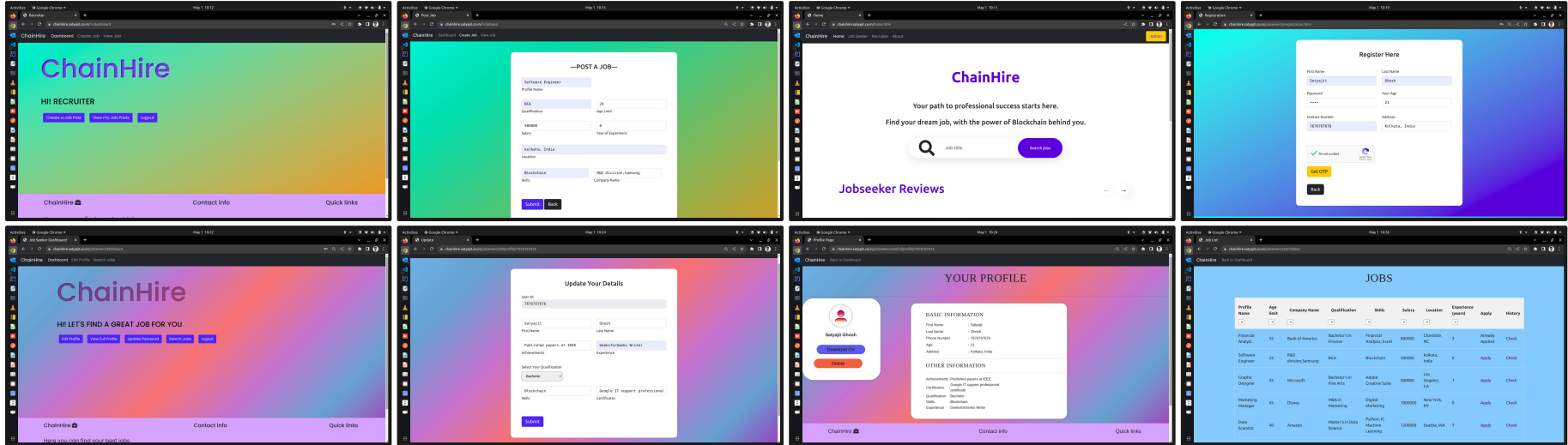
Verifiable Identifier of the hiree

Integrity verifier for application list.

Any changes in record adds a new block in blockchain ledger

# Implementation

## User Interface (UI)



Few snippets from the User Interface(UI)

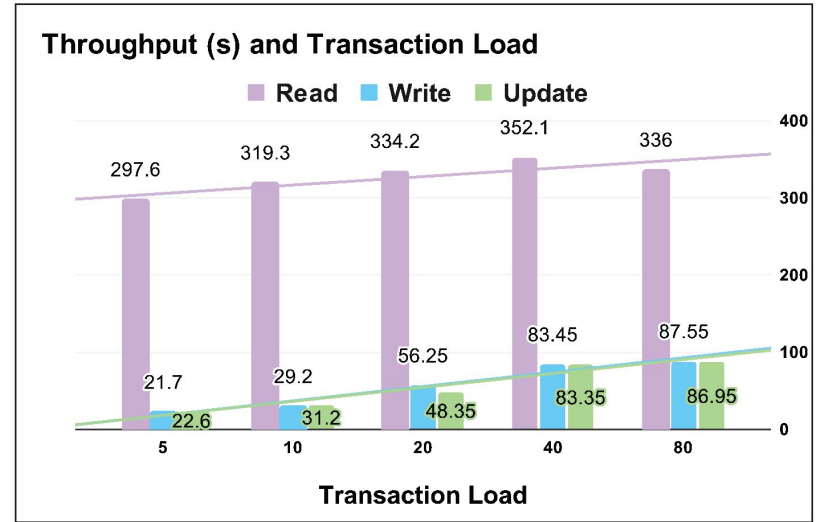
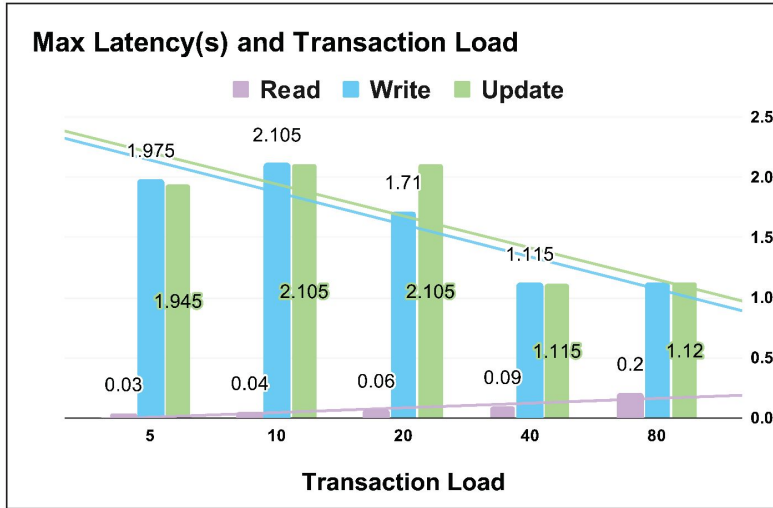
# Evaluation



- **Hyperledger Caliper** is a benchmarking tool for blockchains that enables users to assess the effectiveness of a blockchain implementation.
- A system with AMD Ryzen 3 5300U processor having a base Frequency of 2.6GHz and Max Frequency of 3.8GHz with 8GB of DDR4-3200 RAM is used.
- Configured Hyperledger fabric with **Raft** ordering service with two organizations and two peers on each organization.
- The **endorsement** can be done by any peer of the organization.
- Tested with **Fixed-load** configuration that tries to **maximize throughput** by maintaining a **defined number of backlog transactions**.



# Evaluation



Performance of network on different types of operation

# Conclusion and Future Work



- The use of Permissioned Blockchains is **very new**.
- The use of blockchain in **non-financial sectors**, such as our proposed online job portal, is **less explored**.
- In permissioned environment blockchain **may lose** its key advantages like **trust and transparency** if endorsers are not chosen properly.
- Further research is needed to fully understand the **potential** and **limitations** of using blockchain technology in this way.
- Future plan to use **Decentralized Identifiers (DIDs)**.
- Detailed **security analysis** is required.

# Conclusion and Future Work



Supplementary files and Smart Contract codes are available at

**<https://github.com/SATYAJIT1910/PTJSP>**

# References



- [1] R. Mathisugan, "Online job portal," tech. rep., 2018.
- [2] M. M. R. Prodhan and B. K. Saha, "Online job portal," tech. rep., 2017.
- [3] M. Katariya, H. Shah, and N. Patel, "Online job portal," tech. rep., 2020.
- [4] M. Pinjari, N. De, R. Kokne, A. Siddiqui, and D. Chitre, "Online job portal," *International Research Journal of Engineering and Technology (IRJET)*, vol. 6, Apr 2019.
- [5] N. Karandikar, A. Chakravorty, and C. Rong, "Renewledger : Renewable energy management powered by hyperledger fabric," in 2020 IEEE Symposium on Computers and Communications (ISCC), pp. 1–6, 2020.
- [6] S. J. Moon, I. H. Park, B. S. Lee, and J. Ju Wook, "A hyperledger based P2P energy trading scheme using cloud computing with low capability devices," in 2019 IEEE International Conference on Smart Cloud (SmartCloud), pp. 190–192, 2019.
- [7] J. W. Kim, J. G. Song, H. W. Shin, and J. W. Jang, "Amm based p2p energy trading system using hyperledger fabric blockchain," in 2021 International Conference on Information and Communication Technology Convergence (ICTC), pp. 1747–1749, 2021.
- [8] K. S. S. Wai, E. C. Htoon, and N. N. M. Thein, "Storage structure of student record based on hyperledger fabric blockchain," in 2019 International Conference on Advanced Information Technologies (ICAIT), pp. 108–113, 2019.
- [9] M. R. Amin, M. F. Zuhairi, and M. N. Saadat, "Transparent data dealing: Hyperledger fabric based biomedical engineering supply chain," in 2021 15th International Conference on Ubiquitous Information Management and Communication (IMCOM), pp. 1–5, 2021.
- [10] H. T. Le, T. T. L. Nguyen, T. A. Nguyen, X. S. Ha, and N. Duong- Trung, "Bloodchain: A blood donation network managed by blockchain technologies," *Network*, vol. 2, no. 1, pp. 21–35, 2022.

# References



- [11] Q. Tang, Z. Xia, N. Shu, X. Zuo, L. Zhao, S. Li, and S. Ren, "Research on epidemic material management method based on fabric blockchain," in 2022 4th International Conference on Communications, Information System and Computer Engineering (CISCE), pp. 623–626, 2022.
- [12] N. Kumar S. and M. Dakshayini, "Secure sharing of health data using hyperledger fabric based on blockchain technology," in 2020 International Conference on Mainstreaming Block Chain Implementation (ICOMBI), pp. 1–5, 2020.
- [13] V. Aleksieva, H. Valchanov, and A. Hulyan, "Implementation of smart contracts based on hyperledger fabric blockchain for the purpose of insurance services," in 2020 International Conference on Biomedical Innovations and Applications (BIA), pp. 113–116, 2020.
- [14] A. Poniszewska-Maranda, S. Rojek, and M. Pawlak, "Decentralized electronic voting system using hyperledger fabric," in 2022 IEEE International Conference on Services Computing (SCC), pp. 339–348, 2022.
- [15] N. Ullah, K. A. Al-Dhlan, and W. M. Al-Rahmi, "Kyc optimization by blockchain based hyperledger fabric network," in 2021 4th International Conference on Advanced Electronic Materials, Computers and Software Engineering (AEMCSE), pp. 1294–1299, 2021.
- [16] N. Mishra and H. Levkowitz, "Performance evaluation of permissioned based personal data vault implemented using hyperledger fabric v2.x," in 2022 International Conference on Intelligent Data Science Technologies and Applications (IDSTA), pp. 138–145, 2022.
- [17] N. Banoun and N. Diarra, "Authentication of mobile iot devices using hyperledger fabric blockchain," in 2021 Eighth International Conference on Software Defined Systems (SDS), pp. 1–6, 2021.
- [18] R. Shivers, M. A. Rahman, M. J. H. Faruk, H. Shahriar, A. Cuzzocrea, and V. Clincy, "Ride-hailing for autonomous vehicles: Hyperledger fabric-based secure and decentralize blockchain platform," in 2021 IEEE International Conference on Big Data (Big Data), pp. 5450–5459, 2021.



# Thank You

*Let's Connect*

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