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ProVault: A Blockchain-Integrated File Management System for Professional Workflows

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Abstract

In the digital era, secure and efficient file management is a critical necessity across industries. **ProVault** is an **AI-powered, decentralized file management system** that leverages **IPFS for secure storage and blockchain for data integrity**, ensuring that files remain tamper-proof and easily accessible. The platform is designed to cater to **corporate organizations, legal firms, healthcare institutions, and academic sectors**, where document security, accessibility, and efficient retrieval are paramount. With **AI-driven features** such as **smart search, content summarization, and explanation tools**, ProVault enhances document handling, making it easier for users to extract relevant information from vast repositories.

This paper explores the **technology stack behind ProVault**, including **blockchain, AI, role-based access control (RBAC), and biometric authentication**, all of which contribute to its **highly secure and user-friendly** architecture. The **methodology section** discusses the **integration of IPFS, smart contract implementation, and AI algorithms** that power the system's automation and security features. Additionally, the **application section** highlights the diverse use cases of ProVault, demonstrating its effectiveness for **businesses, academic researchers, developers, and creative professionals** who require seamless file collaboration and version tracking.

The study concludes by emphasizing **ProVault's role in revolutionizing digital file management** through **decentralized security, AI-powered automation, and seamless collaboration features**. With its **in-app video calling, version history tracking, and multi-layered authentication**, ProVault provides a **future-ready, all-in-one solution for secure document handling and team collaboration**. This research underscores the **importance of integrating blockchain and AI in file management systems**, offering a scalable and **efficient alternative to traditional centralized storage solutions**.

I.INTRODUCTION

In today's digital landscape, collaboration and security are two essential pillars for professionals working with sensitive documents and records. However, there is currently no

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platform that effectively integrates **secure file management, real-time collaboration, and decentralized storage** while ensuring data privacy. The **need for security** is paramount in various professional sectors, including legal, healthcare, finance, and research, where private records such as **case files, legal agreements, and medical histories** must be safeguarded against unauthorized access and tampering. Inspired by GitHub—where programmers seamlessly share and collaborate on code regardless geographical boundaries—ProVault aims to extend this concept to **non-IT professionals**, offering them a **secure, blockchain-powered environment** for collaboration and document management. The primary objective of ProVault is to enable professionals across various domains to work together efficiently without compromising data security. By integrating **blockchain technology for tamper-proof records, InterPlanetary File System (IPFS) for decentralized storage, and artificial intelligence (AI) for document processing**, ProVault ensures that users have an **advanced yet accessible platform** for their work. One of the critical challenges faced during development was **selecting a suitable blockchain network that balances security,** collaboration platform where documents remain tamper-proof and accessible across distributed networks.

Vora, Nayyar, Tanwar, Tyagi, Kumar, and Obaidat present a blockchain-based framework for securely managing Electronic Health Records (EHRs). Their study highlights how blockchain enhances patient data privacy while allowing seamless access for authorized users. This aligns with ProVault's objective of providing professionals outside the IT industry with a secure document storage system where confidential files, such as legal agreements **efficiency, and cost-effectiveness**, making the platform viable for professionals across industries. The evolving nature of digital security threats makes ProVault a timely and crucial solution for organizations and individuals seeking **a modern, decentralized, and AI-powered** approach to document collaboration.

II. LITERATURE SURVEY

The integration of blockchain and decentralized storage systems like IPFS has gained significant attention due to its ability to enhance security, privacy, and accessibility. Lin, Sicato, Rathore, Sung, and Park explore a decentralized storage architecture that leverages blockchain and IPFS to ensure secure and immutable document management. Their work emphasizes the importance of eliminating centralized points of failure, making it ideal for environments where data integrity and privacy are crucial. ProVault aligns with these principles by providing professionals a secure

and medical records, can be shared without compromising security. By integrating role-based access control (RBAC) and encryption, ProVault ensures that sensitive data remains protected while fostering efficient collaboration among authorized stakeholders.

Sari and Sipos introduce FileTribe, a decentralized platform that uses IPFS for file storage and blockchain for tracking modifications and access control. This model ensures that all changes to shared files are recorded immutably, providing a transparent and verifiable history of modifications. ProVault incorporates similar functionality by allowing professionals to track document versions, reducing the risk of unauthorized alterations. This approach is particularly beneficial for industries requiring compliance with regulatory standards, such as finance, law, and healthcare, where auditability and data integrity are essential.

Anthal, Choudhary, and Shettiyar discuss the vulnerabilities of centralized file-sharing systems and propose blockchain-based alternatives like Filecoin and Storj. Their work underscores the risks associated with traditional cloud storage solutions, including data breaches and unauthorized access. ProVault addresses these concerns by utilizing IPFS for distributed file storage while ensuring cost-effective and scalable operations. Furthermore, by incorporating AI-driven search and automated document summarization, ProVault enhances productivity and accessibility, making it a comprehensive solution for professionals seeking both security and efficiency in their collaborative projects.

III. PROPOSED SYSTEM

ProVault is a decentralized, AI-powered document collaboration platform designed to provide secure and efficient file management for professionals. The system integrates **IPFS for decentralized file storage**, **Google Gemini API for AI-driven document processing**, and **Jetpack Compose with Kotlin** for a seamless mobile experience. Security is enhanced with **Google authentication, biometric access, and Role-Based Access Control (RBAC)**,

ensuring that only authorized personnel can access or modify sensitive documents. Additionally, **an in-app video calling feature** enables real-time collaboration, while AI capabilities, such as **document summarization and smart search**, optimize file accessibility and understanding.

1. Architecture & Framework

ProVault's architecture is designed to ensure security, scalability, and usability. The core components include:

- **Decentralized Storage (IPFS):** All uploaded files are stored on IPFS, ensuring immutability and tamper-proof data integrity. Only file hashes are recorded on-chain to enhance privacy and reduce blockchain storage costs.

- **AI-Powered Document Management:** Google Gemini API is integrated to provide **file summarization, content explanation, and intelligent search**, helping users quickly retrieve and understand documents.

- **Mobile-First Design:** Built with **Jetpack Compose in Kotlin**, the app provides a modern, responsive UI tailored for **Android 5.0 (Lollipop)** and later, ensuring compatibility across a wide range of devices.

- **Security & Authentication:** The platform incorporates **Google authentication (OAuth 2.0) for seamless login**, **biometric authentication (fingerprint, face unlock) for enhanced security**, and **RBAC-based access control** to prevent unauthorized modifications.

2. Security & Access Control

Security is a cornerstone of ProVault, ensuring confidential documents remain protected against unauthorized access:

- **End-to-End Encryption (E2EE):** All data transmissions, including video calls, are encrypted using industry-standard encryption algorithms such as AES-256 for stored files and TLS for in-transit data.

- **Role-Based Access Control (RBAC):** Different roles, such as **Admin, Editor, and Viewer**, are assigned to users, controlling file access based on predefined permissions.

- **Multi-Factor Authentication (MFA):** Users can enable **biometric authentication** in addition to Google sign-in for an extra layer of security.

- **Audit Trail & File Tracking:** Every modification made to a file is logged, ensuring a transparent and trackable history of changes.

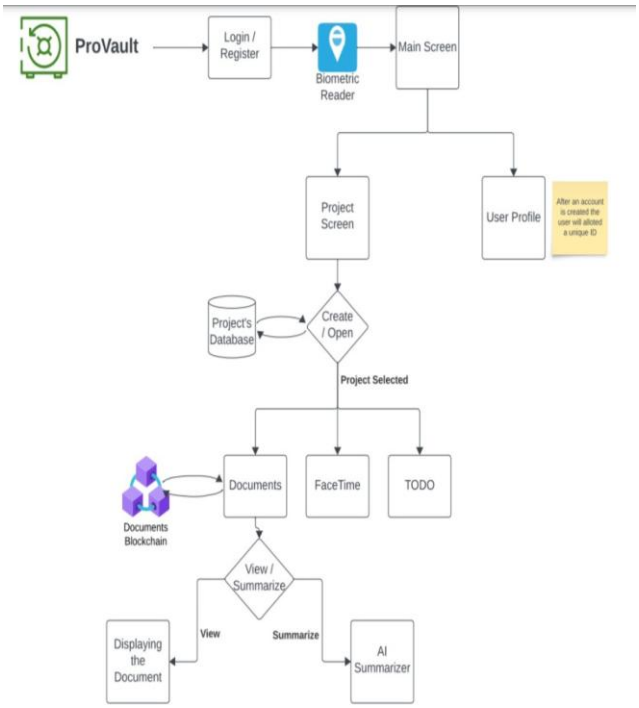
3. Collaboration Document Management

ProVault is designed for seamless document collaboration, incorporating features that enhance productivity and ease of use:

- **Annotations & Tags:** Users can mark critical documents with **custom annotations and tags**, categorizing files based on importance.

- **Real-Time Collaboration:** The **built-in video calling feature** allows professionals to discuss documents in real-time, enhancing communication efficiency.

- **Version Control & Change Tracking:** Users can view the **modification history of each document**, enabling better management of project updates.



IV. METHODOLOGY

The development of **ProVault** follows a structured methodology to ensure the integration of decentralized storage, AI-driven document processing, and secure access management. The methodology is divided into key phases, including technology stack selection, system requirement analysis, AI and blockchain integration, and security implementation.

1. Technology Stack Selection

The foundation of **ProVault** is built using **Kotlin and Jetpack Compose**, providing a modern and declarative UI framework for Android applications. **IPFS** is chosen for **decentralized file storage**, ensuring **tamper-proof data integrity**. For AI-driven document processing, **Google Gemini API** is integrated to enable **summarization, smart search, and content explanation**. The authentication layer is managed via

Firebase Authentication, allowing seamless **Google login and biometric authentication**. Security is further enhanced through **Role-Based Access Control (RBAC)** and end-to-end encryption.

2. Requirement Gathering and Analysis

A detailed analysis of file management challenges and collaboration needs was conducted to define **ProVault's** core functionalities. Professionals and organizations often require a secure, **real-time file tracking system**, AI-powered search, and **multi-user collaboration with access control**. The study also emphasized the need for **annotations and tagging**, allowing users to highlight important files and track updates efficiently. The system is designed to be **mobile-first**, supporting devices with at least **4GB RAM** and running **Android 5.0 (Lollipop)** or later.

3. AI and Blockchain Integration

The integration of **Google Gemini API** enables **AI-driven content understanding**, allowing users to **summarize documents, conduct smart searches, and receive contextual file explanations**. AI models are optimized to process large datasets while ensuring minimal computational overhead on mobile devices. The decentralized storage mechanism is built using **IPFS**, where file hashes are stored on the blockchain to maintain an immutable audit trail. This approach enhances data security while reducing dependency on centralized servers.

4. Security and Access Control Implementation

Security is a critical component of **ProVault**, ensuring that only authorized users can access and modify documents. The implementation includes:

- **Google Authentication & Biometric Access:** Users can log in using their Google accounts and enable biometric authentication for added security.

- **Role-Based Access Control (RBAC):** Permissions are assigned based on roles, restricting unauthorized access to confidential documents.

- **Audit Logging & File Versioning:** Every change made to a document is logged, providing a transparent history of modifications.

This structured methodology ensures that **ProVault** remains a **secure, efficient, and AI-powered** document management system tailored for professionals.

V. APPLICATION

ProVault serves as a **secure, AI-powered decentralized file management system**, designed to cater to a diverse range of industries requiring **secure, tamper-proof document storage**. By leveraging **decentralized storage via IPFS**, ProVault guarantees **data integrity and prevents unauthorized alterations**, making it an ideal solution for **corporate organizations, legal firms, healthcare institutions, and financial sectors**. Businesses can securely store **critical contracts, agreements, and financial reports**, eliminating risks related to data loss or corruption. Similarly, **hospitals and healthcare providers** can manage **confidential patient records** with enhanced security and accessibility, ensuring compliance with industry regulations while enabling seamless data retrieval.

With **AI-driven features such as document summarization, smart search, and content explanation**, ProVault enhances **document management efficiency for professionals, students, and researchers**. Academic institutions and universities benefit from **AI-powered search capabilities**, allowing students and educators to **quickly extract relevant information from extensive document repositories**. Legal professionals can utilize **AI summarization tools** to distill key insights from complex legal documents, streamlining decision-making processes. This intelligent automation **reduces manual effort, increases productivity, and minimizes the time spent on document analysis**, making ProVault a powerful tool for knowledge-intensive fields.

ProVault's **role-based access control (RBAC) mechanism** reinforces security in **multi-user environments**, ensuring that only **authorized personnel** can view, modify, or share sensitive files. This feature is particularly beneficial in **collaborative projects, government agencies, and large enterprises**, where strict data access controls are necessary to **protect confidential information**. Furthermore, **biometric authentication and Google login integration** enhance user verification, providing a **seamless yet highly secure access mechanism**. These features make ProVault a **trustworthy solution** for organizations that require **robust security measures and regulatory compliance** in their digital workflows.

In addition to its security features, ProVault offers **real-time file tracking and version history**, making it an excellent solution for **software development teams, creative agencies, and research labs**. Developers can track changes in project files, ensuring **previous versions remain retrievable in case of errors or rollbacks**. Creative professionals and researchers can annotate documents, highlight key sections, and **collaborate more effectively** within an organized digital workspace. Moreover, with its **in-app video calling feature**, ProVault facilitates **seamless collaboration among remote teams**, enabling **virtual meetings, project discussions, and brainstorming sessions**. By combining **AI intelligence, blockchain security, and decentralized storage**, ProVault stands out as a **versatile, secure, and highly efficient file management solution** for modern digital workflows.

VI. CONCLUSION

ProVault revolutionizes **file management by integrating AI, blockchain security, and decentralized storage**, making it an ideal solution for organizations and individuals who prioritize **data integrity, security, and efficiency**. By utilizing **IPFS for decentralized storage**, ProVault ensures that documents remain **tamper-proof and highly accessible**, mitigating risks such as data loss and unauthorized alterations. This makes it a **reliable choice for corporate sectors, legal firms, healthcare institutions, and financial organizations**, where secure document storage and retrieval are critical. The platform not only safeguards sensitive data but also **enhances accessibility** across multiple devices, enabling professionals to manage files seamlessly in **remote and hybrid work environments**.

Beyond security, ProVault is **equipped with AI-driven functionalities** such as **smart search, summarization, and content explanation**, which significantly streamline document handling for **students, researchers, and industry professionals**. Academic institutions can **quickly extract key insights** from large datasets, while legal firms can **summarize lengthy contracts** for efficient decision-making. Furthermore, **role-based access control (RBAC), biometric authentication, and Google login** ensure that file access is **restricted to authorized individuals**, enhancing **confidentiality in multi-user environments**. These features make ProVault a **trusted and scalable solution for businesses and institutions** that require **compliance with security regulations and data protection standards**.

ProVault also **redefines collaboration and workflow management** through its **real-time file tracking, version control, and in-app video calling** capabilities. **Software development teams, creative agencies, and research labs** can benefit from its ability to **track changes, retrieve previous versions, and facilitate remote discussions** without switching between multiple tools. This not only **improves productivity** but also fosters **seamless teamwork** in modern digital workflows. By combining **cutting-edge AI, blockchain security, and user-centric design**, ProVault emerges as a **future-ready, all-in-one file management solution** that empowers individuals and enterprises to **work smarter, faster, and more securely in an increasingly digital world**.

VII. REFERENCES

1) Iuon-Chang Lin, Jose Costa Sapalo Sicato, Shailendra Rathore, Yunsick Sung and Jong Hyuk Park
"Decentralized Data Storage System Using Blockchain and IPFS"
https://www.mdpi.com/2079-9292/8/8/828

2) Jayneel Vora; Anand Nayyar; Sudeep Tanwar; Sudhanshu Tyagi; Neeraj Kumar; M. S. Obaidat "BHEEM: A Blockchain-Based Framework for Securing Electronic Health Records"
https://ieeexplore.ieee.org/document/8644088

3) Laszlo Sari; Marton Sipos "FileTribe: Blockchain-based Secure File Sharing on IPFS"
https://ieeexplore.ieee.org/abstract/document/88 35937

4) Jyotsna Anthal; Shakir Choudhary; Ravikumar Shettiyar
"Decentralizing File Sharing: The Potential of Blockchain and IPFS" https://ieeexplore.ieee.org/abstract/document/10 141817

5) Morteza Alizadeh; Karl Andersson; Olov Schelén "Efficient Decentralized Data Storage Based on Public Blockchain and IPFS"
https://ieeexplore.ieee.org/abstract/document/94 11599