EVIDENCE PROTECTION SYSTEM USING BLOCKCHAIN TECHNOLOGY

Project Stage-II (CS851PC)

Submitted

in partial fulfilment of the requirements for

the award of the degree of

BACHELOR OF TECHNOLOGY

in

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by

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MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (A)

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CERTIFICATE

This is to certify that the report entitled **"Evidence Protection System Using Blockchain Technology"** being submitted by **Mr. MOHAMMED ZAID** bearing Reg.No. **21261A0537** and **Ms. UZMA BEGUM** bearing Reg.No. **21261A0563** in partial fulfilment for the award of **Bachelor of Technology (B.Tech.)** in **Computer Science and Engineering** to the **Department of CSE, Mahatma Gandhi Institute of Technology (A), Hyderabad-500075, Telangana,** is a record of bonafide work carried out by them under our guidance and supervision, at our organization/institution.

The results embodied in this report have not been submitted to any other University or Institute for the award of any degree or diploma.

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DECLARATION

We hereby declare that the work described in this report, entitled **"Evidence Protection System Using Blockchain Technology"** which is being submitted by us in partial fulfilment for the award of **Bachelor of Technology** (**B.Tech.)** in Computer Science and Engineering to the **Department of CSE, Mahatma Gandhi Institute of Technology (A)**, **Hyderabad-500075, Telangana,** is the result of investigations carried out by us under the guidance of **Dr. V. Subba Ramaiah** and **Dr. A. Ratna Raju**.

The work is original and has not been submitted for any Degree/Diploma of this or any other university.

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ABSTRACT

The proposed Evidence Protection System (EPS) represents a paradigm shift in evidence management by combining the strengths of blockchain technology with advanced cryptographic measures. The decentralized nature of the system ensures that evidence records are distributed across multiple nodes, making them inherently resistant to tampering or unauthorized modifications. Each record is secured with a timestamp and verified through consensus mechanisms, ensuring the authenticity and chronological order of the data. The integration of smart contracts further enhances the system's functionality by automating critical processes, such as logging evidence transactions, verifying user permissions, and managing access rights. These contracts eliminate reliance on manual interventions, reducing human error while enforcing strict custody chains that are transparent and auditable. To safeguard sensitive information, the EPS incorporates cryptographic techniques, such as encryption to protect confidentiality and hashing to verify data integrity, enabling users to confirm that evidence has not been altered. By addressing key vulnerabilities in traditional evidence handling, EPS delivers a robust, secure, and trustworthy framework that minimizes risks of tampering, unauthorized access, and data breaches, making it a vital tool in modern evidence protection.

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LIST OF ABBREVIATIONS

S.NO	ABBREVIATIONS	FULLFORM
1.	**HTML**	Hypertext Markup Language
2.	**CSS**	Cascading Style Sheets
3.	**i5**	Intel Core i5
4.	**GB**	Gigabytes
5.	**GAN**	Generative Adversarial Network
6.	**UAT**	User Acceptance Testing

CHAPTER 1
INTRODUCTION

In contemporary society, managing and preserving evidence is critical for fostering trust and accountability in areas such as legal proceedings, supply chain management, financial transactions, and intellectual property disputes. The integrity and authenticity of evidence form the foundation of fair decision-making and justice, yet traditional evidence management practices often struggle to meet these high standards. Centralized storage systems are particularly vulnerable to tampering, unauthorized access, and human errors, which can compromise the credibility of the evidence. These shortcomings underscore the urgent need for innovative solutions capable of ensuring the security, transparency, and reliability of sensitive information. Blockchain technology, with its decentralized and immutable characteristics, has emerged as a promising alternative to address these challenges effectively.

1.1 PROBLEM DEFINITION

Existing systems for evidence management in legal and investigative processes often face various drawbacks, impacting their efficiency, security, and overall effectiveness. Many traditional systems rely on centralized databases, making them vulnerable to hacking, unauthorized access, and manipulation. Traditional systems may lack robust security measures to protect sensitive information. Without advanced encryption and access controls, the risk of data breaches and unauthorized disclosure of evidence remains high.Some existing systems may face challenges in handling a large volume of evidence or adapting to the increasing complexity of legal cases.

1.2 EXISTING SYSTEM

The existing work is a conceptual model called "EvidenceChain" that utilizes blockchain technology to prevent spoliation of evidence in South Asian countries. The model allows citizens to anonymously upload digital evidence, which is then stored in an immutable and indestructible distributed repository. The ownership of evidence is transferred from authorities to ordinary citizens, which can minimize spoliation of evidence and human rights abuse. The model is theoretically tested against high-profile spoliation of evidence cases from four South Asian developing countries.

1.3 PROPOSED SYSTEM

The Evidence Protection System (EPS) presented in this paper harnesses the unique attributes of blockchain technology to create a secure, tamper-proof, and transparent environment for safeguarding evidence across a spectrum of applications. The system offers a comprehensive set of features that address the challenges associated with evidence tampering, data manipulation, and unauthorized access, while also promoting efficient evidence handling and verification. The proposed Evidence Protection System introduces a paradigm shift in evidence management by harnessing the capabilities of blockchain technology. Its robust architecture ensures the integrity, authenticity, and accessibility of evidence, while its automation and security features streamline evidence handling processes. With applications across various domains, the EPS holds the potential to redefine how evidence is protected, shared, and trusted in our increasingly digital and interconnected world.

1.4 REQUIREMENTS SPECIFICATION

Requirement Specifications describe the arti-craft of Software Requirements and Hardware Requirements used in this project.

Software Requirements

1) Software : Python IDE (3.7.0), Node Js, Visual Studio, Community Version, Ganache, MetaMask-Chrome Extension

2) Primary Language : Python

3) Frontend Framework : Flask

4) Back-end Framework : JavaScript ,Python

5) Front-End Technologies : HTML, CSS, JavaScript, Bootstrap4

Hardware Requirements

1) Operating System : Windows Only
2) Processor : i5 and above

3) Ram : 8gb and above

4) Hard Disk : 25 GB in local drive

CHAPTER 2
LITERATURE SURVEY

1.“Blockchain-Powered Forensic Evidence Storage: A New Approach to Data Security” [1] by A. Sangekar, V. Gumalwad, S. Khillare, K. Warbhog, S. Hadbe and U. Tupe.

The paper *"Blockchain-Powered Forensic Evidence Storage: A New Approach to Data Security"* by A. Sangekar et al. explores the use of blockchain technology to enhance the security, transparency, and integrity of forensic evidence storage. It proposes a decentralized system that prevents tampering and ensures traceability of evidence throughout the investigation process. The approach aims to eliminate single points of failure and unauthorized access. By leveraging blockchain’s immutability and smart contracts, the system enhances trust and reliability in forensic data handling.

2.“Implementation of Blockchain and IPFS to safeguard evidentiary data” [2] by S. Srivastava, G. Kaur, Himank and S. Singla.

The paper "Implementation of Blockchain and IPFS to Safeguard Evidentiary Data" by S. Srivastava et al. presents a secure framework combining Blockchain and InterPlanetary File System (IPFS) to protect digital evidence. The system ensures data immutability, decentralized storage, and secure access control. Blockchain is used to store metadata and hash values, while IPFS handles the actual data storage. This hybrid approach enhances the integrity, traceability, and resilience of evidentiary data against tampering or loss.

3.“A Framework for Digital Forensics Using Blockchain to Secure Digital Data” [3] by J. Jacob and S. Kumar.

The paper "*A Framework for Digital Forensics Using Blockchain to Secure Digital Data*" by J. Jacob and S. Kumar proposes a blockchain-based framework to enhance the security and reliability of digital forensic data.

The system ensures tamper-proof logging, transparent evidence tracking, and secure chain of custody. Blockchain's decentralized nature helps maintain data integrity and authenticity throughout investigations. The framework supports real-time verification and promotes trust in digital forensic processes.

4.“A hybrid framework for secure data transfer for enhancing the Blockchain Security” [4] by P. Batta, S. Ahuja and A. Kumar.

The paper *"A Hybrid Framework for Secure Data Transfer for Enhancing the Blockchain Security"* by P. Batta, S. Ahuja, and A. Kumar introduces a hybrid model combining cryptographic techniques with blockchain to improve secure data transfer. The framework integrates symmetric and asymmetric encryption to ensure confidentiality, integrity, and authentication. It strengthens blockchain security by addressing vulnerabilities during data transmission. This approach enhances trust, resilience, and robustness in blockchain-based systems.

5.“Security Digital Evidence” [5] by J. Richter, N. Kuntze and C. Rudolph.

The paper *"Security Digital Evidence"* by J. Richter, N. Kuntze, and C. Rudolph focuses on securing digital evidence through trusted computing and cryptographic methods. It emphasizes ensuring authenticity, integrity, and proper chain of custody in forensic investigations. The authors propose mechanisms to protect evidence from tampering and unauthorized access.

6. “Safe-Keeping Digital Evidence with Secure Logging Protocols: State of the Art and Challenges” [6] by R. Accors.

The paper *"Safe-Keeping Digital Evidence with Secure Logging Protocols: State of the Art and Challenges"* by R. Accorsi reviews existing secure logging mechanisms used to protect digital evidence. It highlights the importance of tamper-evident logs, audit trails, and integrity-preserving techniques in forensic investigations. The paper discusses current solutions, their limitations, and the challenges in ensuring long-term evidence security. It also emphasizes the need for robust, verifiable, and efficient logging protocols in digital forensics.

7. “Evidence-Based Techniques for Evaluating Cyber Protection Systems for Critical Infrastructures” [7] by J. Darby, J. Phelan, P. Sholander, B. Smith, A. Walter and G. Wyss.

The paper *"Evidence-Based Techniques for Evaluating Cyber Protection Systems for Critical Infrastructures"* by J. Darby et al. presents methodologies to assess the effectiveness of cyber protection systems in safeguarding critical infrastructure. It emphasizes data-driven evaluations using real-world scenarios and threat models. The approach helps identify system vulnerabilities, measure resilience, and guide improvements. The authors aim to enhance decision-making in cybersecurity through empirical evidence and structured analysis.

8. “Digital Copyright Depository System Enhanced by Blockchain” [8] by W. Yang, P. He, Z. Yang, X. Yi and C. Chen.

The paper *"Digital Copyright Depository System Enhanced by Blockchain"* by W. Yang, P. He, Z. Yang, X. Yi, and C. Chen proposes a blockchain-based system to protect and manage digital copyrights. The system ensures tamper-proof registration, transparent ownership tracking, and secure verification of digital content. By leveraging smart contracts, it automates copyright validation and dispute resolution.

9. “Blockchain-Based Digital Forensics Investigation Framework in the Internet of Things and Social Systems” [9] by S. Li, T. Qin and G. Min.

The paper *"Blockchain-Based Digital Forensics Investigation Framework in the Internet of Things and Social Systems"* by S. Li, T. Qin, and G. Min introduces a blockchain-enabled framework for conducting digital forensics in IoT and social systems. It ensures secure evidence collection, tamper-proof storage, and transparent traceability. The framework addresses challenges like data volatility and integrity in distributed environments.

Blockchain's decentralization strengthens trust and reliability in forensic investigations across interconnected devices and platforms.

10. “Blockchain for Cybersecurity_ Securing Data Transactions and Enhancing Privacy in Digital Systems” [10] by D. Rajababu, S. Surya, M. Padhiary and H. Modi.

The paper *"Blockchain for Cybersecurity: Securing Data Transactions and Enhancing Privacy in Digital Systems"* by D. Rajababu, S. Surya, M. Padhiary, and H. Modi explores how blockchain technology can be used to secure data transactions and protect user privacy. It highlights blockchain’s role in ensuring data integrity, confidentiality, and transparency in digital systems. The authors discuss cryptographic mechanisms and decentralized structures that mitigate cyber threats. The approach enhances cybersecurity by reducing reliance on centralized authorities and improving trust in data exchanges.

11. “Legal challenges in adopting blockchain for evidence protection” [11] by M. Anderson and J. Thompson.

This paper explores the legal implications of using blockchain for protecting digital evidence.Using real-world case studies, it identifies regulatory and policy challenges in adoption.It highlights how legal systems lag behind technological advancements.A major merit is its comprehensive legal perspective on blockchain use in law.However, it lacks discussion on technical architecture or implementation aspects.

12. “The role of blockchain in enhancing forensic investigation processes” [12] by L. Roberts and K. Williams.

The paper presents a conceptual framework for integrating blockchain into forensic investigation workflows.It emphasizes how blockchain improves transparency, auditability, and data integrity in investigations. It also outlines potential real-world applications in law enforcement.

13. “Blockchain as a service for secure evidence management in cloud environment” [13] by P. Mehta and N. Kumar.

This study proposes a Blockchain-as-a-Service (BaaS) model for secure cloud-based evidence management.It explains how cloud systems can be enhanced with blockchain features for integrity and traceability. The architecture supports scalable and secure storage of digital evidence. Its merit is combining cloud flexibility with blockchain security. The limitation is its dependency on third-party BaaS providers, which could raise trust issues.

14. “Blockchain-based approaches to digital evidence tamper resistance” [14] by S. Zhao, J. Wu, and Y. Zhang .

The paper introduces a private blockchain system using cryptographic protocols to resist evidence tampering.It explains algorithms for secure timestamping and verification of digital evidence.It effectively strengthens data integrity and provides tamper-proof logs.A key merit is the high level of security for sensitive forensic data.However, the approach has high computational overhead and may impact system performance.

15. “Smart contracts in blockchain for secure legal evidence storage” [15] by R. Banerjee and M. Ghosh.

This work explores the use of smart contracts for automating legal evidence storage and validation.It details how legal workflows can be embedded into blockchain logic to ensure secure handling.Smart contracts help reduce manual interventions and errors in the legal process.

16.“Potential Applicability of Blockchain Technology in the Maintenance of Chain of Custody in Forensic Casework”[16] **by** HarshPatil,S.Puri

The paper, *Potential Applicability of Blockchain Technology in the Maintenance of Chain of Custody in Forensic Casework,* explores how blockchain can be utilized to ensure the integrity and transparency of the chain of custody in forensic investigations. It highlights blockchain's ability to create immutable and time-stamped records of evidence handling, enhancing trust and accountability.

17. "Digital Evidence Management System for Cybercrime Investigation using Proxy Re-Encryption" [17] by H. Chougule, Sunny D, Mehul L

The paper, *Digital Evidence Management System for Cybercrime Investigation using Proxy Re-Encryption,* proposes a framework that leverages proxy re-encryption (PRE) technology to securely manage and share digital evidence in cybercrime investigations. PRE enables encrypted evidence to be securely transferred between authorized parties without direct decryption, preserving confidentiality and integrity.

18. "Decentralized Model to Protect Digital Evidence via Smart Contracts Using Layer 2 Polygon Blockchain" [18] by Sumit Kumar
The paper, *Decentralized Model to Protect Digital Evidence via Smart Contracts Using Layer 2 Polygon Blockchain,* proposes a secure framework for safeguarding digital evidence using Polygon's scalable blockchain and smart contracts. It ensures immutability, traceability, and transparency while reducing reliance on centralized systems

19. "Digital Forensic Evidence Management System Using Improved Blockchain"[19] by Venkatesh G, Srushti V Sannakki, Sahana M J, Sridevi S, Sourabh Verma

The paper, Digital Forensic Evidence Management System Using Improved Blockchain, introduces a blockchain-based framework for managing digital forensic evidence, ensuring its integrity, authenticity, and transparency. By leveraging an enhanced blockchain architecture, the system provides tamper-proof storage and tracking of evidence, improving trust in forensic processes. Its merits include enhanced security, decentralized data management, and resistance to evidence manipulation, while demerits involve high computational costs, scalability concerns, and integration challenges with traditional forensic systems.

20. “Blockchain in Legal Evidence Management”[20] by P.Sharma The paper, *Blockchain in Legal Evidence Management,* examines the application of blockchain technology to enhance the security, integrity, and transparency of legal evidence management. It highlights blockchain's potential to create immutable, time-stamped records of evidence handling, ensuring that evidence cannot be tampered with or altered. The merits of this approach include increased trust in the legal process, efficient tracking of evidence, and reduced human error or fraud.

Table 2.1: Literature Survey Table

S.NO	Author(s)	Title	Year	Journal	Methodology	Merits	Demerits
[1]	A. Sangekar, V. Gumalwad, S. Khillare, K. Warbhog, S. Hadbe and U. Tupe	Blockchain-Powered Forensic Evidence Storage: A New Approach to Data Security	2024	IEEE Pune Section International Conference	Implements a decentralized system using blockchain and smart contracts to store and track forensic evidence.	Ensures tamper-proof, transparent, and traceable evidence storage	Implementation complexity and high computational cost
[2]	S. Srivastava, G. Kaur, Himank and S. Singla	Implementation of Blockchain and IPFS to safeguard evidentiary data	2024	IEEE International Conference on Knowledge Engineering and Communication Systems (ICKECS	Stores metadata and hashes on blockchain, while IPFS manages decentralized evidence storage.	Ensures data integrity, immutability, and secure decentralized access	Requires integration of two complex systems, which may lead to performance overhead.
[3]	J. Jacob and S. Kumar	A Framework for Digital Forensics Using Blockchain to Secure Digital Data	2023	IEEE World Conference on Applied Intelligence and Computing (AIC)	Uses blockchain to log, track, and verify digital evidence in real-time.	Ensures data authenticity, transparency, and tamper-proof chain of custody.	Real-time verification can be resource-intensive and may impact system performance.
[4]	P. Batta, S. Ahuja and A. Kumar	A hybrid framework for secure data transfer for enhancing the Blockchain Security	2023	IEEE	Combines symmetric, asymmetric encryption with blockhain	Provides strong confidentiality, integrity, and authentication in data transmission.	Encryption overhead may lead to increased processing time and complexity.

[5]	J. Richter, N. Kuntze and C. Rudolph	Securing digital evidence using trusted computing and cryptography.	2022	IEEE	Applies cryptographic techniques and trusted computing to preserve evidence integrity.	Ensures authenticity, integrity, and reliable chain of custody for digital evidence.	Dependent on specialized hardware and complex trust management.
[6]	*R. Accors*	Safe-Keeping Digital Evidence with Secure Logging Protocols: State of the Art and Challenges	2022	IEEE	Analyzes tamper-evident logs, audit trails, and integrity-preserving techniques.	Improves evidence reliability through verifiable and secure logging systems	Faces challenges in long-term data preservation and protocol efficiency
[7]	J. Darby, J. Phelan, Sholander B. Smith, A. Walter and G. Wyss	Blockchain and Its Impact on Indian Governance	2021	IEEE Access	Uses evidence-based analysis with real-world scenarios and threat models.	Identifies system vulnerabilities and supports informed cybersecurity decisions.	Relies heavily on quality and availability of empirical data.
[8]	W. Yang, P. He, Z. Yang, X. Yi and C. Chen	Blockchain in Legal Evidence Management	2021	IEEE	Uses blockchain and smart contracts for copyright registration and validation.	Ensures tamper-proof ownership tracking and automates dispute resolution.	Legal acceptance and interoperability across jurisdictions may be challenging.
[9]	S. Li, T. Qin and G. Min	Digital Evidence and Blockchain: Challenges and Solutions	2020	IEEE	Implements a decentralized blockchain framework for secure evidence collection and traceability.	Enhances integrity and trust in forensic investigations across distributed environments.	Scalability issues and data synchronization challenges in large IoT networks.
[10]	D. Rajababu, S. Surya, M. Padhiary and H. Modi	Blockchain in Cybersecurity: Concepts and Applications	2019	IEEE Access	Utilizes cryptographic techniques and decentralized blockchain structures to protect data.	Ensures data integrity, confidentiality, and reduces dependency on centralized systems.	High energy consumption and scalability limitations in large-scale deployment.

[11]	M. Anderson and J. Thompson	Legal challenges in adopting blockchain for evidence protection	2019	IEEE Access	Legal analysis of blockchain use in evidence protection through case studies.	Highlights real-world legal gaps and policy issues.	Lacks technical implementation details.
[12]	L. Roberts and K. Williams	The role of blockchain in enhancing forensic investigation processes	2018	IEEE Access	Framework-based review of blockchain integration into forensic processes.	Enhances transparency and traceability.	Scalability issues not deeply explored.
[13]	P. Mehta and N. Kumar	Blockchain as a service for secure evidence management in cloud environment	2018	IEEE Access	Proposes Blockchain as a Service (BaaS) model for cloud-based evidence storage.	Enables secure and scalable cloud integration.	BaaS dependency on third-party trust.
[14]	S. Zhao, J. Wu, and Y. Zhang	Blockchain-based approaches to digital evidence tamper resistance	2017	IEEE Access	Cryptography techniques for tamper resistance using private blockchain.	Strong data integrity and auditability.	High computational overhead.
[15]	R. Banerjee and M. Ghosh	Smart contracts in blockchain for secure legal evidence storage	2017	IEEE Acess	Implements smart contracts for automated legal evidence management.	Automation reduces human error and bias.	Legal enforceability of smart contracts is uncertain.
[16]	Harsh Patil, Ravshish k.Kohli, S.Puri	Potential applicability of blockchain technology in the maintenance of chain of custody in forensic casework	2017	Springer	Empirical analysis, blockchain solution	Focused on secure storage in legal contexts	Narrow focus on storage, may overlook other aspects

[17]	H.Chougule,Sunny D, Mehul L	Digital Evidence Management System for Cybercrime Investigation using Proxy Re-Encryption	2017	Elsevier	Framework development, case studies	Provides practical frameworks for Indian context	May not be universally applicable
[18]	Sumit kumar,arun kumar,Sanjeev kumar,Vishnu Sharma	Decentralized Model to Protect Digital Evidence via Smart Contracts Using Layer 2 Polygon Blockchain	2017	IEEE Transactions on Information Forensics and Security	Theoretical framework, blockchain implementation	Advanced blockchain integration for evidence protection	May not account for practical implementation challenges
[19]	Venkatesh. G, Srushti V Sannakki, Sahana M J, Sridevi S, Sourabh Verma	Digital Forensic Evidence Management System Using Improved Blockchain	2016	International Journal of Computer Applications	Case study, blockchain application	Context-specific insights for Indian legal systems	Limited generalizability to other legal systems
[20]	P. Sharma	Blockchain in Legal Evidence Management	2016	Pearson India	Case studies, theoretical analysis	Specific focus on legal evidence management	Limited scope on broader applications

CHAPTER 3
METHODOLOGY

Evidence Protection Systems (EPS) using blockchain rely on ensuring data integrity, transparency, and secure access to sensitive information. Key features include leveraging blockchain's immutability to prevent tampering, timestamping to establish a verifiable chronology, and cryptographic hashing to maintain data integrity. Smart contracts facilitate automated workflows, ensuring a transparent chain of custody and reducing the risk of human errors. Consensus mechanisms enhance security by requiring network agreement for data validation, while cryptographic techniques, such as encryption, protect sensitive data from unauthorized access. These elements work in tandem to provide a robust framework for evidence management, minimizing risks of data breaches and enhancing trust in critical sectors.

3.1 TECHNOLOGIES USED:

1. **Blockchain Frameworks**: Platforms like Ethereum or Hyperledger Fabric provide the foundation for implementing decentralized, tamper-resistant evidence management systems.

2. **Smart Contracts**: Automate evidence handling processes, such as verifying user permissions and maintaining transparent custody chains, ensuring operational efficiency and accuracy.

3. **Cryptographic Hashing**: Secures data integrity by generating unique, tamper-evident fingerprints for each piece of evidence, allowing detection of unauthorized modifications.

4. **Consensus Mechanisms**: Ensure network-wide agreement on recorded data, preventing unauthorized alterations and reinforcing trust in the system.

5. **Decentralized Storage**: Solutions like IPFS or Filecoin store large files securely while linking them to blockchain-based hashes, ensuring accessibility and data authenticity.

3.2 DEVELOPMENT PROCESS:

Requirements Gathering: The requirements were gathered from stakeholders, focusing on secure evidence storage, access control, and chain-of-custody tracking. The goal was to define key features and ensure the system met both technical and user needs.

System Design: The design phase focused on defining blockchain architecture, smart contracts, and database schema. Wireframes were created to visualize user interaction and ensure ease of use while meeting security requirements.

Implementation: The backend involved smart contract deployment and server-side logic, while the frontend focused on building an accessible user interface. Decentralized storage (IPFS) and cryptographic hashing ensured data integrity and secure evidence storage.

Testing: Testing included manual, user acceptance, security, and performance testing to ensure functionality, usability, and security. Feedback from users helped refine features, and performance tests validated system efficiency under various conditions.

Manual Testing: This phase simulated interactions such as uploading evidence, accessing records, and verifying the integrity of data through the blockchain. It helped ensure that the application functioned as expected, especially with smart contracts and cryptographic features.

User Acceptance Testing (UAT): This involved key stakeholders, such as moderators and legal analysts, testing the platform for usability. Their feedback was used to refine features, improve the user experience, and ensure the system met operational goals.

Security Testing: Given the sensitivity of the data, rigorous security testing was conducted to identify any vulnerabilities, such as potential exploits in the smart contracts or unauthorized access to evidence.

Performance Testing: Performance testing was conducted to measure how efficiently the system handled various use cases, such as uploading large files, verifying blockchain data, and performing multiple queries simultaneously. This ensured the system remained fast and responsive under various loads.

Deployment: The system was deployed using cloud platforms and hosted on GitHub Pages. GitHub Actions automated CI/CD for efficient deployment, ensuring continuous updates and secure system operation.

CHAPTER 4

DESIGN OF EVIDENCE PROTECTION SYSTEM

4.1 DESIGN

The design of a project lays out the blueprint for how it will function. It details the steps, materials, and tools needed to achieve the project's goals. It's like a recipe that ensures everyone involved understands how to turn the idea into reality.

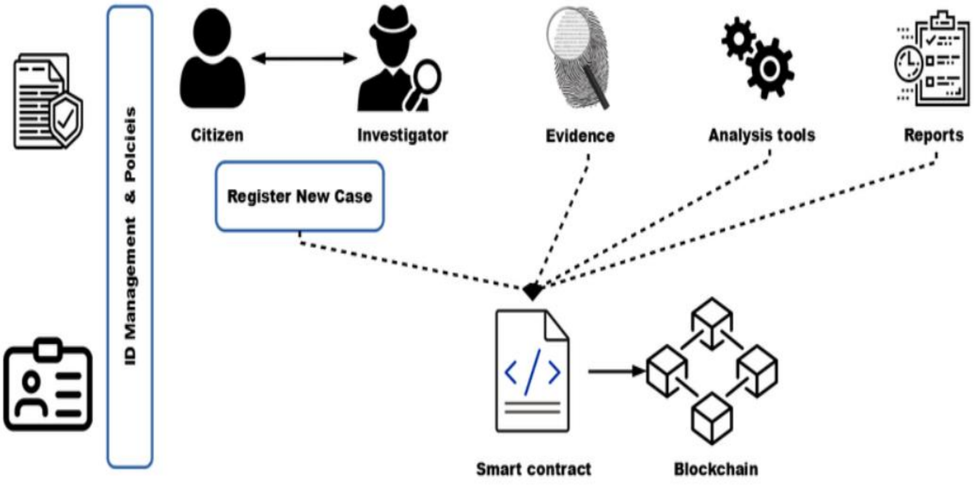


Figure 4.1 Design of Evidence Protection System

1. The **Evidence Protection System (EPS)** is designed to offer an efficient and secure experience for different user roles, including legal analysts, evidence moderators, and general users. The system architecture, as shown in Figure 3.1, provides customized functionalities for each role to address their specific needs while ensuring essential evidence management services are accessible to all. Legal analysts and system administrators have advanced tools for reviewing and verifying evidence records, while moderators are provided with an intuitive interface for monitoring evidence access

and ensuring compliance with legal standards. General users can securely upload and view evidence, with automated tracking of data integrity and chain-of-custody. The core functions of the system focus on ensuring data security, immutability, and transparency, making it reliable, accessible, and secure for all involved parties.

2. **Login:** Users access the **Evidence Protection System (EPS)** through a secure login interface, where they enter their credentials, such as username or email and password. This authentication process ensures that only authorized individuals—such as legal analysts, evidence moderators, and general users—can access the system's sensitive features. The login mechanism enforces role-based access control (RBAC), ensuring that each user type can only interact with the system's functionalities according to their designated permissions, enhancing both security and user-specific experiences.
3. **Cloud Authentication:** Upon successful login, cloud-based authentication mechanisms, such as Firebase Authentication or similar secure services, validate user credentials to ensure that only authorized users gain access to the Evidence Protection System (EPS). This authentication layer plays a critical role in safeguarding user data, protecting sensitive evidence, and ensuring that only users with the appropriate permissions can access certain features. By using cloud authentication, the system ensures robust security, preventing unauthorized access and maintaining the integrity and confidentiality of the evidence and associated processes.
4. **User Roles:**

   Administrator: Administrators oversee the system’s overall functionality, ensuring proper security and compliance with legal standards:

   Full access to the system for managing users, permissions, and system settings.

   Ability to review all evidence uploaded by users and validate blockchain records.

Control over data storage, encryption settings, and audit trails for compliance.

Monitor system performance and access logs for suspicious activities.

Law Enforcement: Law enforcement officials use the system to upload, review, and manage evidence related to criminal investigations:

Upload digital evidence (e.g., documents, photos, videos) securely to the blockchain.

Access blockchain records to verify the authenticity and integrity of evidence.

Option to share evidence securely with other authorized entities while maintaining chain-of-custody integrity.

Notification of any changes in the status or integrity of evidence.

Forensic Experts: Forensic experts are tasked with analyzing and verifying evidence integrity:

Access to detailed records of the evidence stored on the blockchain, including timestamped audit trails.

Ability to conduct forensic analysis on evidence to assess authenticity and potential tampering.

Tools to annotate or flag evidence for further investigation.

Generate reports on evidence authenticity, providing expert validation.

General User (Evidence Submitter): General users can submit evidence for protection or verification purposes:

Ability to securely upload digital evidence, such as images, videos, or documents.

Receive confirmation of evidence submission along with a unique identifier and timestamp, ensuring immutability.

Access status updates and notifications when evidence is successfully uploaded and verified.

Can track the chain of custody to ensure evidence integrity throughout its lifecycle.

Common Services:

Blockchain-Backed Evidence Storage: All users benefit from the system's decentralized storage model, which ensures that evidence cannot be tampered with or altered after submission. Blockchain guarantees a transparent and immutable chain of custody.

Secure Verification & Authentication: The platform uses cryptographic techniques to authenticate the evidence and its associated metadata (e.g., timestamp, uploader information) on the blockchain.

Audit Trail & Transparency: Blockchain technology provides a transparent and verifiable audit trail for every piece of evidence, allowing users to track any changes or access attempts in real-time.

Help and Support: Users can access technical support, training resources, and FAQs for guidance on submitting evidence, using the system, or resolving any issues with evidence integrity.

Educational Resource Center: A repository of materials to educate users on blockchain technology, data protection laws, best practices for evidence handling, and the importance of preserving the integrity of digital evidence.

4.2 PROCESS FLOW DIAGRAM

A **Process Flow Diagram (PFD)** visually represents the steps or stages involved in managing evidence within the **Evidence Protection System (EPS)**. It outlines the sequence of activities, decision points, and dependencies between various components of the system. Each step in the diagram typically includes a specific task, such as evidence upload, encryption, or verification, along with any conditions or criteria that must be met before proceeding to the next step. The flowchart helps to illustrate the entire process, from evidence submission to final verification, highlighting any decision points such as access control checks or smart contract validation. It also assists in identifying potential bottlenecks, ensuring that all required processes—such as secure storage, access control, and data integrity verification—are properly accounted for in the project plan and workflow

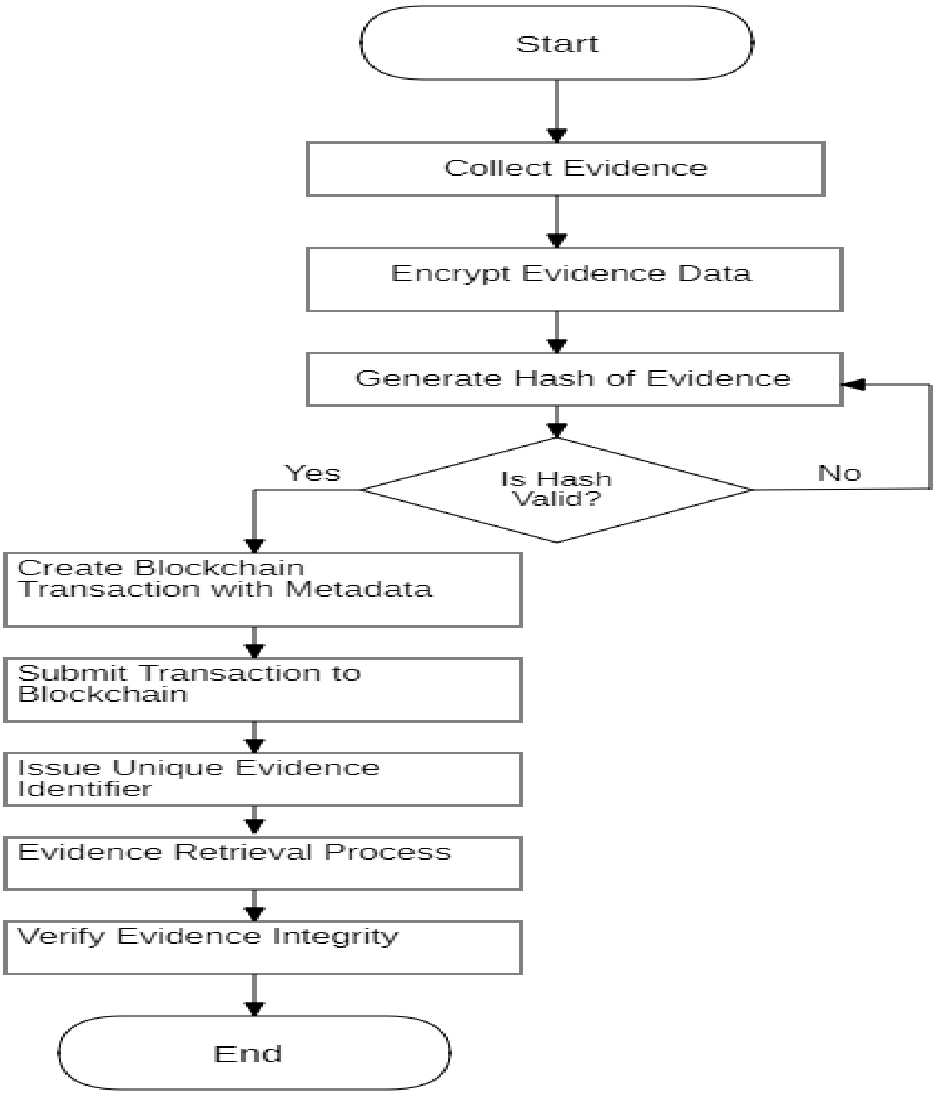

Start
Collect Evidence
Encrypt Evidence Data
Generate Hash of Evidence
Is Hash Valid?
Yes
No
Create Blockchain Transaction with Metadata
Submit Transaction to Blockchain
Issue Unique Evidence Identifier
Evidence Retrieval Process
Verify Evidence Integrity
End

Figure 4.2 Process flow Diagram of Evidence Protection System

1. The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system.

2. The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system.
3. DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output.
4. DFD is also known as bubble chart. A DFD may be used to represent a system at any level of abstraction. DFD may be partitioned into levels that represent increasing information flow and functional detail.

4.3 SYSTEM ARCHITECTURE

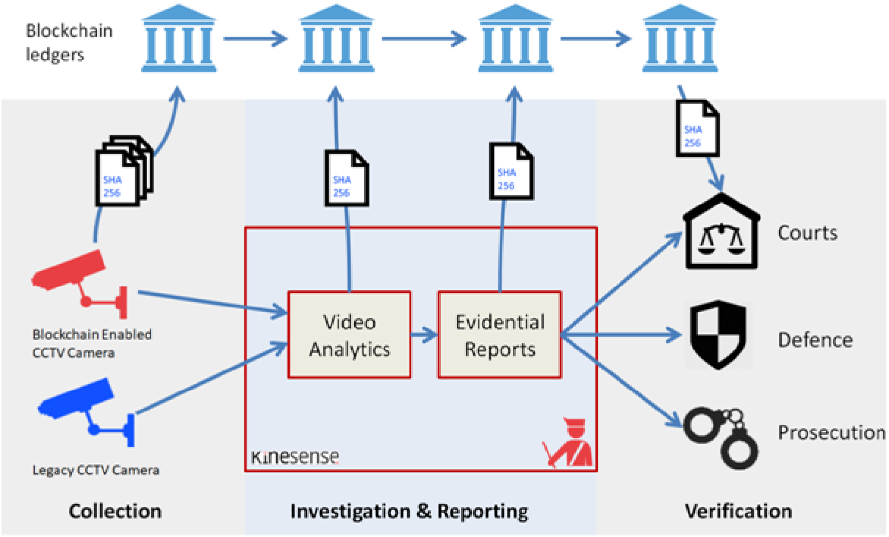


Figure 4.3: Detailed System Architecture of Evidence Protection System

Figure 4.3 illustrates the detailed data flow and system architecture of the Evidence Protection System (EPS). The process begins with the submission of evidence (documents, images, or videos), which, if it's a video, is split into individual frames. These frames or images are then processed through exploratory data analysis (EDA) to identify underlying patterns or irregularities that may indicate evidence tampering. After the EDA step, the data is passed through the detection system, which uses blockchain-based verification, cryptographic hashing, and smart contracts to assess the authenticity of the evidence. The system employs various techniques to ensure data integrity, such as timestamping and chain-of-custody tracking.

4.4 UML DIAGRAMS

Use case diagram:

The Use Case Diagram of Evidence Protection System depicts interactions between a User and a system. The **actor** (User) is shown performing five use cases. These use cases include **Register or Signup,** allowing new users to create an account, and **Login or Signin**, enabling existing users to access their accounts. The **Add Information** use case lets users input data, while **Check Information** allows them to view stored data. Lastly, **Logout** ensures secure session termination.

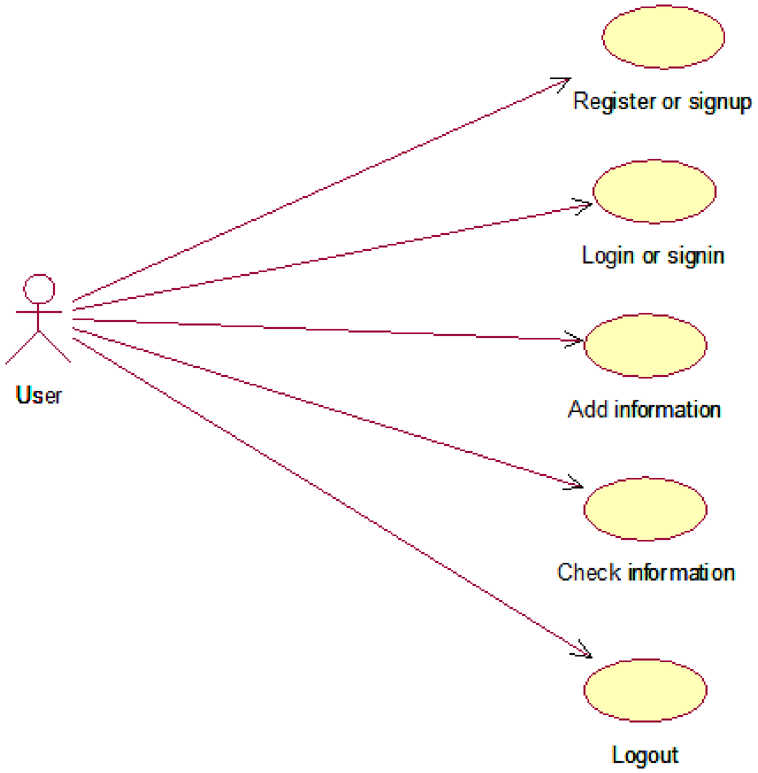


Figure 4.4.1 Use Case Diagram of Evidence Protection System

Class diagram:

The Class Diagram of Evidence Protection System have five main classes: **User Register**, **User Login**, **Add Information**, **Check Information**, and **Logout**. The **User Register** class contains attributes like **username, password, and other details**, with a method **register()** for account creation. The **User Login** class includes **username and password** attributes, along with a **login()** method for authentication. Once logged in, users can use the **Add Information** class to store **data** using the **add information()** method. The **Check Information** class allows users to access stored **data** with the **check information()** method. Finally, the **Logout** class has a **logout()** method for secure exit.

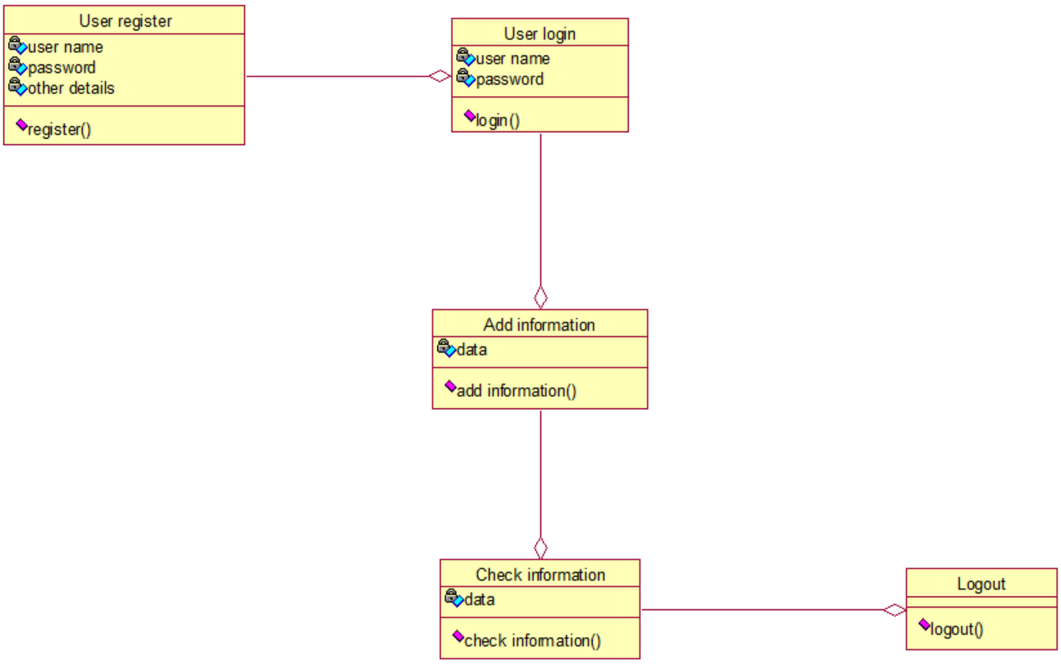


Figure 4.4.2 Class Diagram of Evidence Protection System

Activity diagram:

The Activity Diagram of Evidence Protection System represents the user flow in a system. It starts with the **Open Application** step, where the user accesses the system. Next, the user can **Register** to create an account before proceeding to **Login**. After logging in, they have the option to **Add Information**, which allows storing data in the system. The user can then **Check Information** to view the stored data. Once done, they can choose to **Logout**, ensuring a secure exit. The flow ends with the **End** state, marking the completion of the process.

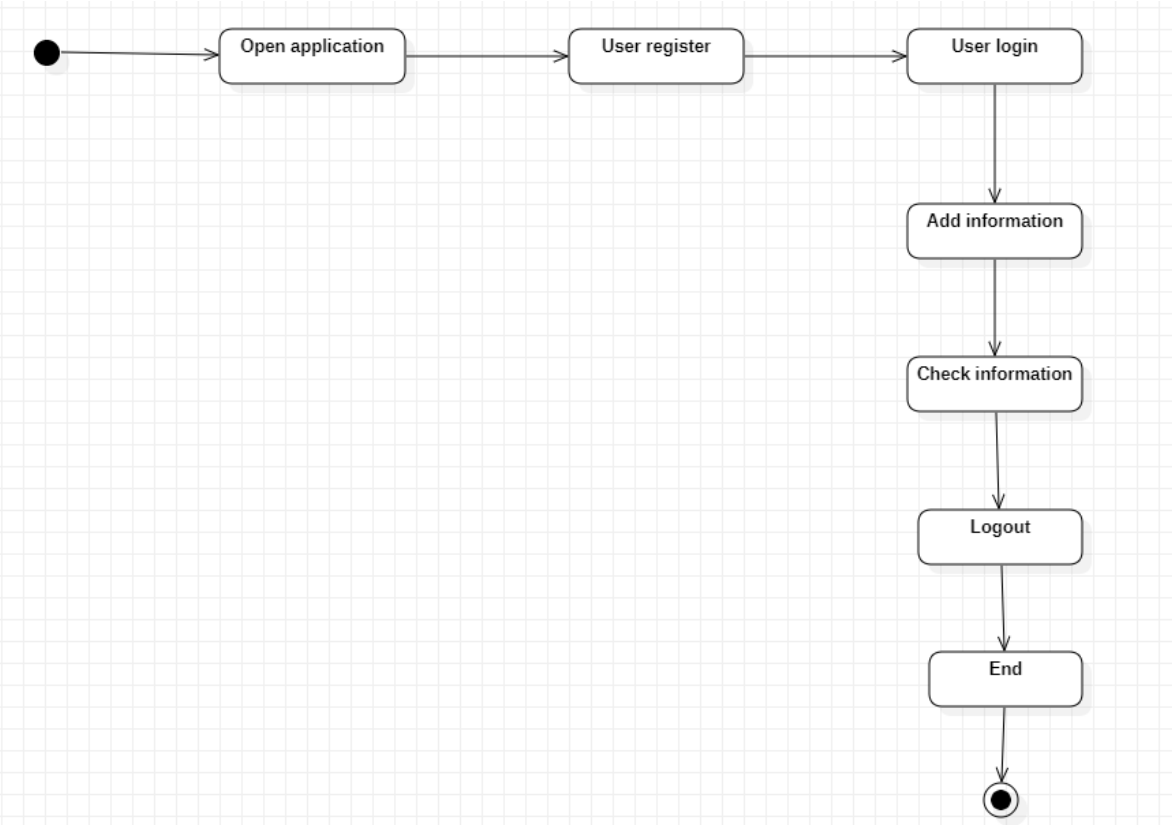


Figure 4.4.3 Activity Diagram of Evidence Protection System

Sequence diagram:

The **Sequence Diagram** of Evidence Protection System illustrates the interaction between a **User** and the **System**. The user starts by sending a **Register** request to the system to create an account. Once registered, they proceed to **Login**, where the system verifies their credentials. After logging in, the user can **Add Information**, which is sent to the system for storage. They can then **Check Information**, retrieving stored data from the system. Finally, the user **Logs out**, terminating the session. Each action is represented by an arrow from the **User** to the **System**, showing the step-by-step communication.

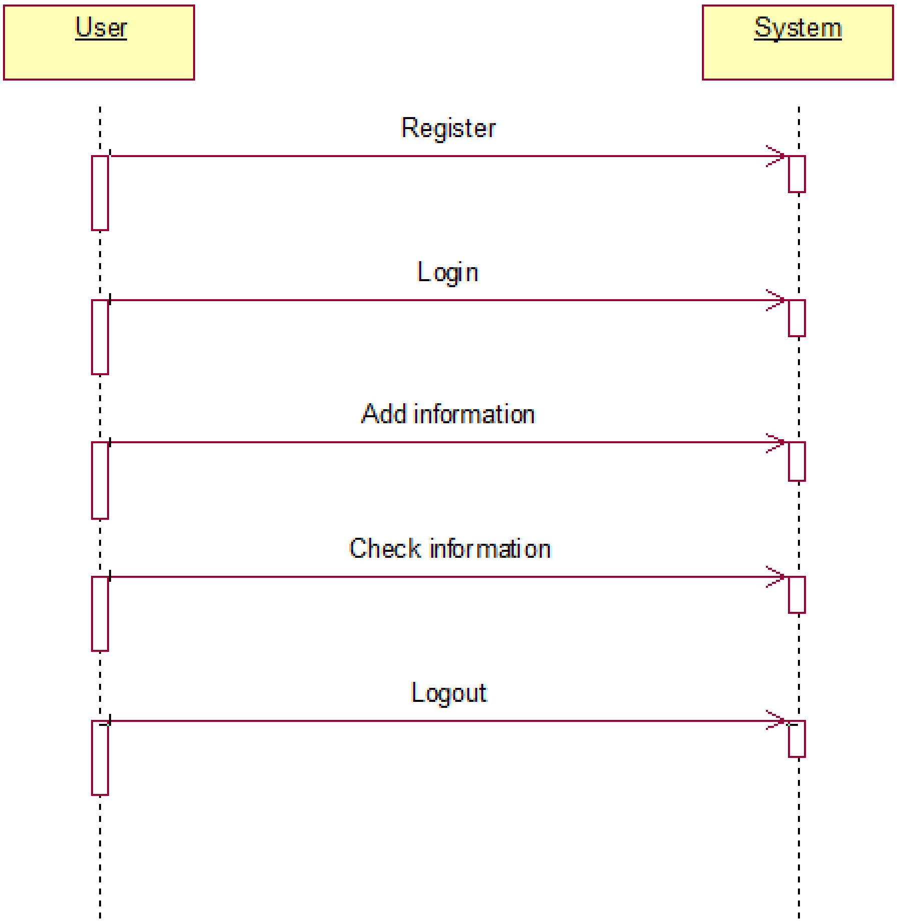


Figure 4.4.4 Sequence Diagram of Evidence Protection System

Collaboration diagram

The Collaboration diagram of Evidence Protection System represents a Basic Interaction Flow between a User and a System. The user initiates the interaction by performing five sequential actions: Register, where they create an account, followed by Login to access the system. Once logged in, the user can Add Information, storing data within the system. They can then Check Information to retrieve stored data. Finally, the user Logs Out, ending their session. The arrow between the user and the system signifies communication and interaction.

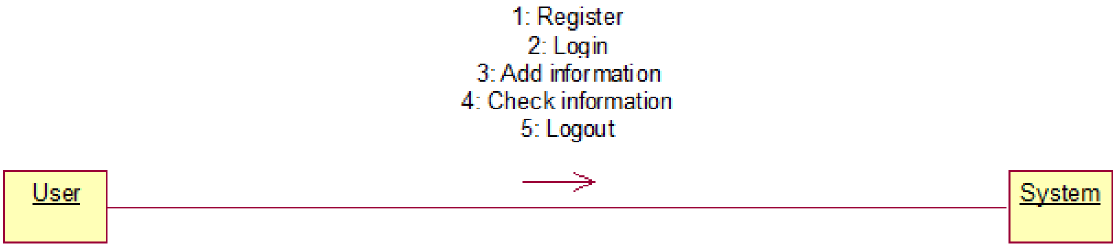


Figure 4.4.5 Collaboration diagram of Evidence Protection System

Component diagram:

The Component Diagram of Evidence Protection represents the structure of a user interaction system. It consists of five main components: **User Register**, **User Login**, **Add Information**, **Check Information**, and **Logout**. The **User Register** component allows users to create an account, followed by **User Login** for authentication. Once logged in, users can interact with the **Add Information** component to store data. They can then retrieve stored data using the **Check Information** component. Finally, the **Logout** component ensures a secure exit from the system. components.

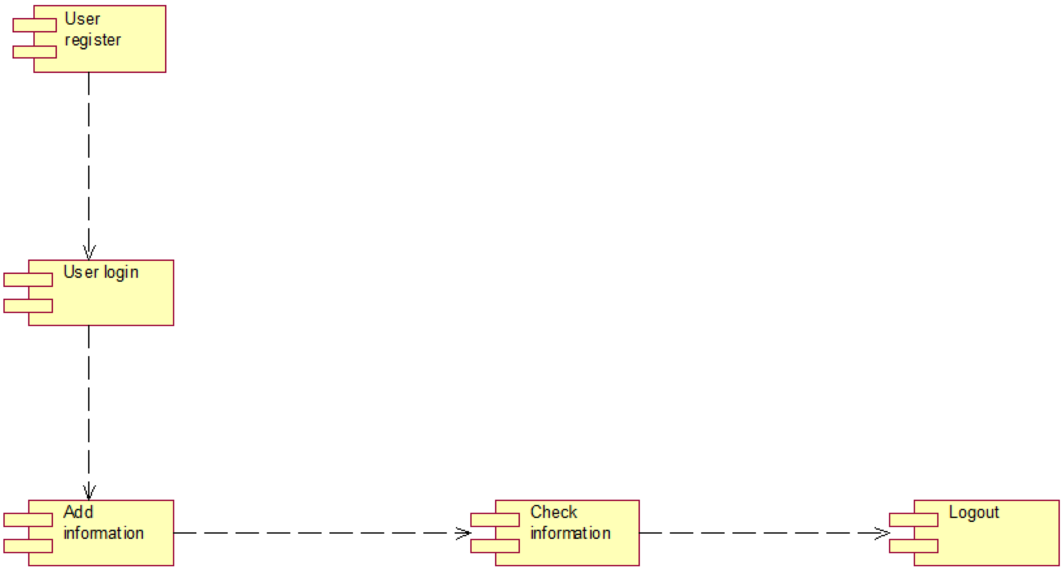


Figure 4.4.6 Component diagram of Evidence Protection System

Deployment diagram:

The **Deployment Diagram** of Evidence Protection System illustrates the interaction between a **User** and a **System**. The diagram consists of two primary components: the **User**, representing the end-user interacting with the system, and the **System**, which processes user requests. The connection between them signifies communication, where the user sends requests and receives responses from the system. This structure helps in understanding how users interact with a system at a high level. It can represent any software system, such as a web application, authentication system, or database-driven application. The simplicity of this diagram makes it useful for foundational system design discussions.

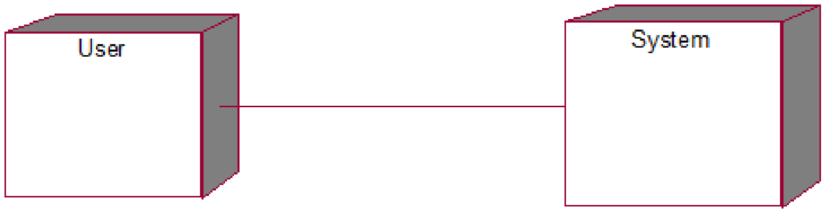


Figure 4.4.7 Deployment diagram of Evidence Protection System

CHAPTER 5
IMPLEMENTATION

MODULES:

User Signup

This module allows individuals to create accounts within the system by providing necessary details such as name, email, and password. The registration process ensures that user data is securely stored, leveraging blockchain technology to maintain data integrity and prevent unauthorized modifications.

User Sign-in

Once registered, users can sign in to the system using their credentials. The authentication process verifies the provided information against stored records, granting access to system functionalities based on user roles and permissions. Blockchain-based security ensures tamper-proof authentication.

Add Evidence Information

This module enables users to input or upload evidence-related data, such as documents, images, and videos. The system ensures that all uploaded information is authenticated and stored securely using blockchain technology. By leveraging the immutability feature of blockchain, this module guarantees that once evidence is added, it cannot be altered or deleted, maintaining its credibility.

Verify & Retrieve Evidence

Users can access and verify stored evidence using a unique identifier. The system provides search and retrieval functionalities to ensure authorized individuals can view specific evidence while maintaining security. Blockchain ensures that the integrity of stored evidence remains intact by offering a transparent audit trail that confirms no unauthorized modifications have occurred.

Access Control & Permissions

This module implements role-based access control, ensuring that only authorized users can view or modify specific pieces of evidence. Permissions are managed securely using blockchain authentication, which prevents unauthorized access while allowing transparency for authorized users.

Audit & Tamper Detection

The system logs all interactions with the evidence, creating an immutable audit trail for tracking changes. If an unauthorized attempt is made to modify or access evidence, the blockchain-based system detects and records the attempt, ensuring data remains protected. Alerts and notifications can be generated in case of potential security breaches.

Final Verification & Approval

Before being used in legal or official proceedings, evidence must be verified and approved. This module allows authorized personnel, such as law enforcement or legal professionals, to cross-check and validate the authenticity of stored evidence. The blockchain's hashing mechanism ensures that the data has not been altered after submission, providing a transparent and trustworthy verification process.

Algorithms:

Step 1: AES Encryption

Algorithm: Advanced Encryption Standard (AES)

Purpose: Ensures the **confidentiality** of sensitive evidence data by encrypting the file before it is processed or stored. This prevents unauthorized access even if data is exposed.

Contribution: Protects sensitive content from being read or misused by unauthorized users.

Step 2: SHA-256 Hashing

Algorithm: Secure Hash Algorithm (SHA-256)

Purpose: Converts the encrypted evidence into a unique, fixed-size hash. This acts as a digital fingerprint to detect any tampering.

Contribution: Ensures **data integrity** by allowing verification that the evidence has not been altered.

Step 3: Timestamping

Mechanism: Blockchain native timestamp (automatically generated with block creation)

Purpose: Assigns a precise date and time to each evidence entry.

Contribution: Maintains the **chronological order** of records, which is crucial for legal and forensic validity.

Step 4: Smart Contract Execution

Technology: Smart Contracts (e.g., Solidity on Ethereum)

Purpose: Automates key processes such as:

1) Logging evidence transactions

2) Verifying user permissions

3) Managing access rights

Contribution: Ensures **automation, transparency, and enforcement of access policies**, reducing human errors and enhancing trust.

Step 5: Consensus Mechanism

Algorithm:

PBFT / PoA (for private blockchain)

PoW / PoS (for public blockchain)

Purpose: Validates the transaction by reaching agreement among nodes before adding it to the blockchain.

Contribution: Ensures **data validity and resistance to tampering** by achieving distributed agreement.

Step 6: Blockchain Storage

Technology: Distributed Ledger Technology (DLT)

Purpose: Stores the final encrypted and hashed evidence with metadata in a secure, tamper-proof format across decentralized nodes.

Contribution: Provides **immutability and traceability**, making it impossible to modify or delete records once added.

5.1 TECHNOLOGY STACK

Frontend: HTML, CSS, JavaScript, Bootstrap4
Backend: Flask, Node.js
Database: SQLite3, Blockchain (Ethereum/Ganache)
Software: Python IDE (3.7.0), Visual Studio Community Version, Ganache, MetaMask Chrome Extension
Primary Language: Python, JavaScript

5.2 FEATURES

1. User Authentication

The system provides a secure registration and login process, ensuring only authorized individuals can access the platform. It leverages blockchain-based authentication to store user credentials securely, preventing unauthorized access or tampering. Role-based access control is implemented to differentiate between general users, legal authorities, and administrators, granting appropriate permissions based on user roles.

2. Dashboard

Admin Dashboard: Displays system analytics, user activity logs, and tools to manage blockchain transactions, user accounts, and evidence records.

Legal Authority Dashboard: Provides access to verified evidence records, search functionalities, and the ability to approve or reject evidence submissions.

User Dashboard: Allows users to upload and manage their evidence records, view verification status, and track all past interactions with their submitted data.

3. Evidence Submission & Management

Users can upload evidence in various formats, including documents, images, and videos. Each submission is recorded on the blockchain with a unique hash, ensuring immutability and authenticity. The system automatically timestamps and secures uploaded content, preventing any future alterations.

4. Evidence Verification & Audit Trail

Authorized personnel can retrieve and verify stored evidence by checking blockchain records. The system maintains a transparent audit trail, ensuring every interaction with the evidence is securely logged. This ensures accountability and provides legal authorities with verifiable proof of data integrity.

5. Secure Access & Permission Management

Role-based access ensures that only authorized users can access or modify specific evidence records. Blockchain authentication further strengthens security, preventing unauthorized alterations while allowing seamless transparency for legal professionals.

6. Real-Time Notifications & Updates

Users receive real-time notifications when evidence is successfully submitted, verified, or accessed by authorized personnel. The system also alerts users if an attempt to tamper with stored evidence is detected.

7. Final Verification & Approval

Before evidence is used in legal proceedings, authorized legal professionals can perform final verification. Blockchain hashing mechanisms ensure that data remains unaltered after submission, guaranteeing the authenticity of stored evidence.

By integrating these features, the **Evidence Protection System** ensures a secure, transparent, and tamper-proof approach to managing digital evidence using blockchain technology.

5.3 IMPLEMENTATION DETAILS

1. Frontend Implementation

HTML: Structures the layout for various pages, including login, signup, dashboards, and evidence submission forms.

CSS: Ensures a responsive design, creating a user-friendly interface for various devices.

JavaScript: Manages client-side logic, including form validations, real-time notifications, and asynchronous data fetching from the blockchain.

2. Backend Implementation

Flask: Handles server-side operations, managing blockchain interactions and user requests.

Node.js: Facilitates communication with the Ethereum blockchain and handles smart contract interactions.

Ganache (Ethereum Blockchain): Simulates a local blockchain environment for smart contract testing and evidence storage.

MetaMask: Provides a secure way for users to interact with the blockchain and authorize transactions.

3. Real-Time Communication

Blockchain Transactions: Ensures secure and transparent data storage for every evidence submission.

Smart Contracts: Automates evidence verification and ensures integrity by validating records against blockchain hashes.

Notifications: Users and legal authorities receive real-time alerts for successful submissions, verification status, and suspicious activities.

These implementation components ensure a **secure, decentralized, and efficient** system that prevents tampering, enhances transparency, and provides verifiable proof of digital evidence integrity.

5.4 USER INTERFACE

1. Home Page

Provides three options: **Admin Login, Legal Authority Login, General User Login.**

2. User Signup Page

Fields: First Name, Last Name, Email, Phone Number, User Type (General User / Legal Authority), Password, Confirm Password.

Sign-Up Process: Validates email uniqueness and securely stores user credentials using blockchain authentication.

3. User Sign-In Page

Verification: Confirms user type and credentials to prevent unauthorized access.

Successful Login: Redirects to the appropriate dashboard based on user role; otherwise, displays an "Invalid User" message.

4. User Dashboard

Welcome Message: Greets users with their name and profile info.

Upload Evidence: Interface for users to submit documents, images, or videos as evidence.

View Submission History: Displays all previously submitted evidence with blockchain verification details.

Evidence Status: Shows whether submitted evidence has been verified or is pending approval.

Logout: Option to securely log out of the system.

5. Legal Authority Dashboard

Welcome Message: Displays a welcome message with the user's name and role.

Review Evidence: List of submitted evidence for verification, with blockchain authentication details.

Audit Logs: Provides a transparent history of all interactions with stored evidence.

Notifications: Alerts legal professionals when new evidence requires verification.

Final Verification: Approve or reject evidence submissions based on blockchain records.

Logout: Option to securely sign out.

6. Admin Dashboard

System Overview: Displays analytics on user activity, blockchain transactions, and evidence verification statistics.

Manage Users: Provides an interface to view and manage user roles and permissions.

Audit Logs: Tracks all interactions within the system for security and compliance purposes.

Logout: Option to securely sign out.

CHAPTER 6

RESULTS

6.1 User Signup Interface:

Figure 6.1 displays the User Signup page of the Evidence Management System Using Blockchain. The top navigation bar contains options for User Signup and User Sign-in.

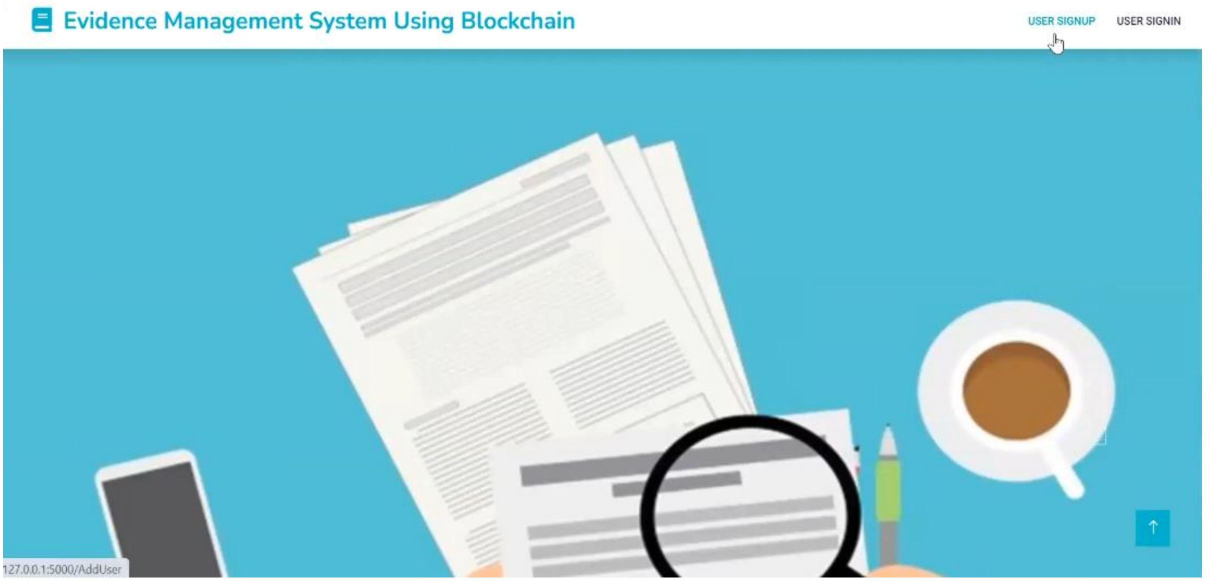
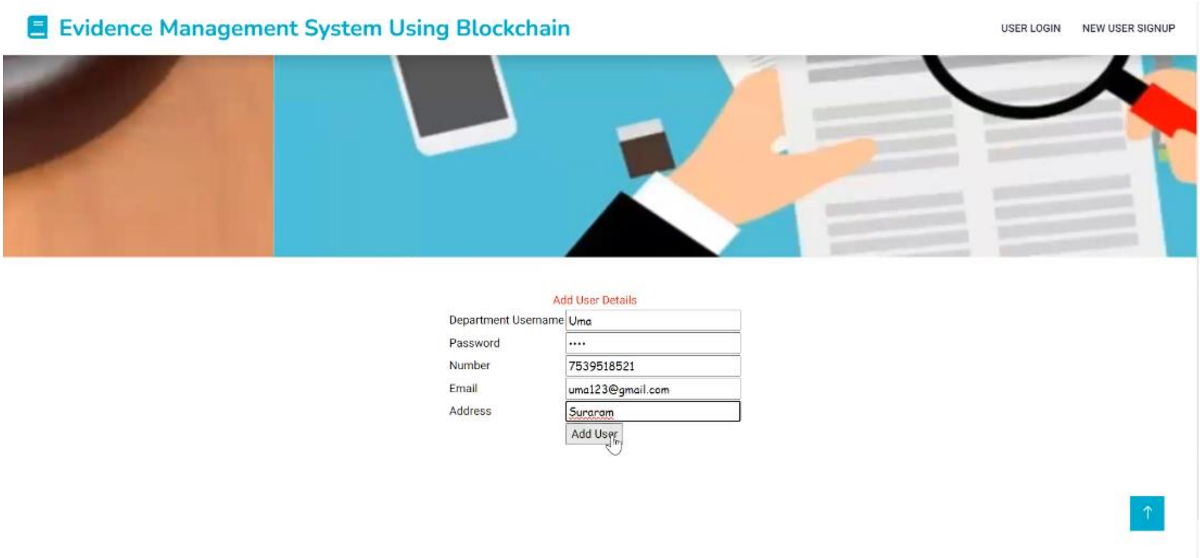


Figure 6.1 User Signup Interface of Evidence Protection System

6.2 User Registration Page

Figure 6.2 represents the User Registration page of the Evidence Management System Using Blockchain, designed to securely manage user details. The interface includes a form where users can enter their Department Username, Password, Phone Number, Email, and Address before submitting it using the "Add User" button. This registration process ensures that only authorized personnel can access the system. The navigation bar at the top provides options for User Login and New User Signup, allowing users to either log in or create a new account.



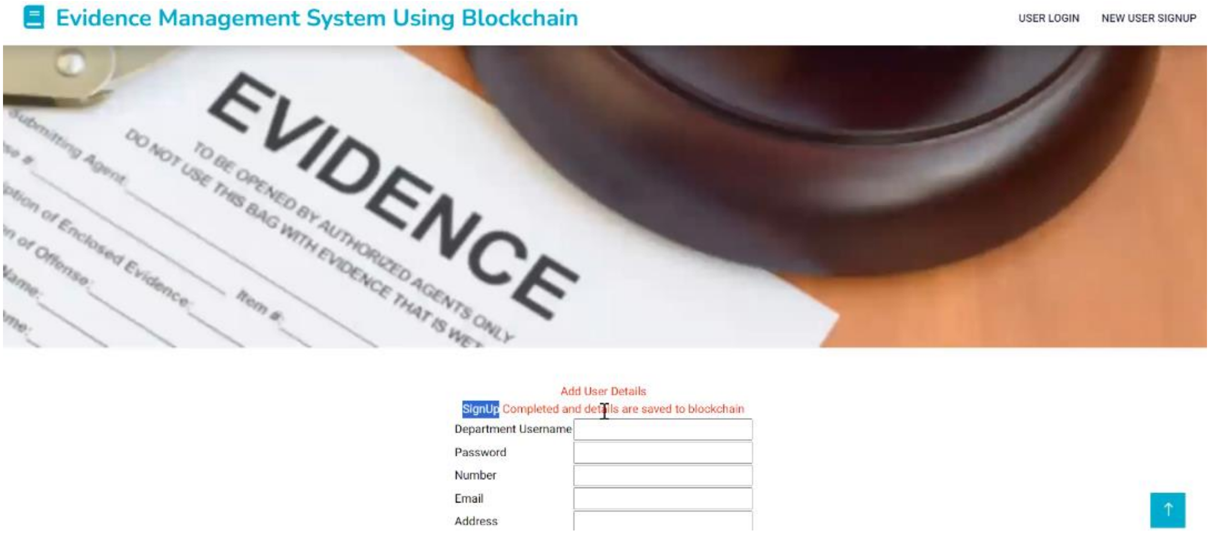
Add User Details

Department Username	Uma
Password	••••
Number	7539518521
Email	uma123@gmail.com
Address	Suraram

Figure 6.2 User Registration Page of Evidence Protection System

6.3 User Signup Confirmation (1):

Figure 6.3 shows the signup confirmation page of the Evidence Management System Using Blockchain. A message at the top of the form indicates that signup is completed and user details are saved to the blockchain, ensuring secure and immutable record-keeping. Below this, the registration form is displayed with fields for Department Username, Password, Phone Number, Email, and Address, allowing new users to input their details


Evidence Management System Using Blockchain
USER LOGIN
NEW USER SIGNUP
EVIDENCE
TO BE OPENED BY AUTHORIZED AGENTS ONLY
DO NOT USE THIS BAG WITH EVIDENCE THAT IS WET
Submitting Agent
Description of Enclosed Evidence
Item #

Add User Details

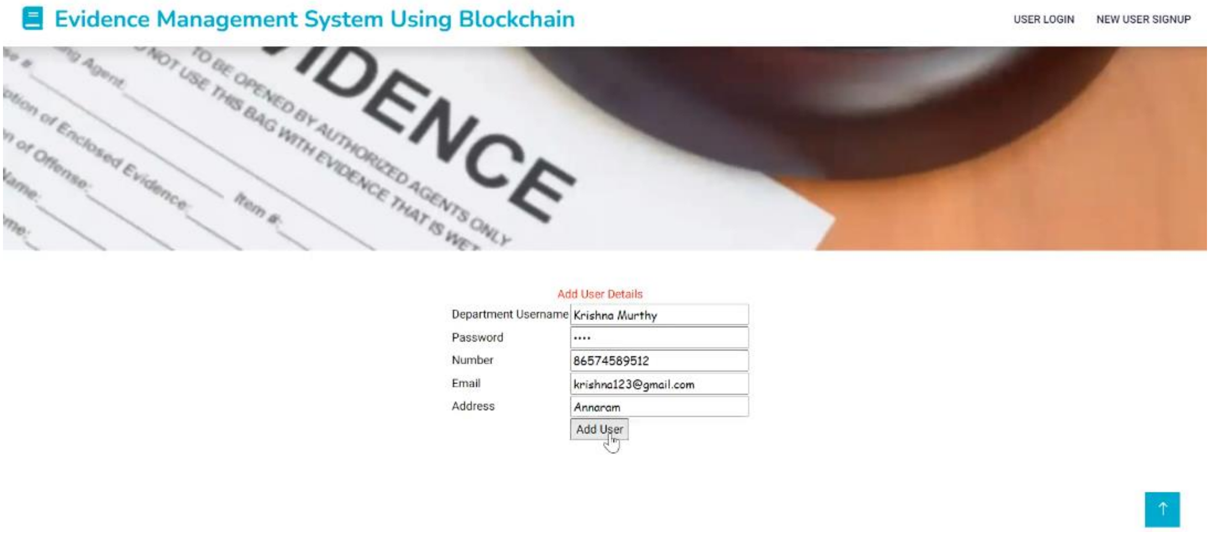
SignUp Completed and details are saved to blockchain

Department Username	
Password	
Number	
Email	
Address	

Figure 6.3 User Signup Confirmation (1) Page of Evidence Protection System

6.4 User Signup (2):

Figure 6.4 shows the User Registration page of the Evidence Management System Using Blockchain, where a second user is being added. The form titled "Add User Details" is filled with the new user's information, including Department Username, Password, Phone Number, Email, and Address. The "Add User" button is being clicked to submit and store the details securely in the blockchain.



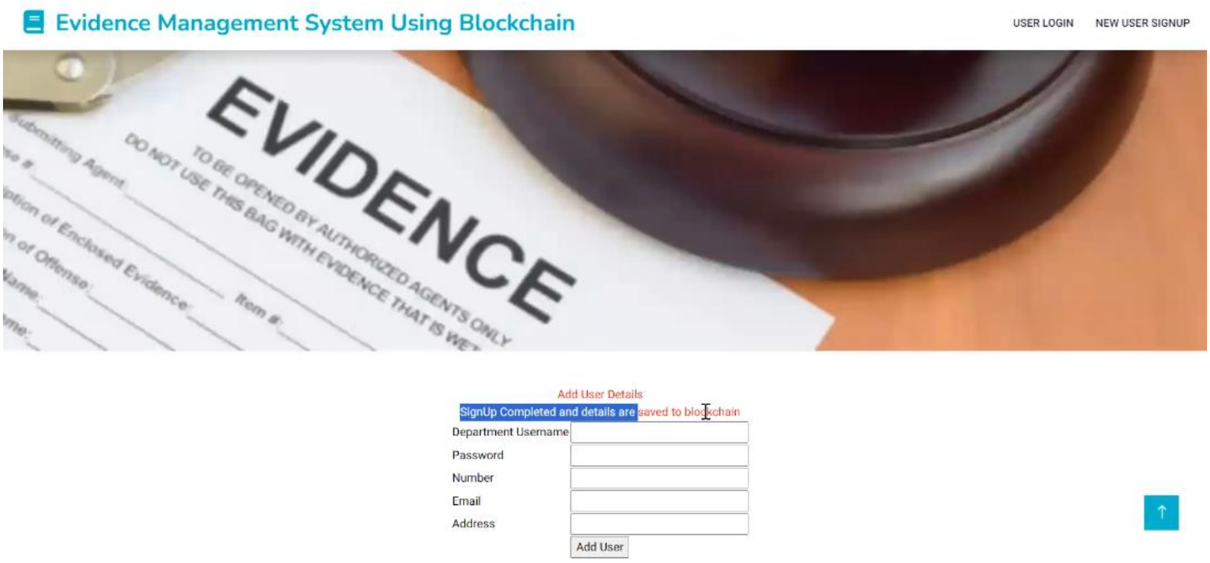
Add User Details

Department Username	Krishna Murthy
Password	••••
Number	86574589512
Email	krishna123@gmail.com
Address	Annaram

Figure 6.4 User Signup (2) Page of Evidence Protection System

6.5 User Signup Confirmation (2):

Figure 6.5 shows a webpage for an "Evidence Management System Using Blockchain." The interface includes a registration form for adding user details such as Department Username, Password, Number, Email, and Address. A confirmation message, "SignUp Completed and details are saved to blockchain," is displayed. The header includes options for "USER LOGIN" and "NEW USER SIGNUP."



Evidence Management System Using Blockchain

USER LOGIN NEW USER SIGNUP

Add User Details

SignUp Completed and details are saved to blockchain

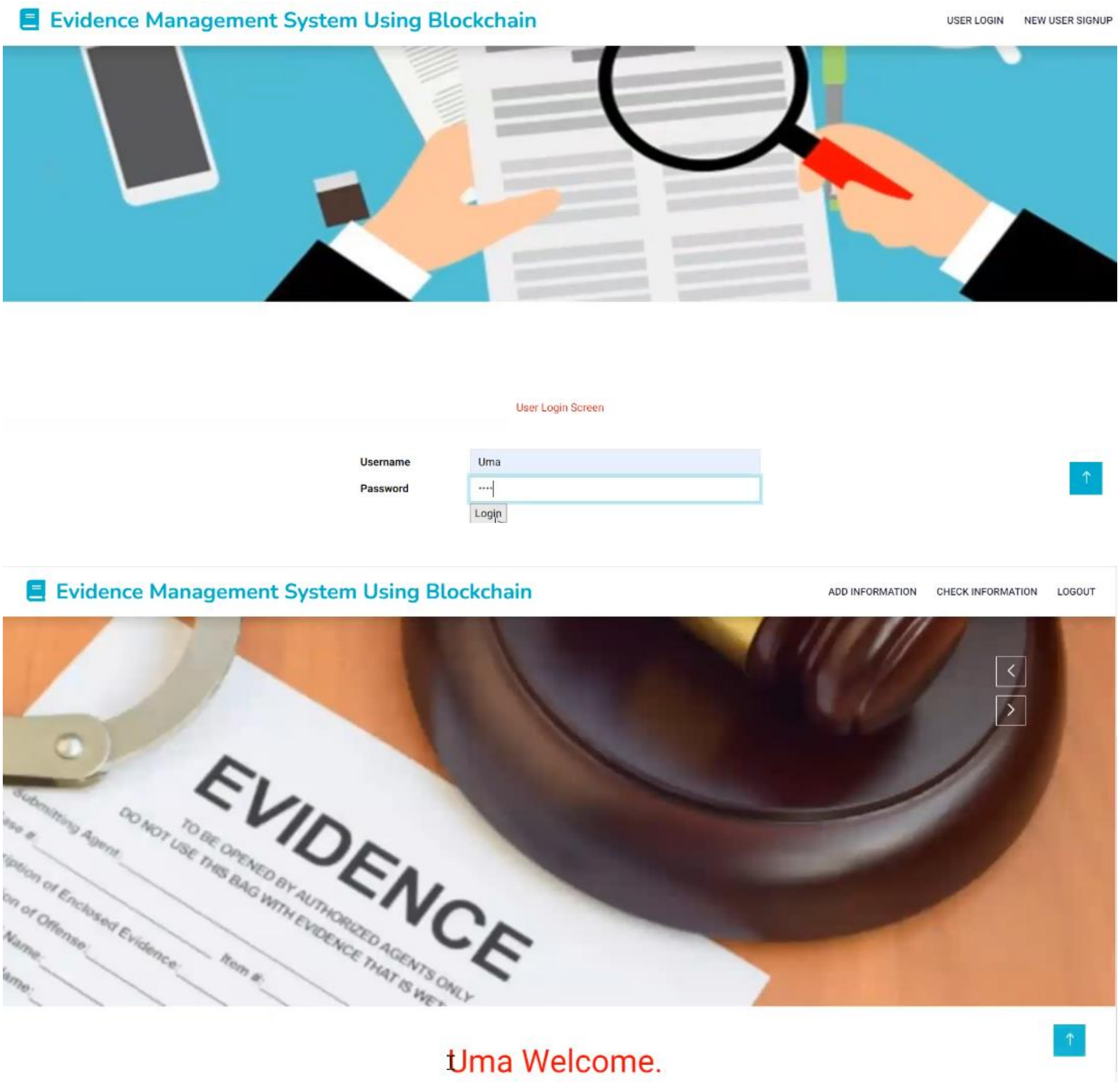
Department Username	
Password	
Number	
Email	
Address	
	Add User

Figure 6.5 User Signup Confirmation (2) Page of Evidence Protection System

6.6 User login:

Figure 6.6 shows the login page of the "Evidence Management System Using Blockchain." It includes fields for entering a username and password, along with a Login button for user authentication. The interface features a clean and professional layout, with options for USER LOGIN and NEW USER SIGNUP located in the top-right corner. Upon accessing the page, a welcome message is displayed to greet the user.

Evidence Management System Using Blockchain



Evidence Management System Using Blockchain
USER LOGIN
NEW USER SIGNUP
Login
Evidence Management System Using Blockchain
ADD INFORMATION
CHECK INFORMATION
LOGOUT
EVIDENCE

User Login Screen

Username Uma

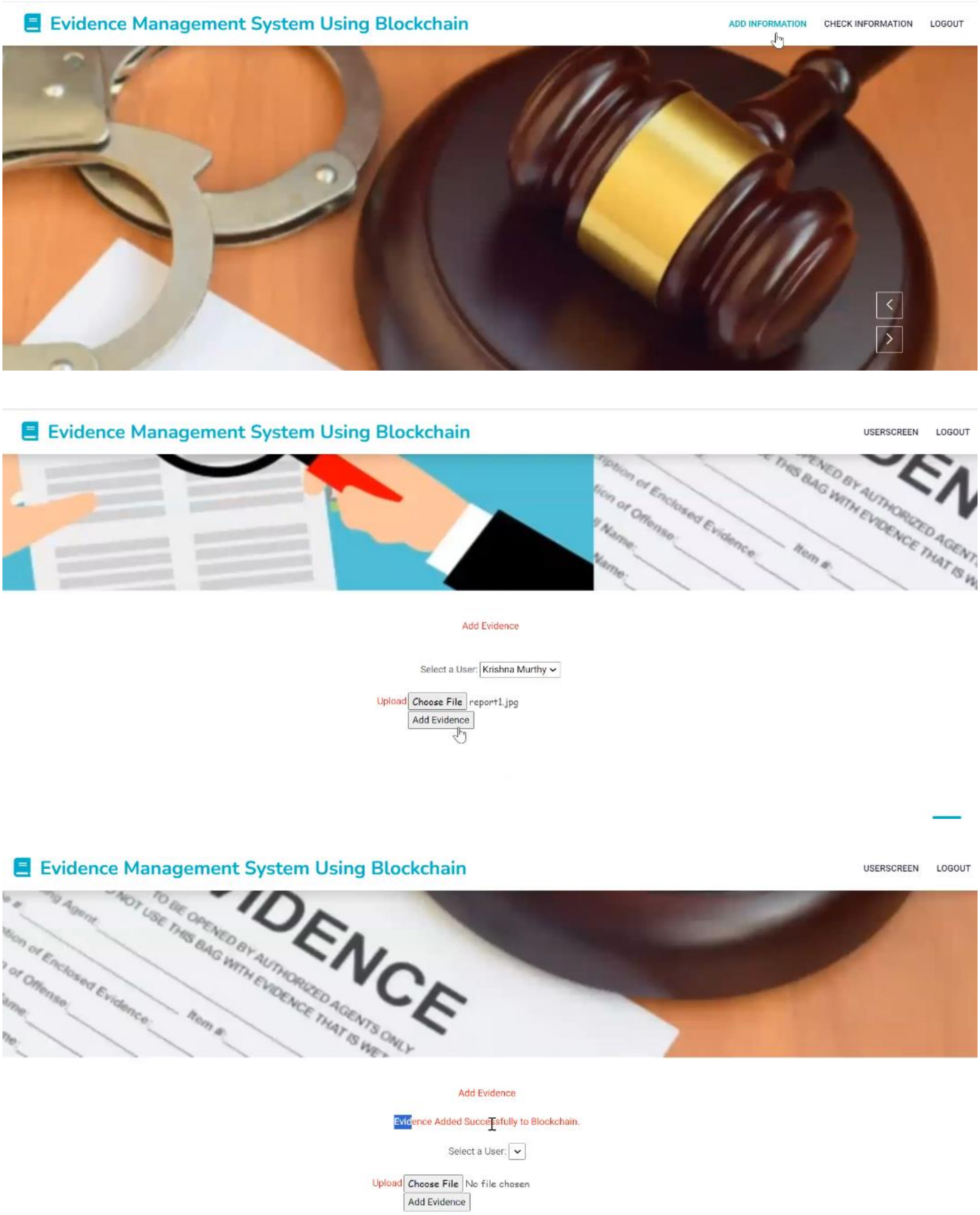
Password ····

Uma Welcome.

Figure 6.6 User Login Page of Evidence Protection System

6.7 Add Information and Evidence:

Figure 6.7 shows the user dashboard of the Evidence Management System Using Blockchain after a successful login, featuring options such as Add Information, Check Information, and Logout. The second image displays the Add Evidence interface, where a user named Krishna Murthy is selected and a file named report1.jpg is uploaded as evidence. The final image confirms successful evidence submission with the message "Evidence Added Successfully to Blockchain." This process ensures secure and tamper-proof documentation of evidence while offering a user-friendly interface.


Evidence Management System Using Blockchain
ADD INFORMATION
CHECK INFORMATION
LOGOUT
Evidence Management System Using Blockchain
USERSCREEN
LOGOUT
Evidence Management System Using Blockchain
USERSCREEN
LOGOUT

Add Evidence

Select a User: Krishna Murthy

Upload Choose File report1.jpg

Add Evidence

Add Evidence

Evidence Added Successfully to Blockchain.

Select a User:

Upload Choose File No file chosen

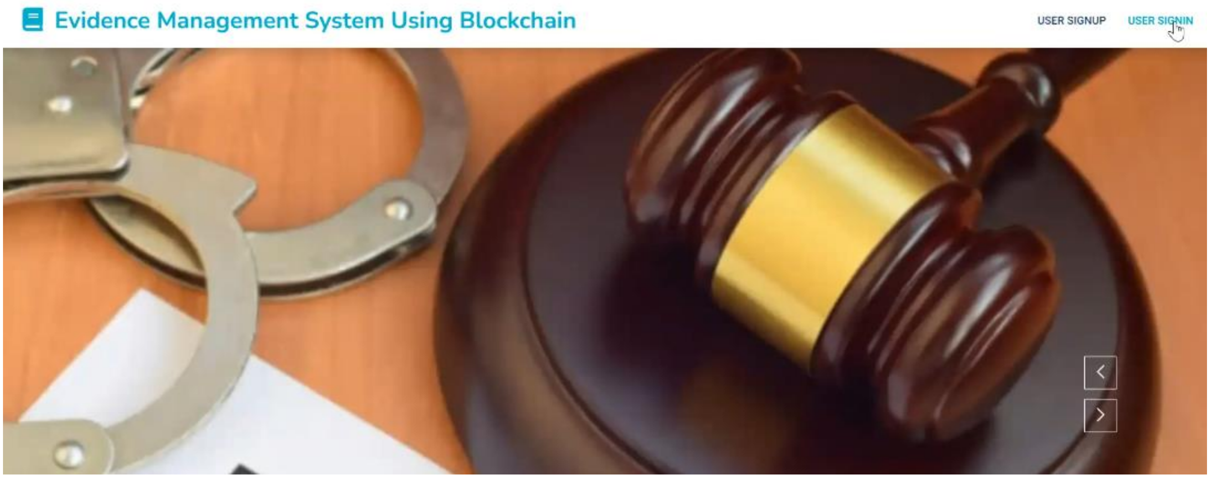
Add Evidence

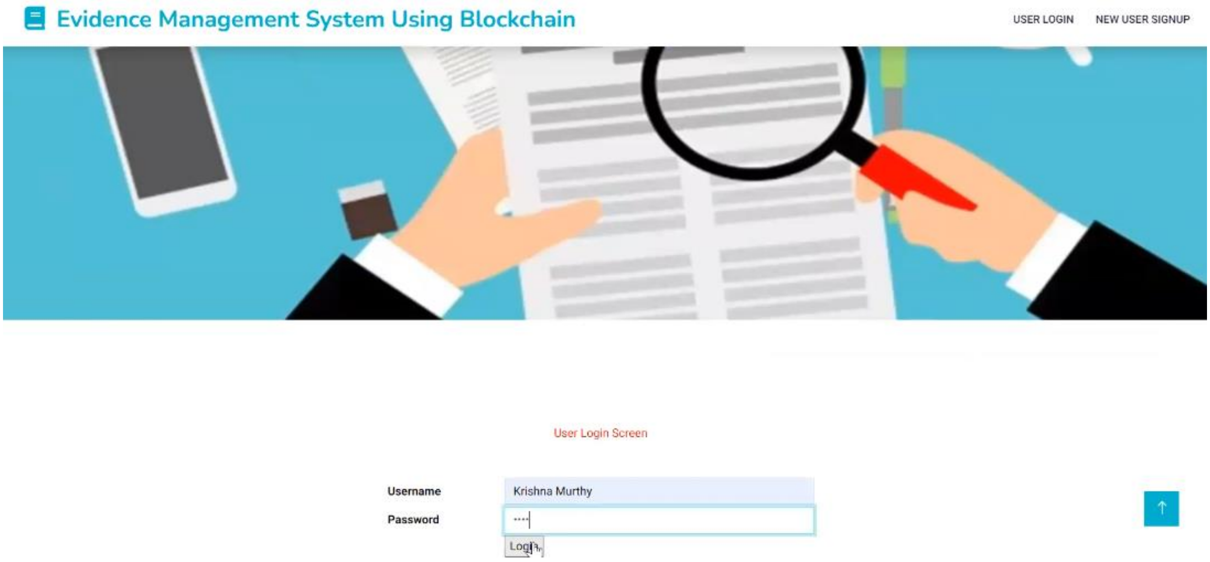
Figure 6.7 Add Information and Evidence Page of Evidence Protection System

6.8 User Signin:

Figure 6.8 shows a user signing into the Evidence Management System using Blockchain, beginning with the login interface where credentials are entered.

The login screen allows a registered user, such as Krishna Murthy, to input their username and password for authentication. Upon successful login, the system redirects the user to the main dashboard, displaying a personalized welcome message along with options such as "Add Information," "Check Information," and "Logout."





User Login Screen

Username Krishna Murthy

Password ••••

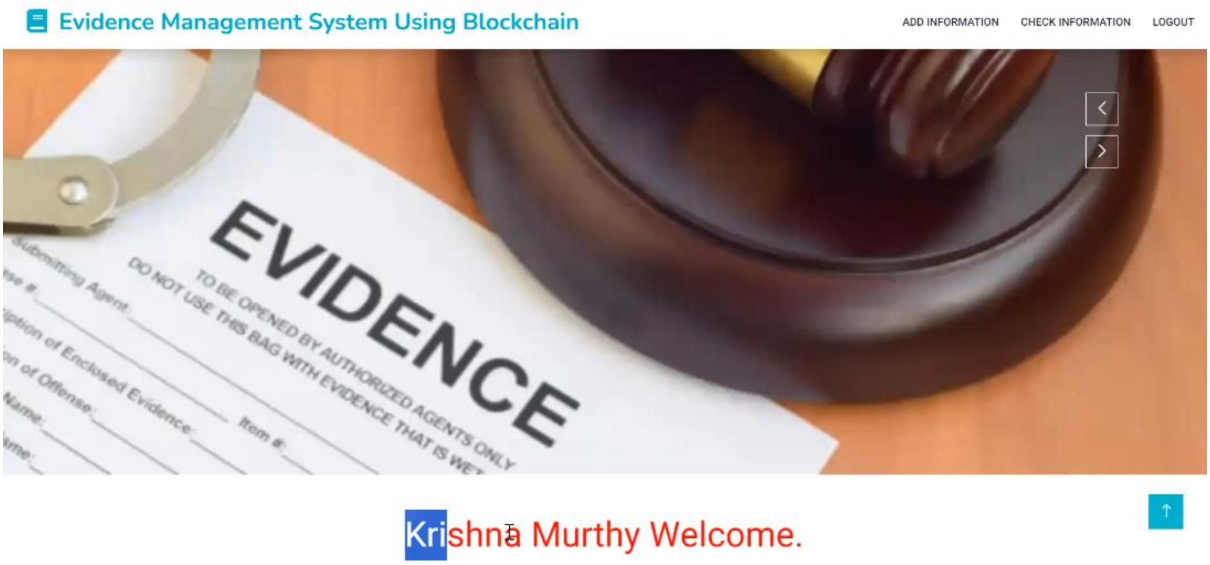
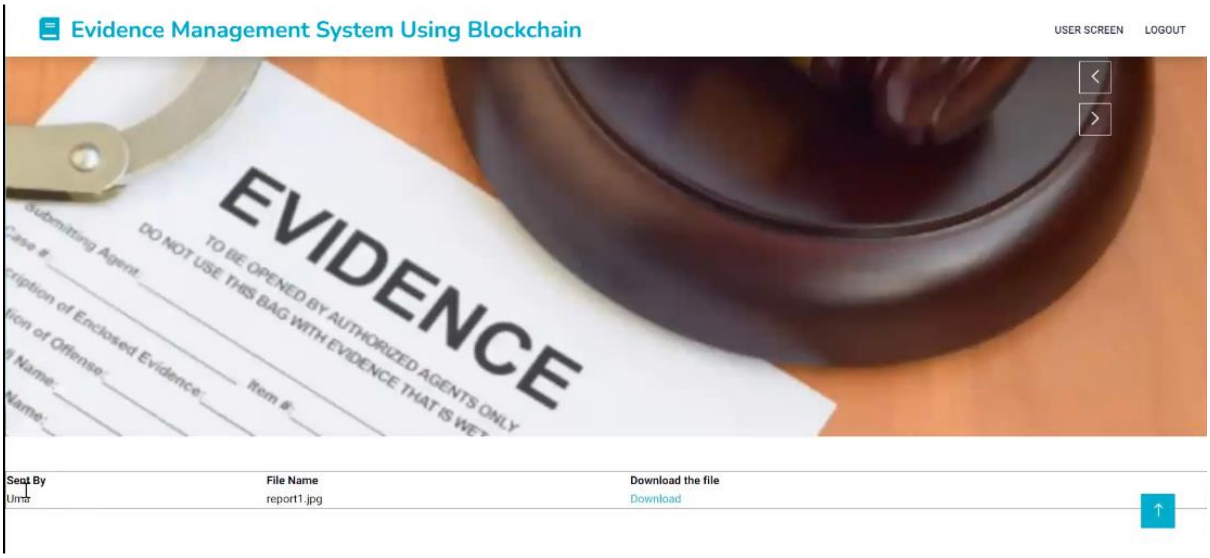


Figure 6.8 User Sigin Page of Evidence Protection System

6.9 Checking information and Displaying:

Figure 6.9 shows the "Check Information" section of the Evidence Management System Using Blockchain, where users can view previously uploaded evidence. The system presents a detailed record that includes the sender's name, file name, and a download option. This functionality enhances transparency and security by ensuring that all evidence remains tamper-proof and easily retrievable through blockchain technology.

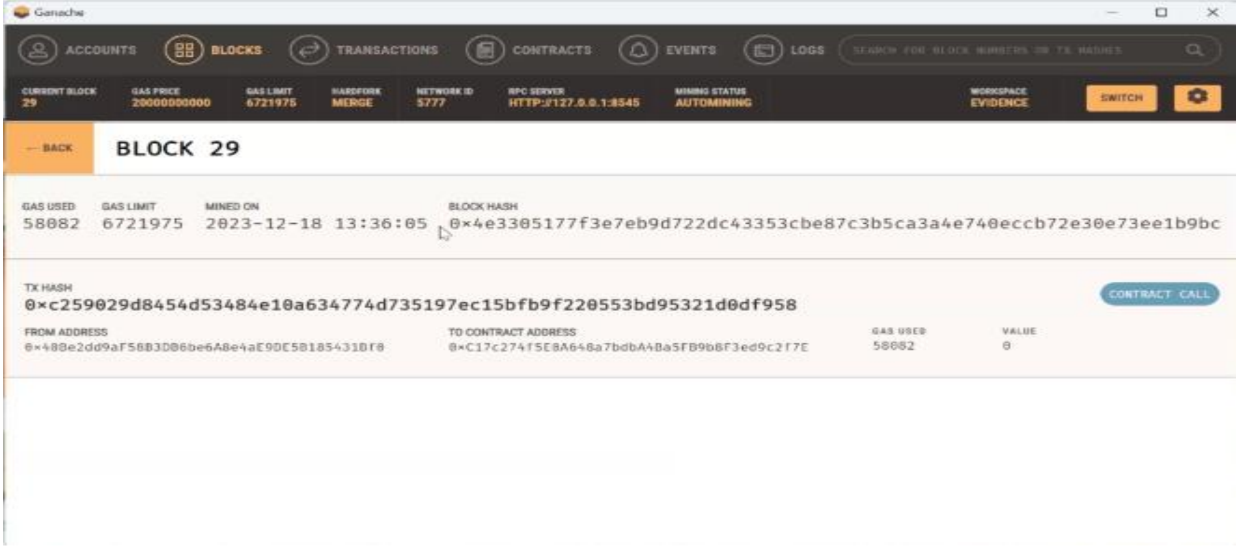

Evidence Management System Using Blockchain
USER SCREEN
LOGOUT
EVIDENCE
TO BE OPENED BY AUTHORIZED AGENTS ONLY
DO NOT USE THIS BAG WITH EVIDENCE THAT IS WET
Download

Sent By	File Name	Download the file
Uma	report1.jpg	Download

Figure 6.9 Checking information and Displaying Page of Evidence Protection System

6.10 Ganache Screen

Figure 6.10 shows the details of Block 29 from Ganache, a local Ethereum blockchain environment used for testing smart contracts. The block was mined on 2023-12-18 at 13:36:05 and consumed 58082 units of gas. It includes a transaction with a unique hash, ensuring data integrity and traceability. The transaction was made from a user address to a smart contract address, with no Ether value transferred, indicating contract execution. This highlights the secure, transparent, and tamper-proof nature of blockchain-based transactions during testing and development.



CURRENT BLOCK 29
GAS PRICE 20000000000
GAS LIMIT 6721975
HARDFORK MERGE
NETWORK ID 5777
RPC SERVER HTTP://127.0.0.1:8545
MINING STATUS AUTOMINING
WORKSPACE EVIDENCE

BLOCK 29

GAS USED	GAS LIMIT	MINED ON	BLOCK HASH
58082	6721975	2023-12-18 13:36:05	0×4e3305177f3e7eb9d722dc43353cbe87c3b5ca3a4e740eccb72e30e73ee1b9bc

TX HASH
0×c259029d8454d53484e10a634774d735197ec15bfb9f220553bd95321d0df958

FROM ADDRESS	TO CONTRACT ADDRESS	GAS USED	VALUE
0×488e2dd9aF58B3D86be6A8e4aE9DE58185431Bf8	0×C17c274f5E8A648a7bdbA4Ba5FB9b8F3ed9c2f7E	58082	0

Figure 6.10 Ganache Screen of Evidence Protection System

6.11 Metamask Screen

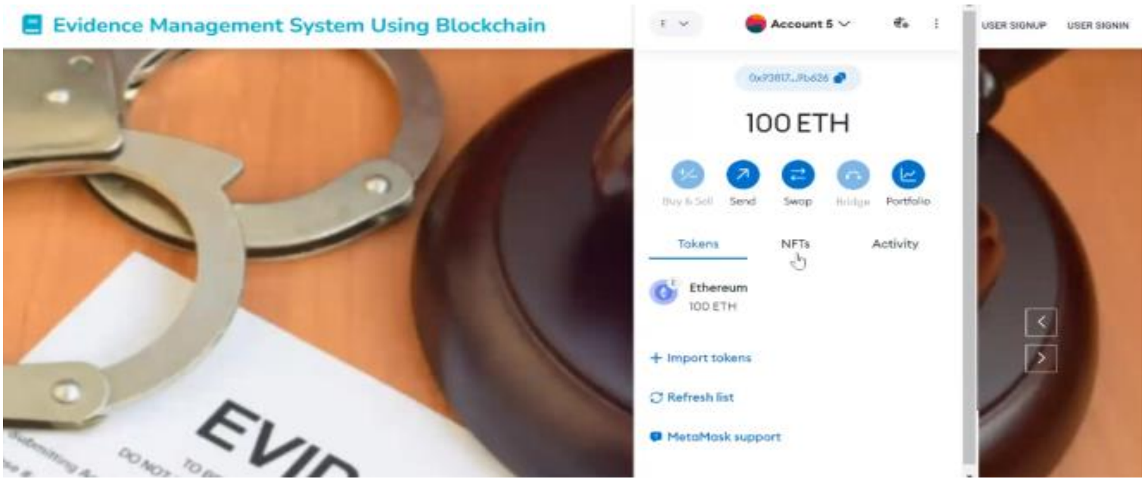


Figure 6.11 Metamask Screen of Evidence Protection System

Figure 6.11 displays a blockchain-based *Evidence Management System* interface. On the left side, symbolic legal items like a gavel and handcuffs represent digital evidence handling. On the right, a MetaMask wallet interface shows **100 ETH** under *Account 5*, highlighting the integration of blockchain and cryptocurrency within the system. Features like *Send*, *Swap*, and *Bridge* suggest user control over tokens, indicating secure, traceable transactions involved in evidence verification or access processes.

6.12 Tabular Representation of Test Cases and Results

Table 6.12: Test Cases and Results

S.NO	TEST CASE	OBJECTIVE	RESULT	COMMENTS
1	User Signup	Verify that the system registers users successfully with valid data.	Passed	System registered users successfully.
2	User Login	Ensure users can log in with valid credentials.	Passed	Login successful with correct credentials.
3	Upload Evidence File	Verify that evidence files are hashed and stored on blockchain.	Passed	File hashed and stored securely on blockchain.
4	View Stored Evidence	Confirm that uploaded evidence can be retrieved accurately.	Passed	Evidence displayed as expected.
5	Invalid Signup Attempt	Ensure error message appears for missing or invalid data.	Passed	Displayed appropriate error: “Missing fields.”
6	Invalid Login Attempt	Ensure system blocks access for incorrect credentials.	Passed	Displayed error: “Invalid credentials.”
7	Failed Evidence Upload	Ensure user sees error message if file upload fails.	Passed	Displayed error: “File not uploaded.”
8	No Evidence Found	Ensure system handles absence of stored evidence gracefully.	Passed	Displayed error: “No evidence found.”

CHAPTER 7
CONCLUSION AND FUTURE SCOPE

7.1 CONCLUSION

The conclusion marks the culmination of an extensive endeavor aimed at revolutionizing evidence management through the integration of blockchain technology. Through meticulous development, deployment, and rigorous testing, the evidence protection system has been successfully realized, demonstrating its functionality and performance under various conditions. Central to its efficacy is the utilization of blockchain, which ensures the creation of tamper-proof evidence records. Leveraging blockchain's inherent features, including immutability, cryptographic security, transparency, and reliability, the system provides robust security measures to safeguard sensitive evidence effectively. This integration signifies a significant step forward from traditional methods, offering improved integrity through unalterable records, heightened security through cryptographic measures, and enhanced accessibility through transparent access for authorized users. The project's achievement of milestones underscores the transformative potential of blockchain in evidence management, promising more secure, transparent, and reliable systems for the legal and investigative realms.

7.2 FUTURE SCOPE

The successful integration of blockchain technology in evidence management lays the foundation for future advancements in the field. Future research could explore the implementation of advanced cryptographic techniques, AI-driven analytics, and interoperability with emerging technologies like IoT and AI. Additionally, collaboration with legal experts and stakeholders can refine the system to meet specific regulatory requirements and enhance its adoption. Overall, the future scope involves harnessing innovative technologies and interdisciplinary collaborations to further enhance the security, integrity, and accessibility of evidence management systems.

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APPENDIX

```
# Import necessary libraries
from flask import Flask, render_template, request
from datetime import datetime
import json
from web3 import Web3, HTTPProvider
import os

# Create the Flask application instance
app = Flask(__name__)

# Define global variables
global details, user

# Function to read data from the blockchain
def readDetails(contract_type):
    global details
    details = ""

    # Connect to local blockchain node
    blockchain_address = 'http://127.0.0.1:8545'
    web3 = Web3(HTTPProvider(blockchain_address))
    web3.eth.defaultAccount = web3.eth.accounts[0]

    # Load compiled smart contract
    compiled_contract_path = 'Evidence.json'
    deployed_contract_address =
'0xE71F01f10f84501Ef88523FB0577a6B72a164984'  # Deployed contract
address
```

```
    # Load contract ABI
    with open(compiled_contract_path) as file:
        contract_json = json.load(file)
        contract_abi = contract_json['abi']
    file.close()

    # Connect to the smart contract
    contract = web3.eth.contract(address=deployed_contract_address,
abi=contract_abi)

    # Read appropriate data based on contract type
    if contract_type == 'adduser':
        details = contract.functions.getuser().call()
    if contract_type == 'evidence':
        details = contract.functions.getevidence().call()

    # Remove any "empty" prefix
    if len(details) > 0 and 'empty' in details:
        details = details[5:]

# Function to save data to the blockchain
def saveDataBlockChain(currentData, contract_type):
    global details
    global contract
    details = ""

    blockchain_address = 'http://127.0.0.1:8545'
    web3 = Web3(HTTPProvider(blockchain_address))
    web3.eth.defaultAccount = web3.eth.accounts[0]
    compiled_contract_path = 'Evidence.json'
    deployed_contract_address =
'0xE71F01f10f84501Ef88523FB0577a6B72a164984'  # Contract address

    # Load contract ABI
    with open(compiled_contract_path) as file:
        contract_json = json.load(file)
        contract_abi = contract_json['abi']
    file.close()

    # Connect to smart contract
    contract = web3.eth.contract(address=deployed_contract_address,
abi=contract_abi)

    # Read existing data
    readDetails(contract_type)

    # Append new data and call corresponding setter function
    if contract_type == 'adduser':
        details += currentData
        msg = contract.functions.setuser(details).transact()
        tx_receipt = web3.eth.waitForTransactionReceipt(msg)
    if contract_type == 'evidence':
        details += currentData
        msg = contract.functions.setevidence(details).transact()
        tx_receipt = web3.eth.waitForTransactionReceipt(msg)

# Route to add new user to the blockchain
@app.route('/AddUser', methods=['POST'])
def AddUser():
    if request.method == 'POST':
```

```
    # Get form data
    username = request.form['t1']
    password = request.form['t2']
    number = request.form['t3']
    email = request.form['t4']
    address = request.form['t5']

    status = "none"
    readDetails('adduser')
    arr = details.split("\n")

    # Check if username already exists
    for i in range(len(arr)-1):
        array = arr[i].split("#")
        if array[1] == username:
            status = username + " Already Exists."
            return render_template('AddUser.html', msg=status)

    # Save new user to blockchain
    if status == "none":
        data = username + "#" + password + "#" + number + "#" + email + "#"
+ address + "\n"
        saveDataBlockChain(data, "adduser")
        return render_template('AddUser.html', msg="SignUp Completed
and details are saved to blockchain")
    else:
        return render_template('AddUser.html', msg="Error in signup
process")

# Route to authenticate user login
@app.route('/UserLoginAction', methods=['POST'])
```

```
def UserLoginAction():
    if request.method == 'POST':
        global user
        username = request.form['t1']
        password = request.form['t2']
        user = username
        status = "none"
        readDetails('adduser')
        arr = details.split("\n")

        # Check credentials
        for i in range(len(arr)-1):
            array = arr[i].split("#")
            if array[0] == username and array[1] == password:
                status = 'success'
                break

        if status == 'success':
            return render_template('UserScreen.html', msg=username + '
Welcome.')
        else:
            return render_template('Login.html', msg='Invalid Details')

# Get list of usernames (except current)
def getusernames(current_user_name):
    readDetails('adduser')
    arr = details.split("\n")
    user_names = []

    for i in range(len(arr) - 1):
        array = arr[i].split("#")
        username = array[0]
        if username != current_user_name:
            user_names.append(username)

    return user_names

# Show evidence upload form
@app.route('/AddEvidence', methods=['GET'])
def AddEvidences():
    global user
    username = getusernames(user)
    return render_template('AddEvidence.html', username_all=username)

# Handle evidence upload
@app.route('/AddEvidence', methods=['POST'])
def AddEvidence():
    global user
    status = "none"
    name = request.form['username']
    file = request.files['t1']

    filename = file.filename
    file_path = os.path.join('static/files/', filename)
    file.save(file_path)

    readDetails('evidence')
    arr = details.split("\n")

    # Check if evidence file already exists
    for i in range(len(arr)-1):
        array = arr[i].split("#")
        if array[1] == filename:
            return render_template('AddEvidence.html', msg="Details Already Exists")

    # Save evidence
    if status == "none":
        data = user + "#" + name + "#" + filename + "\n"
        saveDataBlockChain(data, "evidence")
        return render_template('AddEvidence.html', msg='Evidence Added Successfully to Blockchain.')
    else:
        return render_template('AddEvidence.html', msg="Error in the process.")

# Route to display evidence received by user
@app.route('/CheckEvidence', methods=['GET', 'POST'])
def CheckEvidence():
    if request.method == 'GET':
        global user
        output = '<table border=1 align=center width=100%>'
        font = '<font size=3 color=black>'
        headers = ['Sent By', 'File Name', 'Download the file']

        output += "<tr>" + "".join([f"<th>{font}{h}</th>" for h in headers]) + "</tr>"
        readDetails('evidence')
        arr = details.split("\n")

        # Display all evidence sent to the user
        for i in range(len(arr)-1):
            array = arr[i].split("#")
            if array[1] == user:
                output += f"<tr><td>{font}{array[0]}</td><td>{font}{array[2]}</td>"
                output += f'<td><a href="/static/files/{array[2]}"
download="{array[2]}">Download</a></td></tr>'
        output += "</table><br/><br/><br/>"
        return render_template('CheckEvidence.html', msg=output)

# Basic routes for rendering templates
@app.route('/', methods=['GET', 'POST'])
def home():
    return render_template('index.html', msg='')

@app.route('/AddEvidence', methods=['GET', 'POST'])
def AddEvidencess():
    return render_template('AddEvidence.html', msg='')

@app.route('/AddUser', methods=['GET', 'POST'])
def AddUsers():
    return render_template('AddUser.html', msg='')

@app.route('/CheckEvidence', methods=['GET', 'POST'])
def CheckEvidences():
    return render_template('CheckEvidence.html', msg='')

@app.route('/Login', methods=['GET', 'POST'])
def Login():
    return render_template('Login.html', msg='')
```

```
@app.route('/UserScreen', methods=['GET', 'POST'])
def UserScreen():
    return render_template('UserScreen.html', msg='')

@app.route('/index', methods=['GET', 'POST'])
def index():
    return render_template('index.html', msg='')

# Start the Flask app
if __name__ == '__main__':
    app.run()
```