DIGITAL ASSET MANAGEMENT

TEAM ID: NM2023TMID00920
INSTITUTION: UCEK (5134)

1. INTRODUCTION

1.1 Project Overview

The proposed Ethereum-based Digital Asset Management (DAM) system will revolutionize the way individuals and organizations manage their digital assets. Leveraging the power of Ethereum's blockchain, the project will enable users to create, register, and trade various digital assets, ranging from Non-Fungible Tokens (NFTs) to fungible tokens, in a trustless and decentralized environment. Smart contracts will be at the core of this system, ensuring secure ownership management and streamlined asset transactions.

Furthermore, the DAM system will feature an intuitive user interface that simplifies the asset management process, making it accessible to both experienced blockchain users and newcomers. Interoperability with other blockchain networks will enhance the flexibility and value of digital assets. Compliance with relevant regulations will be a priority to ensure the system's legitimacy and adoption in various regions. The project's scalability and performance optimizations will pave the way for a seamless experience as the ecosystem grows. Overall, this DAM system holds the potential to disrupt traditional asset management by providing a secure, transparent, and user-/friendly solution on the Ethereum blockchain.

1.2 Purpose

The primary purpose of developing a Digital Asset Management (DAM) system on the Ethereum blockchain is to create a secure and decentralized platform for individuals and businesses to effectively manage and trade digital assets. The blockchain's immutable ledger ensures the integrity of asset ownership, allowing users to confidently buy, sell, and trade assets without the need for intermediaries. This democratizes access to asset management, making it accessible to a global audience and fostering a peer-to-peer economy.

Additionally, the DAM system aligns with the broader trend of blockchain technology transforming traditional industries. It provides a solution for artists, content creators, collectors, and businesses to tokenize and manage their assets, including art, music, collectibles, and more, while ensuring traceability and provenance. This platform also unlocks new monetization opportunities, as asset creators can earn from transaction fees or minting their own NFTs. Ultimately, the system's purpose is to empower users, enhance asset liquidity, and bring the benefits of blockchain technology to the world of digital assets.

2.LITERATURE SURVEY

2.1 Existing problems

Our organization, which relies on a wide range of digital assets such as images, videos, documents, and creative content, is directly affected by this problem.Key stakeholders include content creators, marketers, designers, and IT personnel responsible for managing these digital assets. The current digital asset management (DAM) system in our organization isstruggling to efficiently organize, store, retrieve, and distribute our digital assets. The metadata and tagging are inconsistent, leading to difficulties in searching and locatingassets. This inconsistency is affecting various departments and teams, making it challenging for them to access and utilize digital assets effectively.

2.2 References

1. M.Barni and F.Bartolini, Watermarking System Engineering: Enabling Digital Assets Security and Other Applications. CRC Press, 2004
2. U. W. Chohan, “Non-fungible tokens: Blockchains, scarcity, and value”, Critical Blockchain Research Initiative (CBRI) Working Papers, 2021.
3. W. Ku and C.-H. Chi, “Survey on the technological aspects of digitalrights management,” in Proc. International Conference on InformationSecurity (ISC), 2004, pp. 391–403.

4. H. R. Hasan and K. Salah, “Proof of delivery of digital assets using blockchain and smart contracts,” IEEE Access, vol. 6, pp. 65439–65 448,2018.

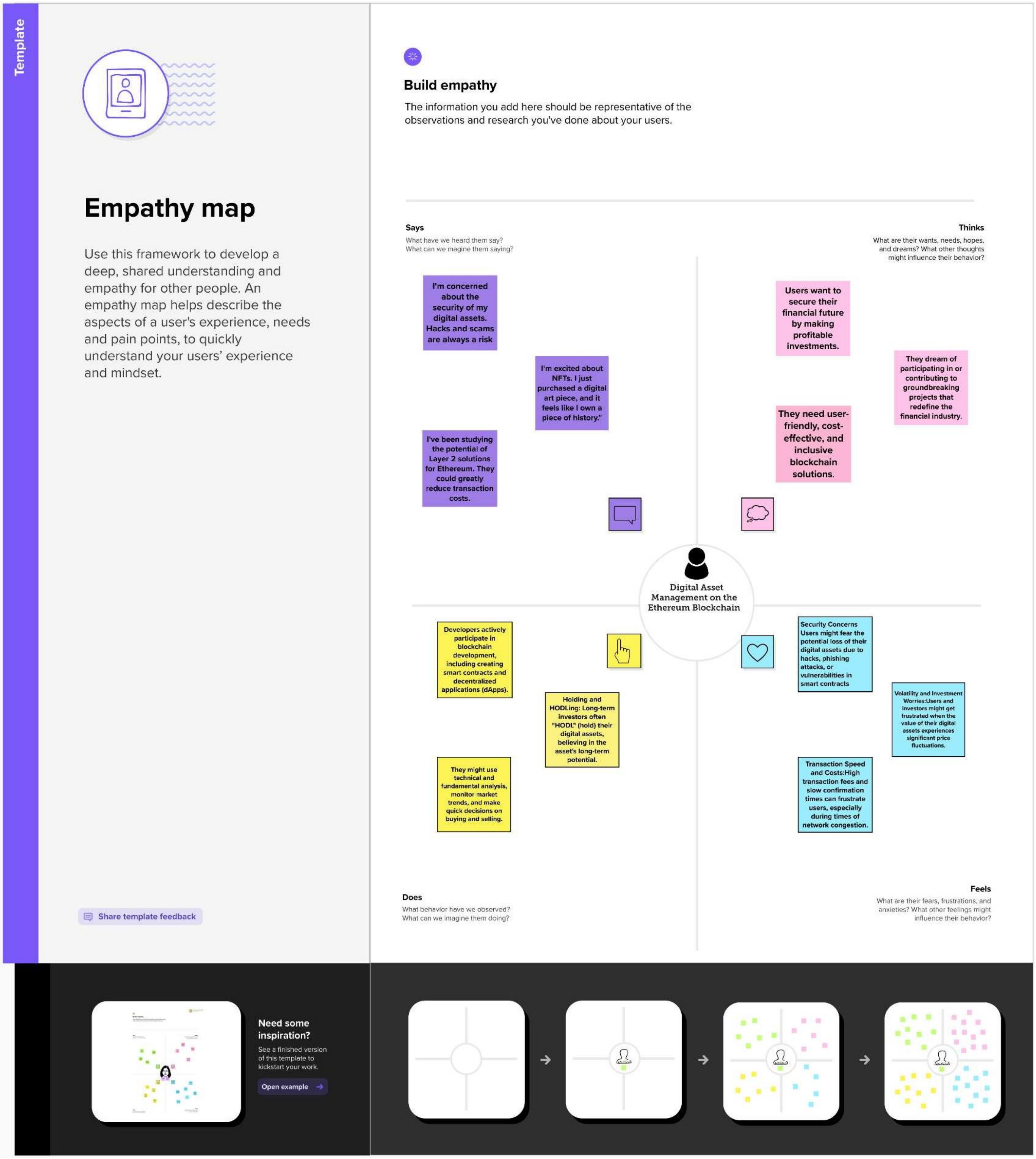
2.3 Problem statement

This issue is pervasive across our organization, impacting all departments and locations that rely on digital assets. It influences marketing campaigns, content creation, product development, and other core functions.

The root causes of this problem include the absence of a centralized asset management system, inconsistent tracking processes, and limited visibility into the condition and location of assets. Inadequate maintenance scheduling and documentation exacerbate the problem. Without an efficient asset management solution, our organization is incurring unnecessary costs and experiencing operational inefficiencies, which directly impact our ability to serve our clients and achieve our business objectives.

3. IDEATION AND PROPOSED SOLUTION

3.1 Empathy Map Canvas



Empathy map

Use this framework to develop a deep, shared understanding and empathy for other people. An empathy map helps describe the aspects of a user's experience, needs and pain points, to quickly understand your users' experience and mindset.

Build empathy

The information you add here should be representative of the observations and research you've done about your users.

Says

What have we heard them say?
What can we magine them saying?

I'm concerned about the security of my digital assets. Hacks and scams are always a risk

I'm excited about NFTs. I just purchased a digital art piece, and it feels like I own a piece of history."

I've been studying the potential of Layer 2 solutions for Ethereum. They could greatly reduce transaction costs.

Thinks

What are their wants, needs, hopes, and dreams? What other thoughts might influence their behavior?

Users want to secure their financial future by making profitable investments.

They dream of participating in or contributing to groundbreaking projects that redefine the financial industry.

They need user-friendly, cost-effective, and inclusive blockchain solutions.

Digital Asset Management on the Ethereum Blockchain

Developers actively participate in blockchain development, including creating smart contracts and decentralized applications (dApps).

Holding and HODLing: Long-term investors often "HODL" (hold) their digital assets, believing in the asset's long-term potential.

They might use technical and fundamental analysis, monitor market trends, and make quick decisions on buying and selling.

Security Concerns Users might fear the potential loss of their digital assets due to hacks, phishing attacks, or vulnerabilities in smart contracts

Volatility and Investment Worries:Users and investors might get frustrated when the value of their digital assets experiences significant price fluctuations.

Transaction Speed and Costs:High transaction fees and slow confirmation times can frustrate users, especially during times of network congestion.

Does

What behavior have we observed?
What can we imagine them doing?

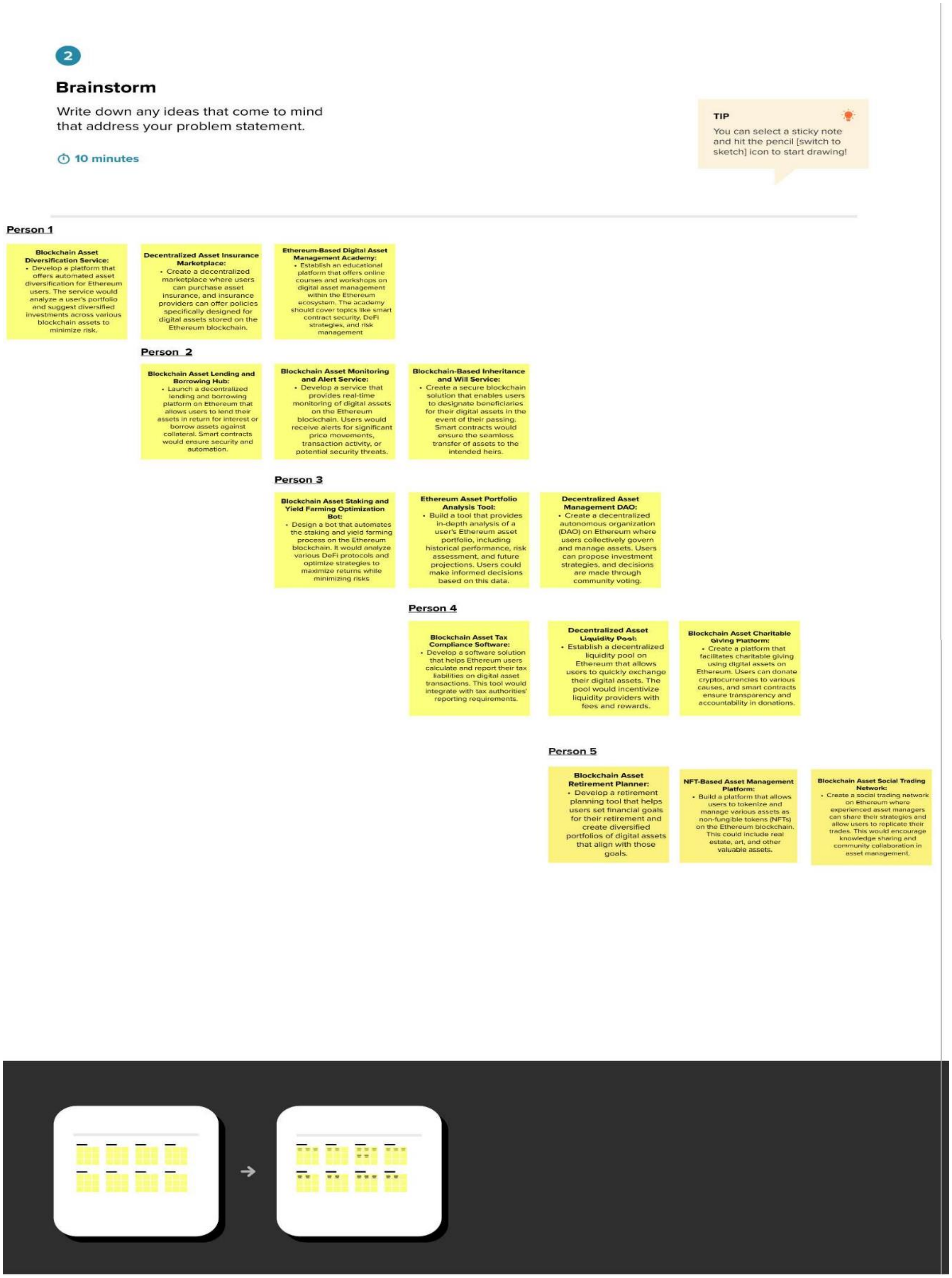
Feels

What are their fears, frustrations, and anxieties? What other feelings might influence their behavior?

Need some inspiration?

See a finished version of this template to kickstart your work.

3.2 Ideation and Brainstorming



2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

TIP

You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

Person 1

Blockchain Asset Diversification Service:
- Develop a platform that offers automated asset diversification for Ethereum users. The service would analyze a user's portfolio and suggest diversified investments across various blockchain assets to minimize risk.

Decentralized Asset Insurance Marketplace:
- Create a decentralized marketplace where users can purchase asset insurance, and insurance providers can offer policies specifically designed for digital assets stored on the Ethereum blockchain.

Ethereum-Based Digital Asset Management Academy:
- Establish an educational platform that offers online courses and workshops on digital asset management within the Ethereum ecosystem. The academy should cover topics like smart contract security, DeFi strategies, and risk management

Person 2

Blockchain Asset Lending and Borrowing Hub:
- Launch a decentralized lending and borrowing platform on Ethereum that allows users to lend their assets in return for interest or borrow assets against collateral. Smart contracts would ensure security and automation.

Blockchain Asset Monitoring and Alert Service:
- Develop a service that provides real-time monitoring of digital assets on the Ethereum blockchain. Users would receive alerts for significant price movements, transaction activity, or potential security threats.

Blockchain-Based Inheritance and Will Service:
- Create a secure blockchain solution that enables users to designate beneficiaries for their digital assets in the event of their passing. Smart contracts would ensure the seamless transfer of assets to the intended heirs.

Person 3

Blockchain Asset Staking and Yield Farming Optimization Bot:
- Design a bot that automates the staking and yield farming process on the Ethereum blockchain. It would analyze various DeFi protocols and optimize strategies to maximize returns while minimizing risks

Ethereum Asset Portfolio Analysis Tool:
- Build a tool that provides in-depth analysis of a user's Ethereum asset portfolio, including historical performance, risk assessment, and future projections. Users could make informed decisions based on this data.

Decentralized Asset Management DAO:
- Create a decentralized autonomous organization (DAO) on Ethereum where users collectively govern and manage assets. Users can propose investment strategies, and decisions are made through community voting.

Person 4

Blockchain Asset Tax Compliance Software:
- Develop a software solution that helps Ethereum users calculate and report their tax liabilities on digital asset transactions. This tool would integrate with tax authorities' reporting requirements.

Decentralized Asset Liquidity Pool:
- Establish a decentralized liquidity pool on Ethereum that allows users to quickly exchange their digital assets. The pool would incentivize liquidity providers with fees and rewards.

Blockchain Asset Charitable Giving Platform:
- Create a platform that facilitates charitable giving using digital assets on Ethereum. Users can donate cryptocurrencies to various causes, and smart contracts ensure transparency and accountability in donations.

Person 5

Blockchain Asset Retirement Planner:
- Develop a retirement planning tool that helps users set financial goals for their retirement and create diversified portfolios of digital assets that align with those goals.

NFT-Based Asset Management Platform:
- Build a platform that allows users to tokenize and manage various assets as non-fungible tokens (NFTs) on the Ethereum blockchain. This could include real estate, art, and other valuable assets.

Blockchain Asset Social Trading Network:
- Create a social trading network on Ethereum where experienced asset managers can share their strategies and allow users to replicate their trades. This would encourage knowledge sharing and community collaboration in asset management.

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

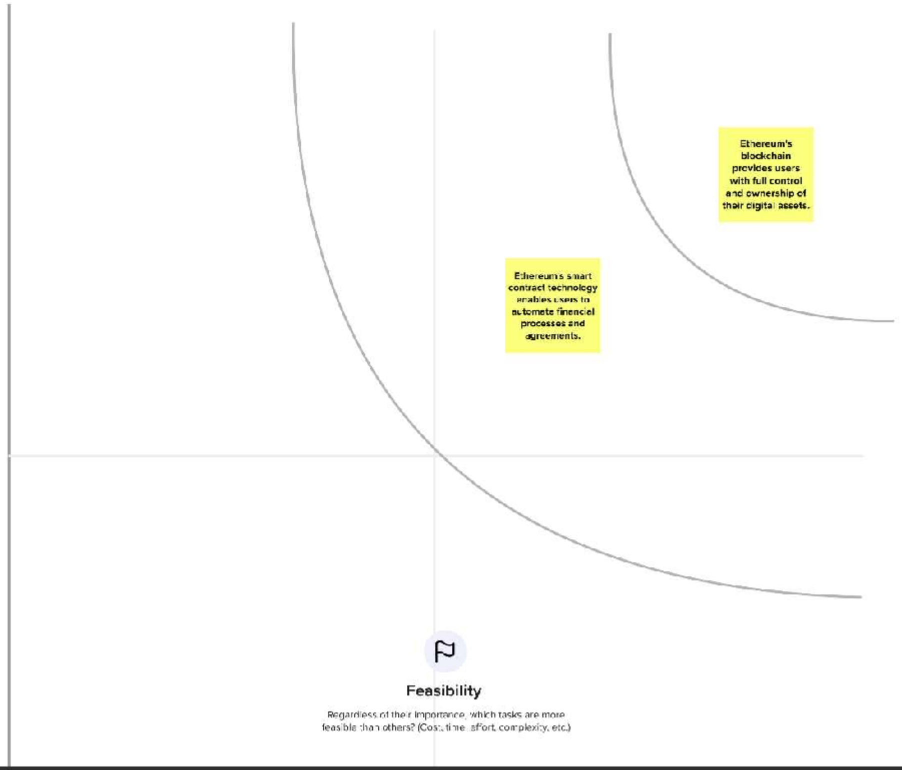
⏱ 20 minutes

TIP

Participants can use their cursors to point at where sticky notes should go on the grid. The facilitator can confirm the spot by using the laser pointer holding the **H key** on the keyboard.

Importance

If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

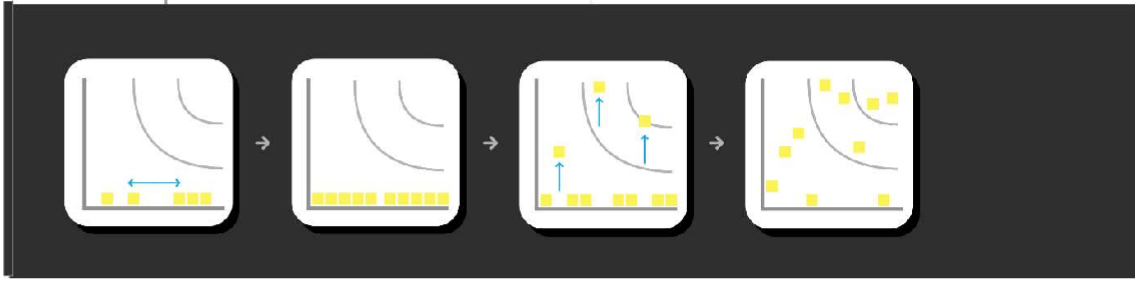


Ethereum's blockchain provides users with full control and ownership of their digital assets.

Ethereum's smart contract technology enables users to automate financial processes and agreements.

Feasibility

Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)



4.REQUIREMENT ANALYSIS

4.1 Functional Requirements

FR No.	Functional Requirement	
FR-1	Asset Creation and Registration	Users should be able to create and register digitalassets on the Ethereum blockchain. Asset registration should include metadata such astitle, description, author, date, and any other relevant information.
FR-2	Asset Storage and Encryption	Digital assets should be securely stored on the blockchain, with data encryption to protect theirintegrity and confidentiality.
FR-3	Asset Tracking and Metadata Management	Users should have the ability to update assetmetadata, including tags, categories, and descriptions. The system should support searching and filteringassets based on metadata.
FR-4	Asset Ownership and Transfer	Assets should be associated with specific owners,and ownership should be transferable through blockchain transactions. Ownership transfers should be securely recorded on the blockchain.
FR-5	Access Control and Permissions	Define access control and permissions for assetviewing, editing, and transfer. Implement role-based access control (RBAC) fordifferent users or user groups.
FR-6	Smart Contracts:	Utilize smart contracts for managing assetownership, transfers, and permissions. Implement contract functionality for executingpredefined rules and logic.
FR-7	Interoperability with Other Systems	Ensure interoperability with other digital asset management systems or blockchain platforms. Support importing and exporting assets and metadata to and from other systems.

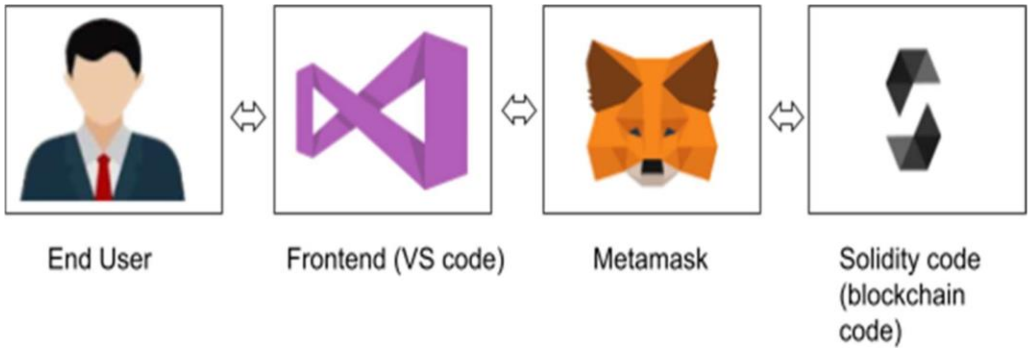
4.2 Non-Functional Requirements

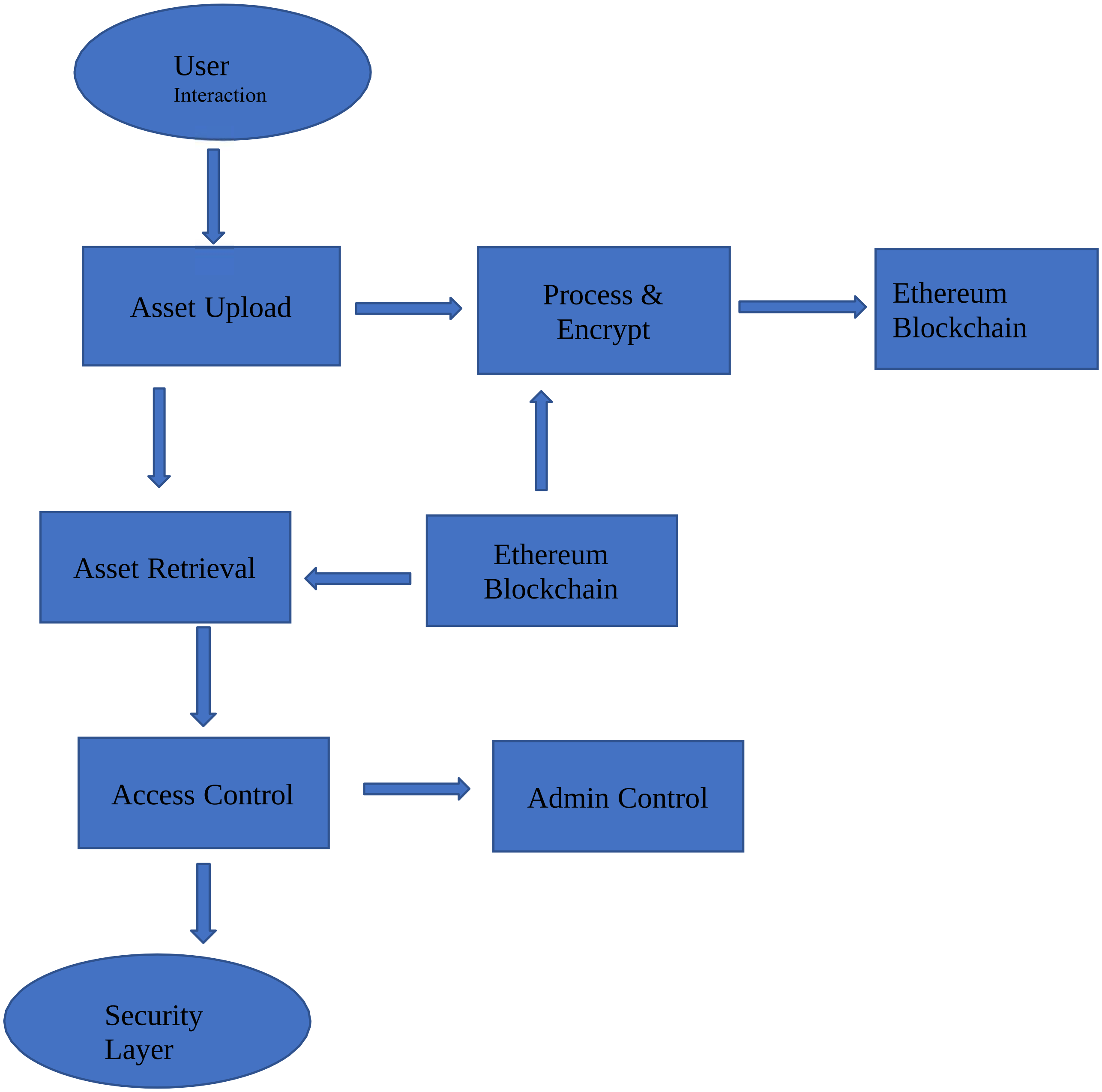
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	A user-friendly and intuitive interface is central to the usability of our Ethereum blockchain- based digital asset management system. With a clean and easy-to-navigate design, users can seamlessly upload, organize, and access their digital assets. We prioritize user onboarding through informative tutorials and tooltips to guide users. Powerful search and filtering options simplify asset discovery, while in- system preview and playback capabilities enhance the user experience. Clear access control settings, mobile responsiveness, and responsive customer support further contribute to a user-centric design, ensuring that our systemaligns with diverse user needs and preferences. Usability remains a key focus, with regular feedback mechanisms in place to continually enhance the user experience
NFR-2	**Security**	The system leverages the Ethereum blockchain's immutability for asset data integrity and uses strong encryption for confidentiality. Access controls, authentication, and authorization mechanisms ensure only authorized users accessand manage assets. Smart contracts automate secure asset transfers, and Ethereum's consensusmechanisms enhance transaction security. Regular security audits, regulatory compliance, incident response planning, and user education collectively create a robust security framework to safeguard digital assets and user data.
NFR-3	**Reliability**	the blockchain's immutable ledger, the system maintains unalterable records of digital asset ownership and transactions, ensuring data integrity. High availability minimizes system downtime, assuring users of consistent access. Regular data backups and a well-defined recovery plan provide reliability in safeguardingassets and data, allowing for swift restoration in the event of data loss or system failures. Strong security measures, including authentication and encryption, enhance both the security and reliability of the DAM system, instilling trust in its performance and the protection of digital assets.

NFR-4	**Performance**	Users expect swift interactions, and the system must deliver. Asset retrieval, uploads, and searchqueries should be optimized to ensure users can work efficiently. Scalability is essential, as the system must maintain usability as the volume of digital assets and users grows. Consistent response times are paramount, and well-defined benchmarks must be met to uphold usability standards. Performance testing and regular system optimization are essential to ensure that the DAM system operates smoothly, regardless of the scale or usage patterns.
NFR-5	**Availability**	Users rely on consistent access to their digital assets, and the system's high availability ensuresthey can do so without disruptions. Minimal downtime for maintenance or updates is a key requirement to prevent operational interruptions.Redundant servers, data backup mechanisms, and disaster recovery plans are integral to maintaining this level of availability, safeguarding assets and user data. Users can trust that their assets are accessible when needed, thanks to a reliable system with a robust availability framework. This confidence in consistent access underpins the system's integrity and user satisfaction.
NFR-6	**Scalability**	As the volume of digital assets and users grows, the system must gracefully adapt without compromising performance. Scalability is achieved through an architecture that can handle increased demands, such as asset uploads, downloads, and search queries, while maintaining response times. It ensures that the DAM system can scale up or out as necessary, accommodating user growth and asset expansion without significant degradation in usability. Scalability testing is a key practice to verify the system's ability to handle peak loads and maintain a seamless user experience. A scalableDAM system provides room for growth and enhances overall user satisfaction

5. PROJECT DESIGN

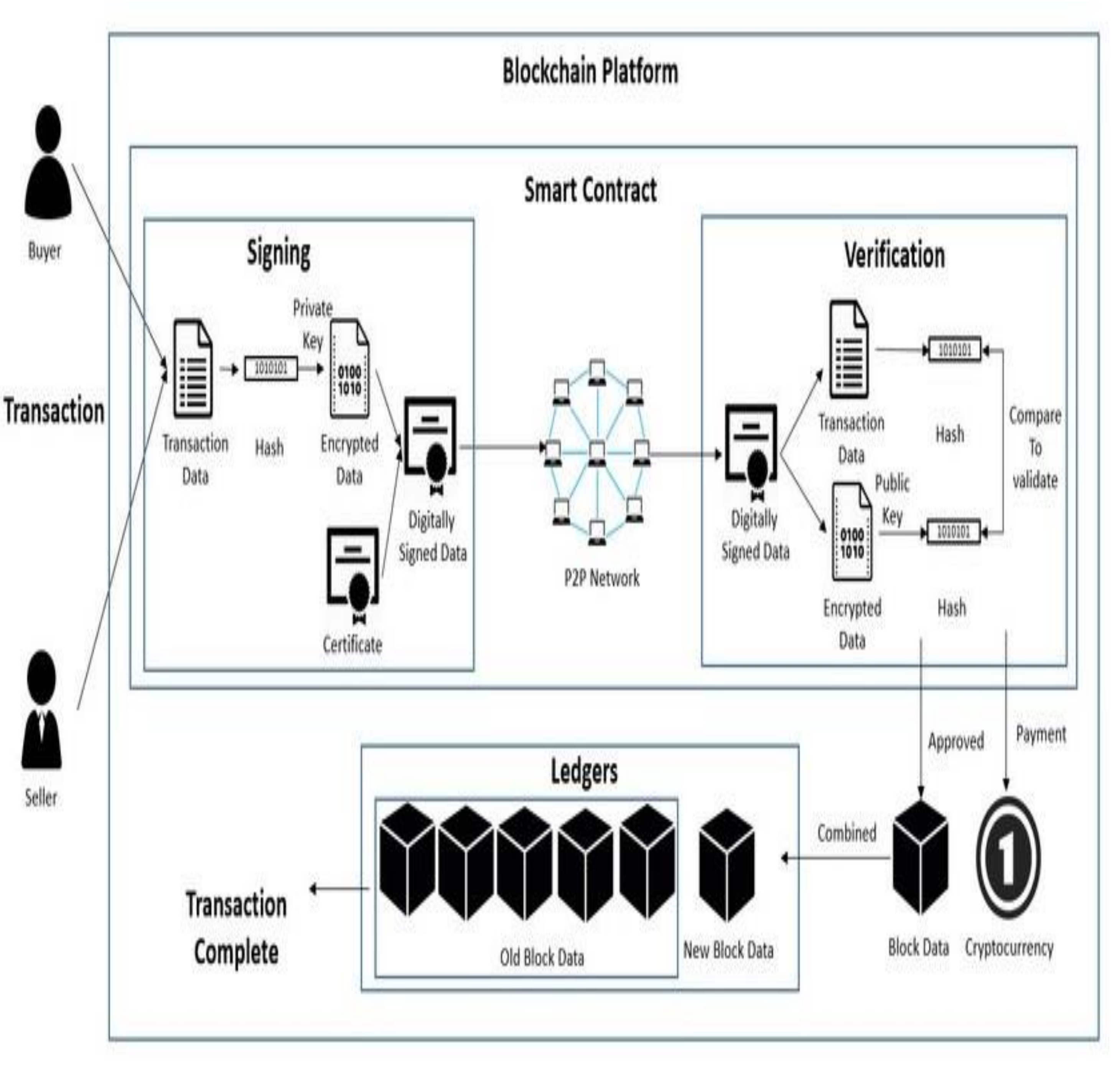
5.1 Data Flow Diagrams and User Stories





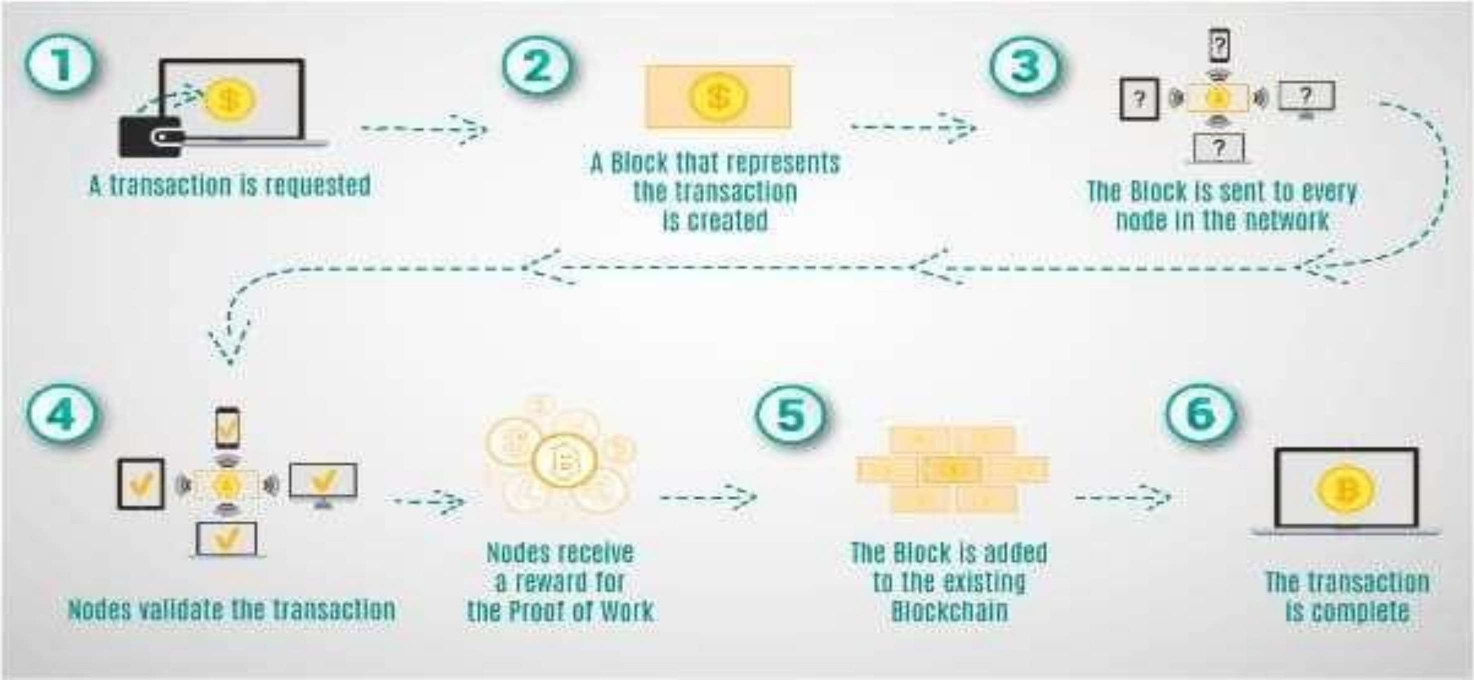
User Type	**Functional Requirements(Epic)**	**User Story Number**	**User Story / Task**	**Acceptance criteria**	**Priority**	**Team Member**
Content Creator	Asset Upload and Management	USN-1	As a content creator, I want to upload multiple image and video assets to the DAM system with drag-and-drop functionality.	Users should be able to drag and drop multiple assetsonto the DAM interface, and the system should process and upload them efficiently.	High	John (Frontend Developer)
Content Creator	Asset Upload and Management	USN-2	As a content creator, I need to add detailed metadata to my assets, including titles, descriptions, and copyright information, to keep them well-organized.	Metadata fields should be easily accessible and editable, and changes should beimmediately reflected in asset information.	High	John (Frontend Developer)
Marketing Manager	Asset Organization and Access Control	USN-3	As a marketing manager, I want to create and assign tags to assets for easy categorization, facilitating efficient asset retrieval.	Tags should be customizable, and assets should be sortable and filterable by assigned tags.	Medium	Sarah (Product Owner)
Marketing Manager	Asset Organization and Access Control	USN-4	As a marketing manager, I need to restrict access to confidential assets to authorized team members only.	Access control settings should allow me to specify who can view, edit, and delete assets, with permissions easily adjustable.	Medium	Sarah (Product Owner
Administrator	System Management	USN-5	As an administrator, I want to monitor and manage asset access, user roles, and system performance.	The admin dashboard should provide insights intouser activity, allow role assignments, and offer system performance metrics.	High	David (SysAdmin)
Administrator	System Management	USN-6	As an administrator, I need to set up automated data backups and a disaster recovery plan for data safety.discipline manner without any issues	The system should regularly back up data and provide a documented & prevent data loss.	High	David (SysAdmin)

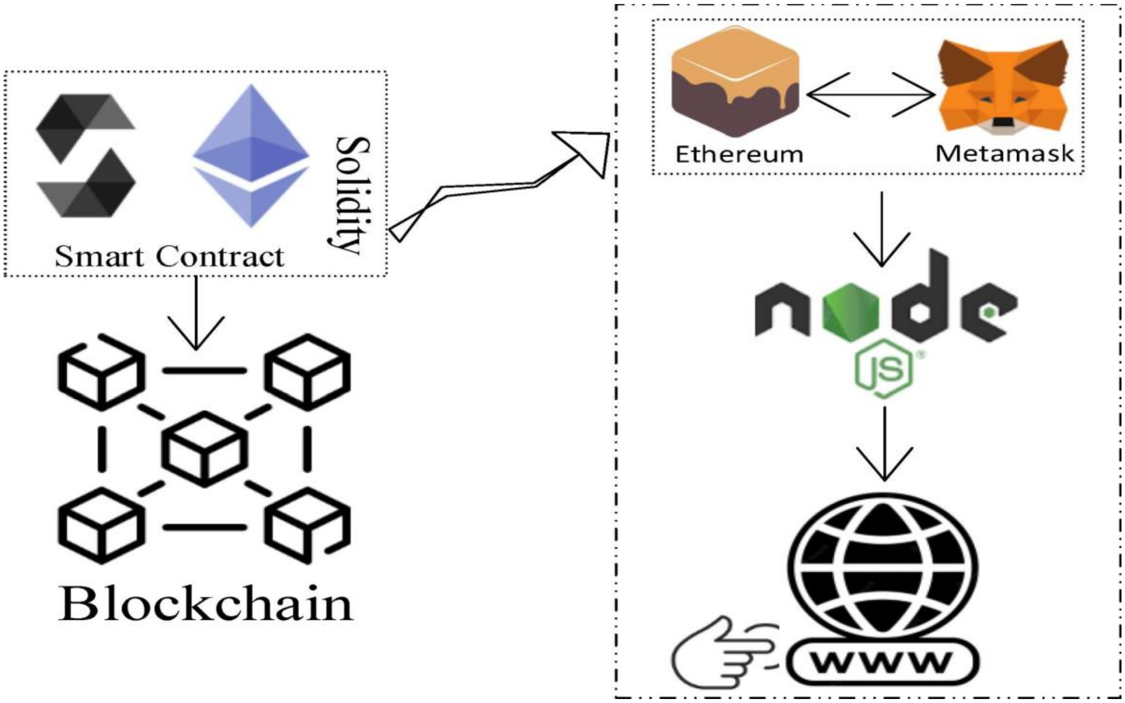
5.2 Solution Architecture



6.PROJECT PLANNING & SCHEDULING

6.1 Technical Architecture


1
A transaction is requested
2
A Block that represents the transaction is created
3
The Block is sent to every node in the network
4
Nodes validate the transaction
Nodes receive a reward for the Proof of Work
5
The Block is added to the existing Blockchain
6
The transaction is complete



6.2 Sprint Planning and Estimation

Divide the Project into Sprints:

Begin by dividing the overall DAM project into sprints. Sprints are time-bound iterations, usually lasting 2-4 weeks, during which specific sets of features or tasks are completed.

Prioritize User Stories:

Review the prioritized user stories from your backlog and select those that will be addressed in each sprint. Ensure that each sprint has a clear focus and goal.

Define Sprint Durations:

Decide on the duration of each sprint. Agile sprints are typically 2-4 weeks long, but you can choose the duration that works best for your team and project.

Create a Sprint Backlog:

For each sprint, create a sprint backlog that includes the user stories, tasks, and features that will be tackled during that sprint.

Assign Story Points:

Estimate the effort required for each user story in the sprint backlog using story points or other estimation methods. This helps in understanding the capacity of the sprint.

Distribute Workload:

Based on the team's capacity and story point estimates, distribute the workload evenly across the sprint backlog items. Ensure that the team can realistically complete the planned work during the sprint.

Define Milestones:

Within each sprint, set specific milestones or checkpoints for key tasks or features. This helps in tracking progress and ensuring that the team is on target.

Adjust for Blockchain Integration:

Consider the complexities of blockchain integration in your delivery schedule. Tasks related to smart contract development, security testing, and Ethereum- specific considerations should be accounted for.

Iterative Development:

Remember that in Agile development, work is delivered incrementally. At the end of each sprint, you should have a potentially shippable product increment.

Continuous Review and Adaptation:

After each sprint, hold sprint reviews and retrospectives to gather feedback, evaluate progress, and make necessary adjustments to the delivery schedule or project priorities.

Release Planning:

Based on the progress in each sprint and the feedback received, plan releases of the DAM.

7. CODING AND SOLUTIONING

7.1 Feature 1

<u>RegisterAsset</u>

- The "Asset" struct represents the properties of a digital asset, including title, description, IPFS hash, and the owner's Ethereumaddress.
- The "assets" array stores registered assets.
- The "registerAsset" function allows a user to register a new asset by providing the title, description, and the IPFS hash of the asset data. It also records the user's Ethereum address as the owner.
- You can emit an event to log the asset registration, providing information about the newly registered asset.

7.2 Feature 2

<u>TransferOwnership</u>

- The "Asset" struct represents the properties of a digital asset, including title, description, IPFS hash, and the owner's Ethereumaddress.
- The "assets" array stores registered assets.
- The "registerAsset" function allows a user to register a new asset,which is owned by the user who registers it.
- The "transferOwnership" function lets the owner of an asset transferownership to another user by specifying the asset's index and the address of the new owner.

7.3 Database Schema

The traditional database schema is replaced with smart contracts, which define the structure and behavior of assets and related data on the blockchain. However, certain off-chain data and metadata may be stored in traditional databases or decentralized storage systems for efficiency and scalability. Below, I'll provide a high-level overview of how the database schema for a DAM system on the Ethereum blockchain might look**.**

On chain ethereum smart contract

AssetContract:

- Attributes:

  Asset title (string)
  Asset description (string)
  IPFS hash for asset
  data (string)Owner
  (address)
  Public status (boolean)

- Functions:

  Register
  asset Transfer
  ownership
  Toggle public
  status

Off-Chain Metadata Storage (Traditional Database or Decentralized Storage):

1. User Profiles:

- Attributes:

  User ID
  Ethereum
  address
  Usernam
  e
  Email
  Other user

2 .Audit Trail:

- Attributes:

  Asset ID
  Action
  User performing the
  actionTimestamp
  Details of the action

3.Asset Metadata:

- Attributes:

  Asset ID
  Asset metadata
  Additional details

8. PERFORMANCE TESTING

8.1 Performance metrics

Asset Upload and Retrieval Speed:

Metric: Average time taken to upload and retrieve assets.
Importance: Measures the speed of asset management, ensuring quick access to assets.

Blockchain Transaction Throughput:

Metric: Transactions per second (TPS) on the Ethereum blockchain. Importance: Indicates how well the system handles blockchain transactions, which is crucial for scalability.

Smart Contract Execution Time:

Metric: Average time taken for smart contract execution. Importance: Evaluates the efficiency of the blockchain-based logic governing asset ownership and access.

Asset Metadata Search Time:

Metric: Time it takes to search for assets based on metadata. Importance: Measures the responsiveness of the system's search functionality.

User Authorization Latency:

Metric: Time it takes to validate and authorize user access to assets. Importance: Ensures that authorized users can access assets promptly while maintaining security.

Storage Space Usage:

Metric: Amount of blockchain storage used by assets and associated data. Importance: Evaluates the cost and efficiency of storage on the blockchain.

Asset Accessibility Uptime:

Metric: Percentage of time assets are accessible.
Importance: Measures the system's reliability and availability for users.

Security Audit Findings:

Metric: Number and severity of security vulnerabilities discovered during audits.
Importance: Identifies potential risks and the need for security improvements.

Ethereum Network Gas Costs:

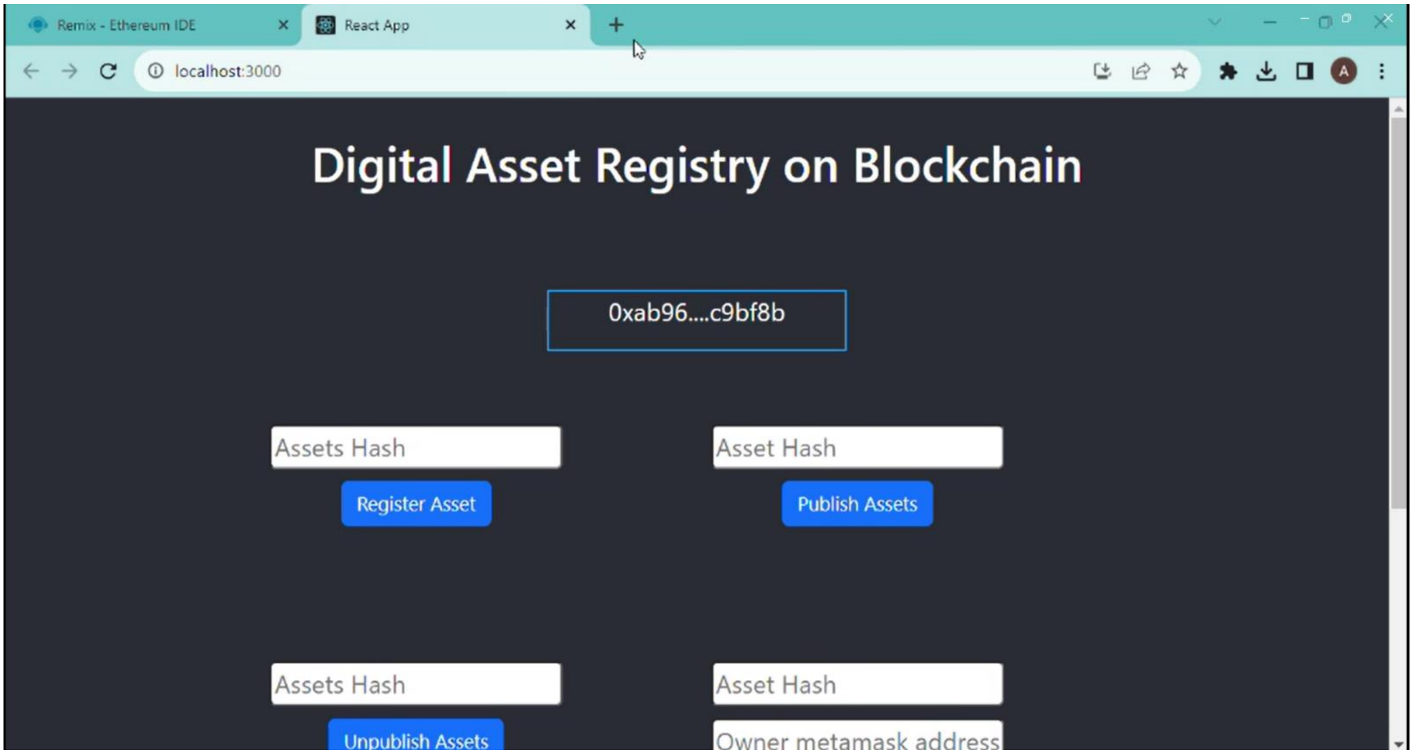
Metric: Total gas costs incurred for transactions and contract interactions. Importance: Measures the cost-efficiency of system operations.

Scalability Metrics:

Metric: System's ability to handle an increasing number of users and assets. Importance: Assesses how well the system can scale with growing demands.

9. RESULTS

9.1Output Screenshots



10. ADVANTAGES AND DISADVANTAGES

ADVANTAGES

Immutability and Transparency: All asset transactions and ownership changes are recorded on the Ethereum blockchain, providing an immutable and transparent audit trail. This enhances trust and security.

Ownership Verification: Ethereum's smart contracts allow for clear ownership verification, reducing disputes and proving the authenticity ofdigital assets.

Decentralization: The Ethereum blockchain operates on a decentralizednetwork, reducing the risk of single points of failure and enhancing security and availability.

Security: Assets stored on the blockchain benefit from robust cryptographic security, making it difficult for unauthorized parties totamper with or steal assets.

Global Accessibility: Ethereum is a global network, making digital assetsaccessible to a worldwide audience without geographic restrictions.

Interoperability: Ethereum's compatibility with various standards andprotocols allows for easy integration with other blockchain-based systems.

Cost-Effective: Smart contracts can automate asset management processes, reducing the need for intermediaries and saving costs.

DISADVANTAGES

Scalability: Ethereum has faced challenges related to network congestionand scalability, making it less suitable for high-frequency asset management.

Gas Costs: Every operation on the Ethereum blockchain consumes gas (transaction fees), which can make frequent asset management expensive.

Data Storage: Storing large digital assets directly on the blockchain canbe inefficient and costly. Many assets are stored off-chain or on decentralized storage systems like IPFS.

Irreversible Transactions: Once a transaction is confirmed on theEthereum blockchain, it is irreversible. Mistakes can be costly.

Smart Contract Vulnerabilities: Poorly written smart contracts can lead tosecurity vulnerabilities and hacks, resulting in loss of assets.

Privacy: The Ethereum blockchain is public, which means that asset datais visible to anyone. For private assets, additional privacy measures are needed.

11. CONCLUSION

Implementing digital asset management on the Ethereum blockchain offers advantages such as immutability, transparency, and decentralized ownership, making it a secure and transparent solution for asset management. However, challenges related to scalability, transaction costs, and regulatory compliance must be carefully addressed to fully realize the potential of this technology. As blockchain technology continues to evolve, Ethereum-based digital asset management holds promise for revolutionizing how we manage and exchange digital assets in various industries.

12. FUTURE SCOPE

The future scope of digital asset management (DAM) on the Ethereum blockchain is exciting and holds considerable potential for innovation andgrowth.

Interoperability with Other Blockchains: Future DAM systems may explore interoperability with other blockchain networks, enabling cross- chain asset transfers and interactions. This could expand the reach of digitalassets and create a more interconnected blockchain ecosystem.

DeFi Integration: Integration with decentralized finance (DeFi) platforms could allow for more advanced financial operations involving digital assets, such as lending, borrowing, and earning interest. This would add a financial dimension to digital asset management.

NFT Enhancements: Non-fungible tokens (NFTs) are a key component of DAM on Ethereum. Future developments may focus on enhancing the functionality of NFTs, such as enabling fractional ownership, composite NFTs, and more interactive experiences.

Cross-Platform Compatibility: DAM systems may offer seamless compatibility with various platforms and devices, ensuring a consistent user experience on web, mobile, and desktop applications.

Decentralized Identity: The integration of decentralized identity solutions could enhance user authentication, privacy, and security in DAM systems. Users may have greater control over their identity and data.

13. APPENDIX

SOURCE CODE:

https://drive.google.com/file/d/1EcRTLuhwfzK1gSi7pFBnQ-YFrKhFZ8Gh/view?usp=sharing.

GIT HUB LINK:

https://github.com/VICKY-UCHIHA/DIGITAL-ASSET-MANAGEMENT.git

DEMO LINK:

https://drive.google.com/file/d/1heHUWbgQSVGqTKqBlNrNV33qu0z_W8F6/view?usp=sharing