Project Report

Team ID	**NM2023TMID03292 9C366DD3745E2298CE94147F381EAA45**
Project Name	Climate Track Smart using blockchain

SUBMITTED BY

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INTRODUCTION

This report explores the potential of blockchain technology to promote sustainability and address climate change challenges in emerging markets. The European Union and the United States are taking steps to unlock the potential of blockchain for a data-powered green economy, and many ecosystem enablers are promoting collaboration, research, financing pilots, and accelerating initiatives in the blockchain and climate ecosystem.

After conducting consultations with key stakeholders and extensive desk research, 52 initiatives were identified that are operating in emerging markets with a focus on climate action. Carbon finance has the highest representation, accounting for 41.2% of the identified initiatives. However, these blockchain initiatives face significant gaps in adoption, regulation, infrastructure, and data quality that limit their potential impact.

The report provides a brief overview of nine initiatives that are using blockchain technology to promote sustainability and address climate change challenges in emerging markets, exploring specific use cases on how blockchain technology can incentivize sustainable land use, enhance investment and insurance for small-scale farmers, promote ocean conservation, and mitigate climate risk.

Project overview :

The term Web3 was first used by Gavin Wood, Polkadot Founder and Co-founder of Ethereum, in 2014. In his words, “Web3 is really sort of an alternative vision of the web, where the services that we use are not hosted by a single service provider company, but rather they’re sort of purely algorithmic things that are, in some sense, hosted by everybody... The idea being that all participants sort of contribute a small slice of the ultimate service”. Other descriptions simply state: Web1 was read-only, Web2 is read-write, Web3 will be read-write-own. The Ethereum organization provided a definition indicating that “Web3 has become a catch-all term for the vision of a new, better internet”, describing it as decentralized, permissionless, with native payments through cryptocurrencies, and trustless

Purpose

After conducting consultations with key stakeholders in the field and extensive desk research, we have identified 52 initiatives that are operating in emerging markets with a focus on climate action. These initiatives are categorized into eight different impact areas: Carbon Finance, Land Restoration, Ocean Conservation, Financial Inclusion, Climate Investment, Climate Insurance, and Agriculture. Carbon Finance has the highest representation, accounting for 41.2% of the identified initiatives.

The impact areas we refer to in this context are the various sectors or fields in which the identified initiatives operate and make a positive impact on climate action and emerging markets. For instance, initiatives operating in Carbon Finance focus on developing financial mechanisms that support the reduction of carbon emissions. Meanwhile, initiatives working in Land Restoration focus on restoring degraded land to improve soil health and reduce carbon emissions. This landscape analysis aims to provide insights into the different areas where blockchain technology is being leveraged to combat climate change and promote sustainability in emerging markets.

1. LITERATURE SURVEY

1. Blockchain for Food tracking system

One of the foremost blockchain-based food tracking systems is the “Food Trust” system developed by IBM. Announced for the first time in 2017, Food Trust has provided traceability in the food supply chain to 80 different brands so far by using blockchain technology. With this traceability, the supply process from producers to consumers can be followed in detail. IBM’s open-source technology based on Hyperledger Fabric allows companies to set their own rules on the system. It is argued that the traceability offered by the Food Trust not only helps food safety but also helps producers with food freshness, sustainability, and waste. Announcing that more than 5 million food products already on the shelves are included in the system, IBM seems confident that this platform will grow strongly. Among the companies using this application are giants such as Dile, Kroger, McCormick and Company, Nestle, Tyson Foods, and Unilever [11]. Walmart has used blockchain to record where every piece of meat it buys from China comes from, where it is processed, where it is stored, and all transactions related to its sale, along with its historical course. All detailed information about the farm where the meat comes from, the factory where it is processed, the batch number of the product, the storage temperature of the product, and transportation can be tracked on the blockchain. In addition to the benefits of processing speed, information sharing, and transparency, the main purpose is summarized as increasing food safety [12]. Provenance has conducted a blockchain-based pilot project in Indonesia to transparently track the movement of products from sea to table in the fishing industry. The seafood trade consists of a very large fishing network, and it is a very difficult sector to control quality. There is no reliable audit in the sector. This project aims to help stop illegal, excessive, harmful to the sea and the environment, and non-sanitary fishing violations in the tuna fish industry. Thus, consumers will be able to view the source of the food they supply transparently, and a legal basis will be established to combat illegal fishing. With the use of this example, the aim is that the use of blockchain technology will facilitate transparency, tracking, and auditing, thus ensuring the safety of food products, preventing illegal and excessive fishing, and preventing damage to the environment [13]. Kim proposes a blockchain-based traceability system with different ontologies, where each one could accomplish and be part of certain transactions. He offers the use of smart contracts. Ethereum, with the Solidity programming language, was used in his study [14]. Feng Tian et al. propose a blockchain solution for agriculture traceability to ensure that the HACCP principles and requirements are addressed during the production, transportation, and preservation of a product [15]. Moreover, Daniel Tse et al. focus on the increasingly serious problem of food safety in China and propose a blockchain solution for the agriculture supply chain, based on the information and transaction security between all the involved parties. In this work, a PEST (political, economic, social, and technological) environment analysis took place to define the challenges and the opportunities of the DLT (Distributed Ledger Technologies) solution [16]. In addition, Francesco Marinello et al. offer a blockchain-based solution focusing on the animal products supply chain in Italy [17]. Kumar et al. propose a rice supply chain system that uses blockchain technology to assure the safety of rice during its flow through the supply chain [18]. Maria Elena Latino et al. propose another interesting idea regarding the agriculture supply chain and the use of Industry 4.0 principles [19]. They refer to the idea of food democracy, according to which consumers are considered citizens and the food is not a good but a civil right. The authors advertise the idea of voluntary traceability and combine it with Industry 4.0 technologies. The significance of voluntary traceability is highlighted, focusing on the volume and the quality of the data collected for each product, as well as the need for a big data platform to handle them. Islam and others published work about the visualization of food supply chain management. Their research aims to propose a new visualization approach that allows supply Electronics 2022, 11, 2491 4 of 26 chain operators to collaborate effectively in the design process of FTSs capable of maintaining streamlined information flow, minimizing information loss, and improving supply chain performance [20]. Bahga et al. proposed work to monitor the food supply chain tracking system on a cloud-based architecture. The proposed system, called CloudTrack, provides the global information of the entire fleet of food supply vehicles and is proposed to be used to track and monitor a large number of vehicles in real time [21]. Caro et al. propose an integrated solution of a blockchain platform named AgriBlockIoT in the agriculture supply chain [22]. AgriBlockIoT is a fully distributed system that uses blockchain technology in combination with IoT devices to collect and distribute traceability data. The proposed solution was tested with two Ethereum and Hyperledger Sawtooth blockchain platforms. AgriBlockIoT enables the integration of IoT and blockchain technologies, creating transparent, fault-tolerant, immutable, and auditable records which can be used for an agri-food traceability system.

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Problem Statement Definition

First, most existing estimates do not consider the risk that a given level of GHGs concentration may lead to exceptionally high increases in temperatures. Second, existing global estimates do not consider the whole range of possible impacts and the uncertainty around them. Finally, the risk of extreme events with large consequences is seldom integrated into the In theory, adaptation constitutes a downward risk to estimates of the impact of climate change.

However, since the treatment of adaptation varies across studies, the extent of this downward risk is unclear. In any case, it is unlikely that this downward risk could offset the upward risk coming from the incompleteness of the estimated impacts.

Despite these uncertainties, the literature suggests that the impacts of climate change could be large.

Moreover, although the evolution of GHG concentration can be reversed by reducing emissions, at least on a sufficiently long period of time, some of the impacts of climate change will be irreversible.

There is a trade-off between avoiding irreversible policy cost and irreversible damages. While it

Is not possible to change the irreversible nature of some damage caused by climate changes, their cost to society can be lowered through efficient adaptation policies. The irreversibility of the cost of mitigation policy can be partly reduced by avoiding policies that encourage irreversible investments that could prove, ex post, not to be cost-effective solutions. Least-cost policies would also lower the overall cost.

Provided that policies are cost-effective, the uncertainty and irreversibility of the impacts of Climate change may justify policy action even if the marginal cost of mitigation exceeds the marginal damage of one additional ton of carbon. Climate change can lead to a significant rise in sea level and catastrophic events with implications on migration and the capital stock. Part of these impacts can be avoided through adaptation policies.

Climate change is expected to damage infrastructure but this effect can also be partly offset by adaptation strategies.

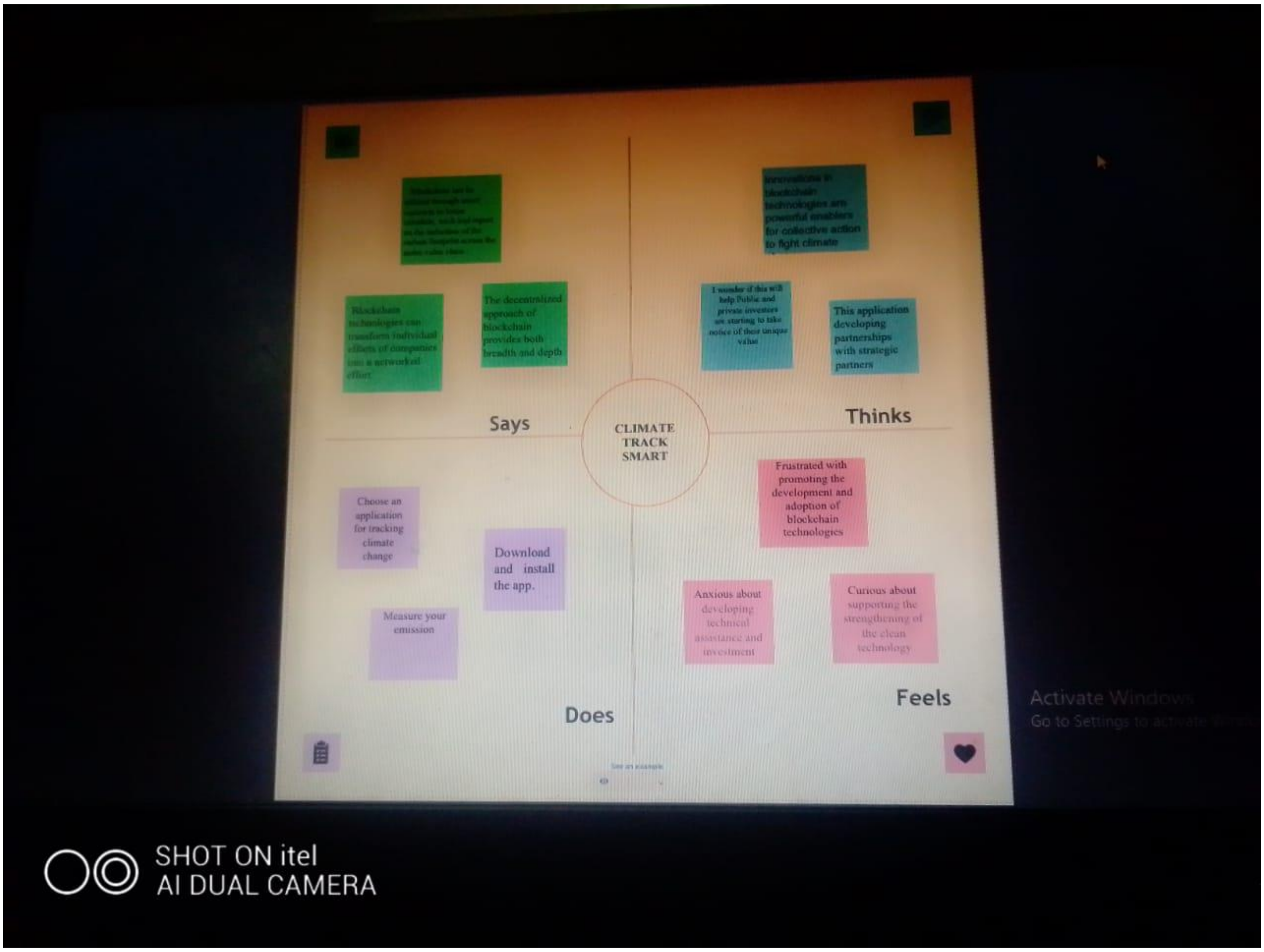
Climate change would also have a negative impact on biodiversity and the ecosystem, although these effects are still partly unknown.
regarding the discount rate. The output of the model is then an optimal GHG emissions path.

A very simple economic module with exogenous growth and production being allocated between consumption and investment with constant exogenous shares. The (regional) production function includes a carbon energy input that emits GHG.

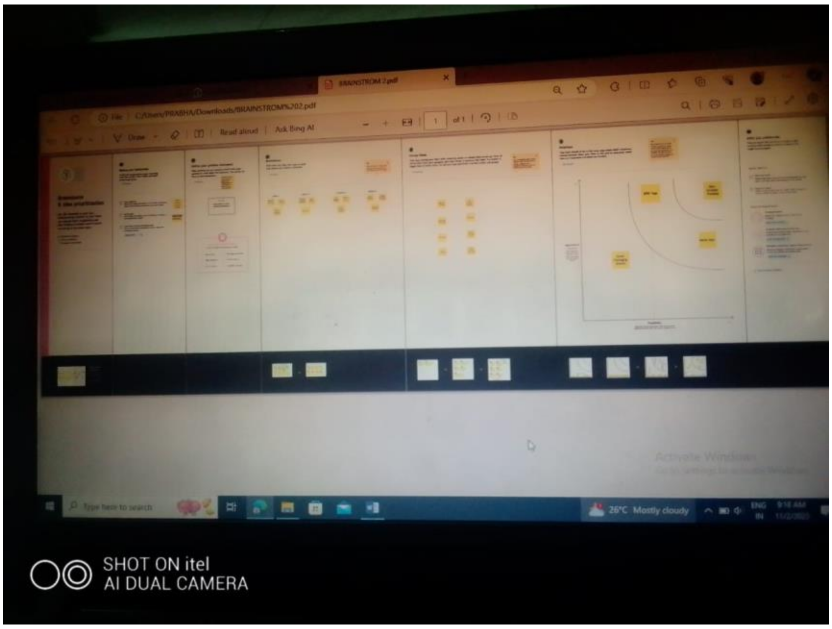
A relatively detailed geophysical module that links GHG emissions to weather changes, in terms either of temperatures only or also of precipitations, storms and sea level rise.

IDEATION & PROPOSED SOLUTION

Empathy Map



Ideation & Brainstorming



REQUIREMENT ANALYSIS

Functional requirement

Name	Description
Algorand	Algorand is a proof-of-stake blockchain cryptocurrency protocol. The platform's native cryptocurrency is called ALGO. Algorand's Layer-1 blockchain is capable of smart contracts and AVM, standard assets, atomic transfers, and rekeying. The platform is considered energy efficient, and it offsets its carbon footprint in partnership with ClimateTrade.
Sustainable Bitcoin Protocol	Sustainable Bitcoin Protocol (SBP) is a platform focused on promoting sustainability in the Bitcoin ecosystem. The platform's main goal is to encourage institutional and corporate adoption of Bitcoin through environmentally friendly practices. SBP is developing a market mechanism that rewards Bitcoin miners who use verified clean energy. Investors can opt to add "Proof of Sustainable Mining" to their BTC holdings through the platform. SBP aims to achieve its sustainability goals without affecting Bitcoin's fungibility.
Polkadot	Polkadot unites and secures a growing ecosystem of specialized blockchains called parachains. The platform enables cross-blockchain transfers of any type of data or asset, not just tokens. Apps and services on Polkadot can securely xcommunicate across chains, forming the basis for a interoperable decentralized web.
CELO	CELO's platform aims to build a regenerative economy through Blockchain. The use cases of their platform include saving (rewards and interest), paying (commerce), sending (remittances), earning (microwork), giving (humanitarian aid), and lending (lending protocol). CELO also supports a "creator economy" use case to support global creators with NFTs. The solutions hosted on their platform include Simplex DNA (data collection), Tokenized Carbon Credits (Toulcan, Flowcarbon), measurement, reporting and verification (MRV Collective), geospatial (Astral), and automated incentives for regenerative stewardship (Green World).
Cosmos	Cosmos is a blockchain-based ecosystem of interconnected apps and services aimed at enabling a decentralized future. One of its key features is a decentralized exchange for digital assets from across the Interchain, with low transaction fees and quick confirmation times. Cosmos also offers a security solution called Interchain Security, which involves securing various chains in exchange for additional staking rewards. It facilitates connections between different chains through its Route functionality, which establishes IBC connections with compatible chains and operates decentralized bridges with chains like Ethereum and Bitcoin. Additionally, Cosmos provides a secure custody solution for digital assets and multi-chain account management through its Hub service.

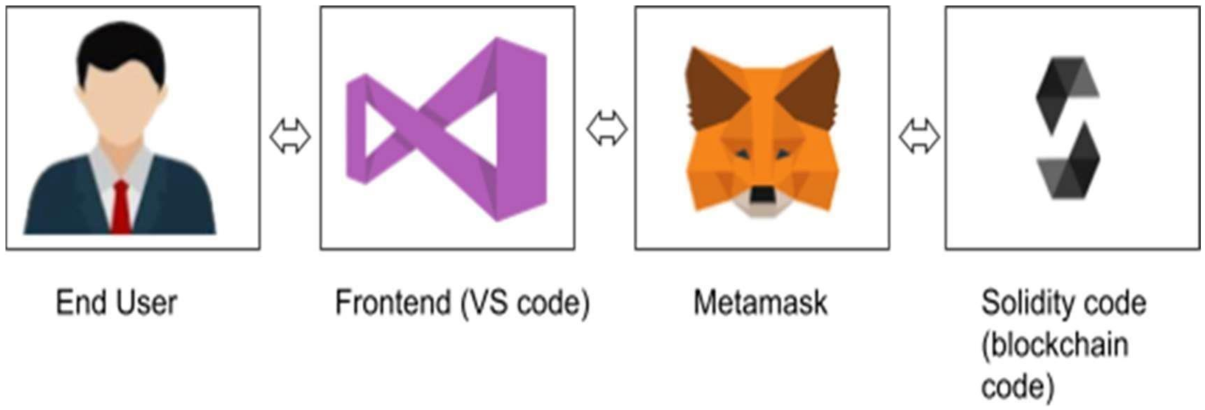
Name	Description
Menthol Protocol	Menthol Protocol is a multi-chain decentralized sustainability protocol that will automatically offset carbon emissions user or dApp transactions with verified renewable energy and carbon credits from around the world. It supports dApps and allows dApp developers/users to be climate-positive in a decentralized and automated way. Menthol Protocol’s vision is to be the go-to multi-chain sustainability middleware for the Defi and NFT space.
Topl	Topl is a decentralized protocol designed to unlock the next wave of inclusive, sustainable innovation across supply chains and markets. The platform is built for impact tracking, tokenization, and transaction.
Solana	Solana is an open-source, public blockchain that supports open-source projects that generate public goods for the community. The platform allows other ecosystem participants to learn from and build on users' work. Solana ensures composability between ecosystem projects by maintaining a single global state as the network scales.

Non-Functional requirements

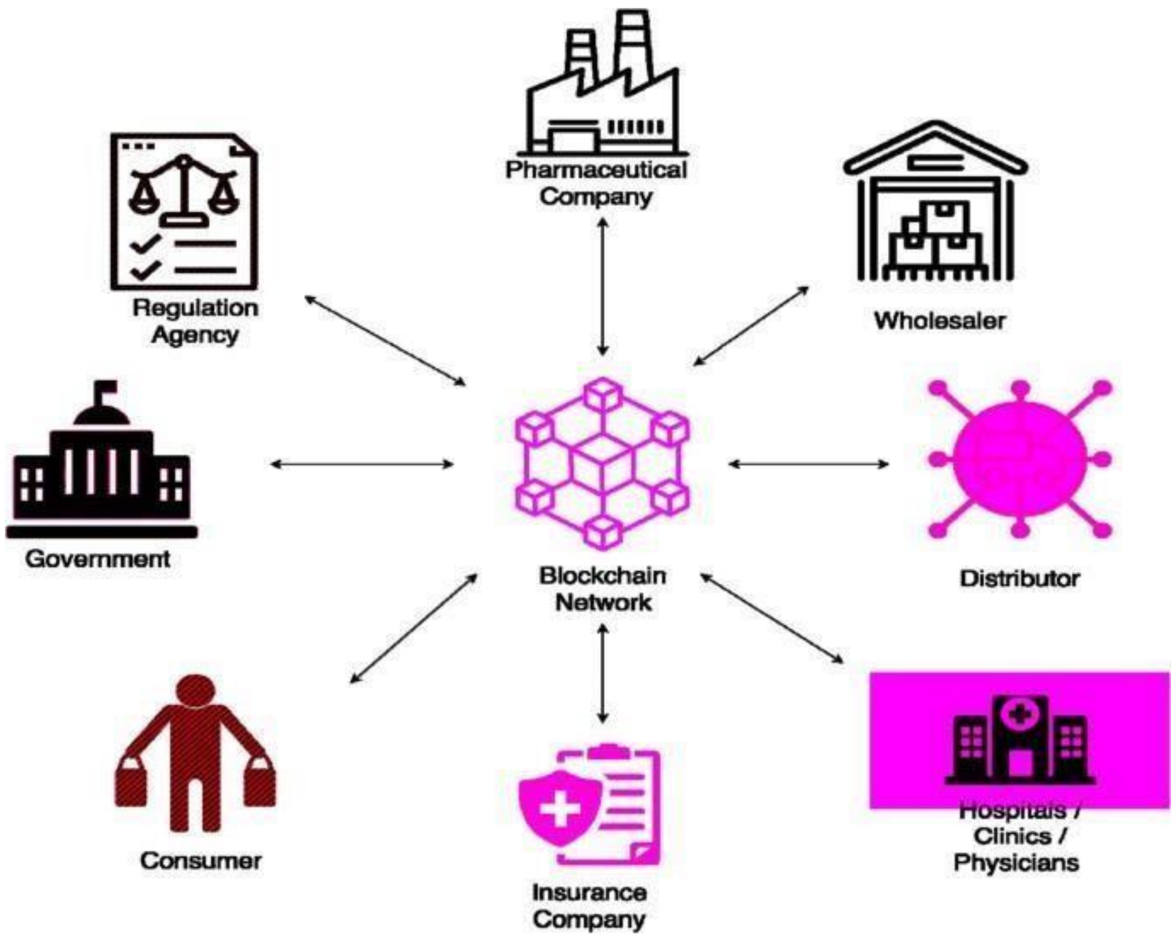
NFR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	For climate track smart, we've proposed a totally new blockchain system. This solution is more secure and scalable than other options currently available. Furthermore, the suggested system can prune its storage effectively, resulting in a robust and usable blockchain storage solution.
NFR-2	**Security**	Traditional solutions to achieve traceability within pharmaceutical supply chain are typically centralized and lack transparency across participants of the supply chain, which allows the central authority to modify information without notifying other stakeholders.
NFR-3	**Reliability**	Blockchain-based climate track smart offers a potential solution to create a distributed shared data platform for an immutable, trustworthy, accountable and transparent system in the PSC**.**
NFR-4	**Performance**	Scalability is essential, as the system must maintain usability as the volume of climate 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 climate track smart operates smoothly,regardlessof the scale or usage patterns.
NFR-5	**Availability**	Blockchain technology ensures an efficient and cost-effective solution that underpins different climatic functions and procedures to ascertain proper identification, tracing, tracking, and provenance.
NFR-6	**Scalability**	Blockchain technology enables creating a private permissioned network to trace and track events in the pharmaceutical supply chain and provides time stamped records of each transaction performed. Examples of events includes, execution and owner, time, location of transaction, and which stakeholders were involved.

3. PROJECT DESIGN

Data Flow Diagrams & User Stories



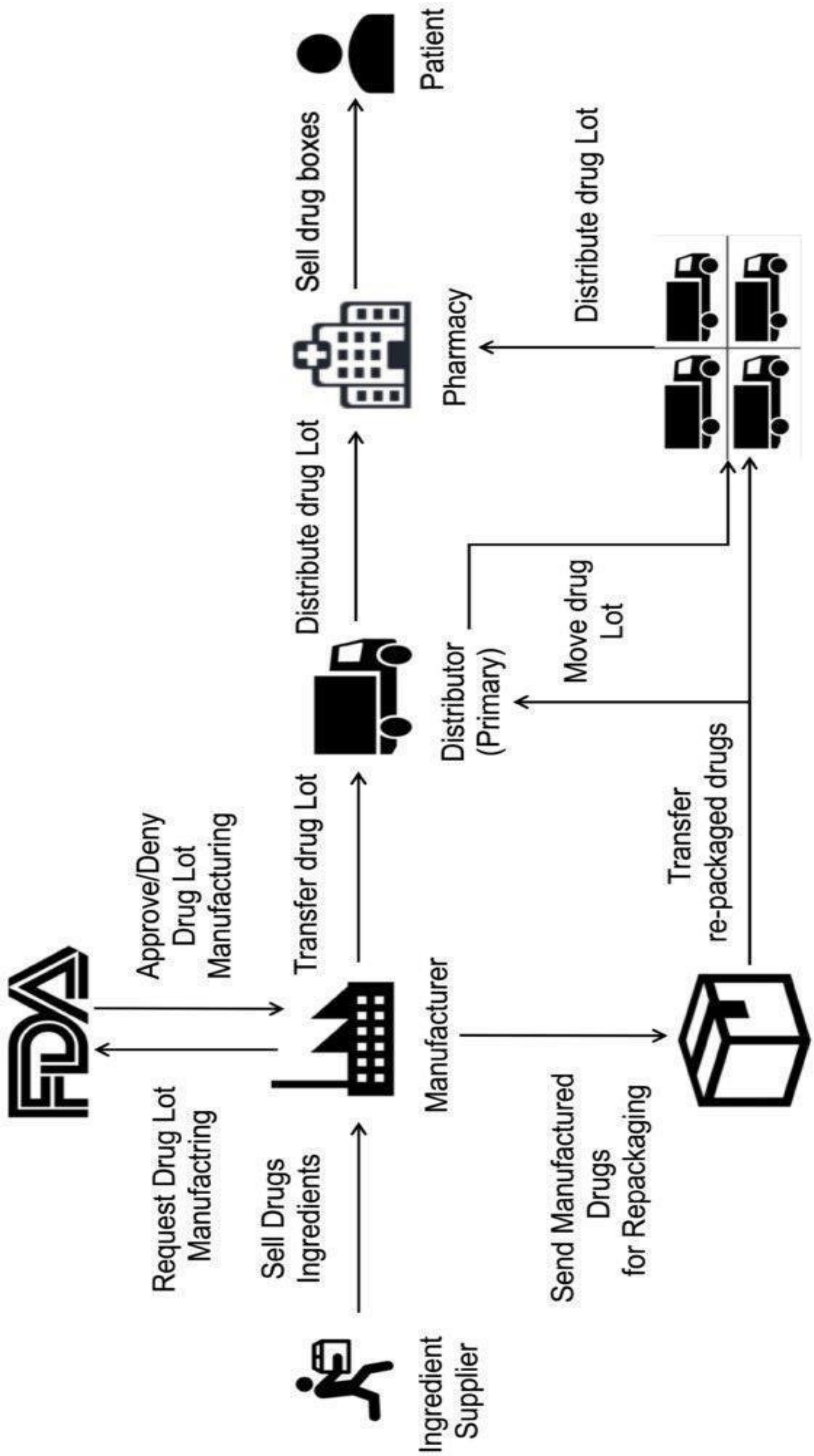
Data Flow Diagrams



User Stories

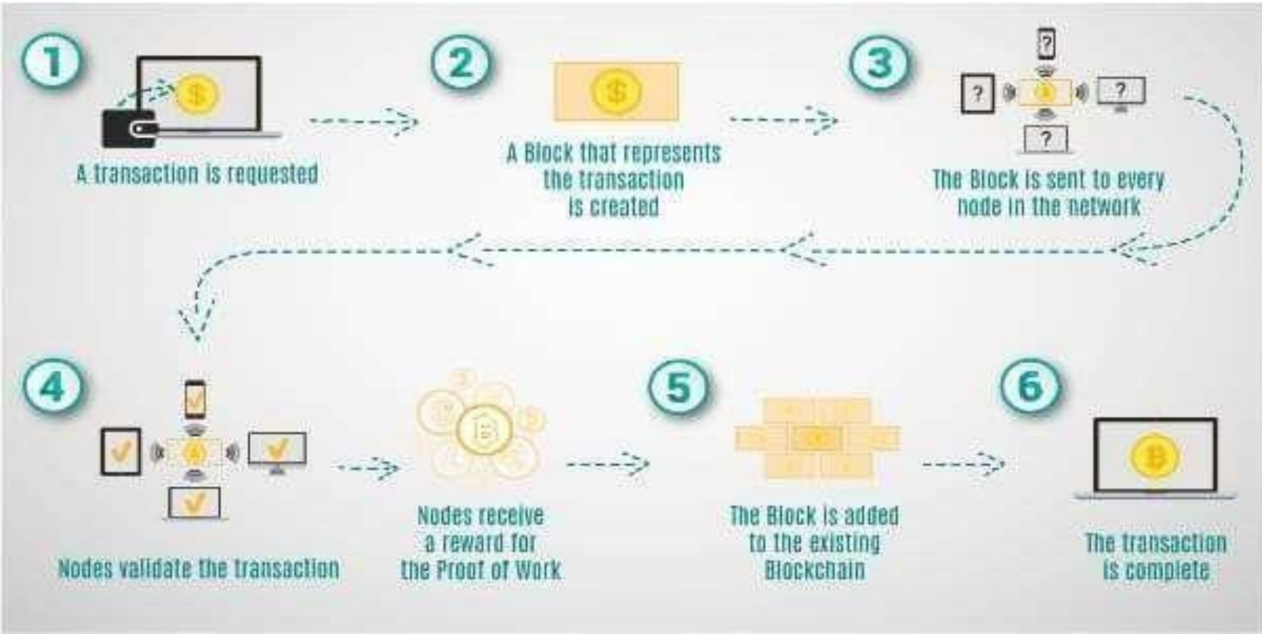
User Type	Functional Requireme nt (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	team Member
Content Creator	Drug Upload and Management	USN-1	As a content creator, I want to upload multiple image and video assets to the drug tracking with drag-and-drop functionality	Users should be able to drag and drop multiple assets onto the drug traceability nterface, and the system should process and upload them efficiently	High	Sindhusa
Content Creator	drug Upload and Management	USN-2	As a content creator, I need to add detailed metadata to my drug, including titles, descriptions, and copyright information, to keep them wellorganized	Metadata fields should be easily accessible and editable, and changes should be immediately reflected in drug information	Medium	gokul
Marketing Manager	Drug Organization and Access Control	USN-3	As a marketing manager, I want to create and assign tags to drug for easy categorization, facilitating efficient drug retrieval.	Tags should be customizable, and drug should be sortable and filterable by assigned tags	Medium	roja
Marketing Manager	drug Organization and Access Control	USN-4	As a marketing manager, I need to restrict access to confidential drug to authorized team members only	Access control settings should allow me to specify who can view, edit, and delete drug , with permissions easily adjustable	High	yugabharath
Administra tor	System Management	USN-5	As an administrator, I want to monitor and manage drug access, user roles, and system performance.	The admin dashboard should provide insights into user activity, allow role assignments, and offer system performance metrics	High	sindhusa
Administra tor	System Management	USN-6	As an administrator, I need to set up automated data backups and a disaster recovery plan for data safety.disciplie	The system should regularly back up data and provide a documented recovery plan to prevent data loss.	High	roja

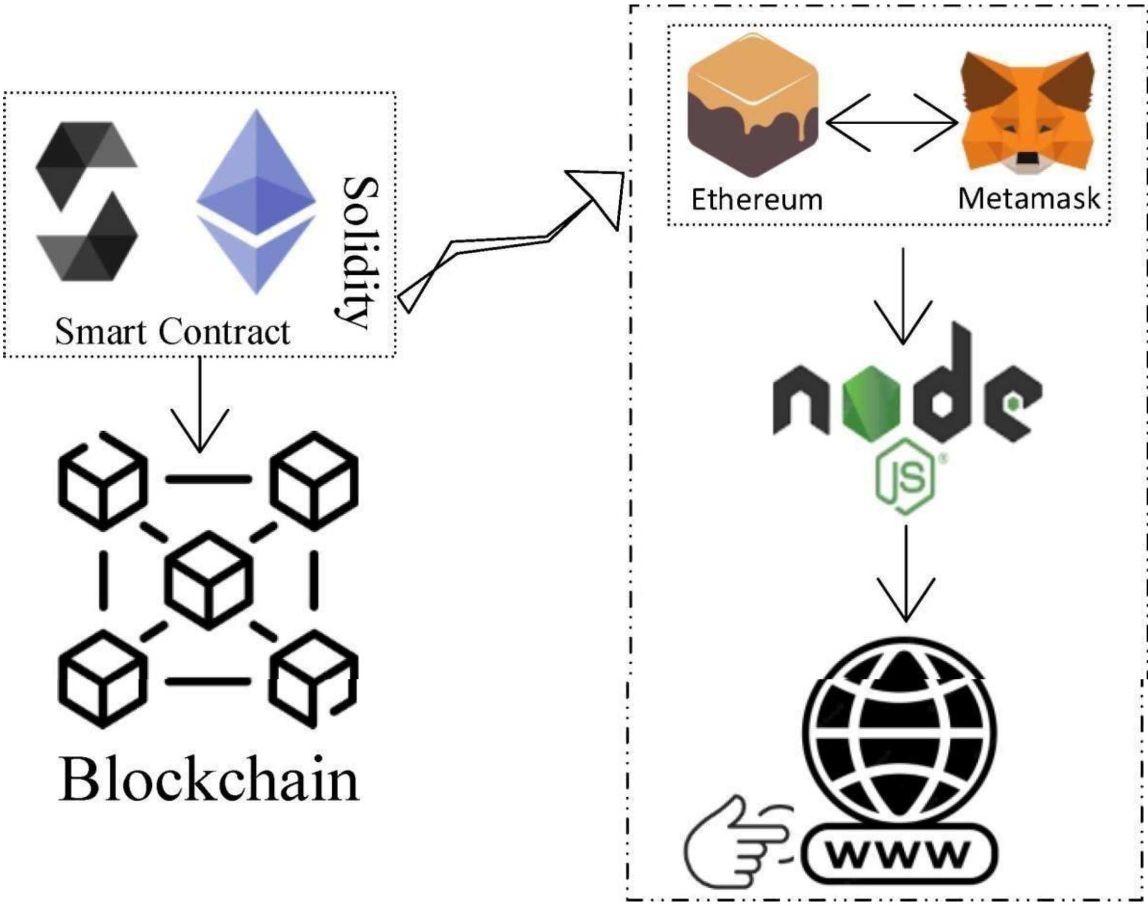
Solution Architecture



4. PROJECT PLANNING & SCHEDULING

Technical Architecture





Sprint Planning & Estimation

1. User Story Backlog:

Start by creating a backlog of user stories. These stories should represent the features, enhancements, or tasks needed for your drug traceability. Ensure they are well-defined, with clear acceptance criteria.

2. Prioritization:

Collaborate with stakeholders to prioritize the user stories based on their importance and impact. High-priority stories should be at the top of the backlog.

3. Sprint Planning Meeting:

Hold a sprint planning meeting with your development team. During this meeting, select a set of user stories from the backlog to work on during the upcoming sprint. Consider the team's capacity and the complexity of the stories.

4. Story Point Estimation:

Use a method like story point estimation to estimate the effort required for each user story. The team assigns relative points to stories to indicate their complexity. This helps in determining how many stories can be included in the sprint.

5. Sprint Goal:

Define a clear sprint goal, which should align with the project's objectives. The goal should provide a sense of purpose for the sprint.

6. Daily Stand-Ups:

Conduct daily stand-up meetings to keep the team updated on progress, discuss any challenges, and make necessary adjustments to the sprint plan.

7. Sprint Review:

At the end of the sprint, hold a sprint review meeting to showcase the completed work to stakeholders. Gather their feedback and insights.

8. Sprint Retrospective:

After the review, conduct a sprint retrospective to assess what went well and what could be improved. Use this feedback to make process enhancements for the next sprint.

9. Continuous Improvement:

Agile principles emphasize continuous improvement. Apply lessons learned from each sprint to refine the process, including better estimation and planning.

10. Blockchain Integration Considerations:

When estimating and planning, consider the complexities related to blockchain integration, such as smart contract development, security measures, and the use of Ethereum's capabilities.

Sprint Delivery Schedule

1. Divide the Project into Sprints:

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

2. 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.

3. 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.

3. 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.

4. 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.

5. 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.

6. 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.

7. Adjust for Blockchain Integration:

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

8. 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.

9. 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.

10. Release Planning:

Based on the progress in each sprint and the feedback received, plan releases of the drug traceability. These releases can be scheduled according to the completion of major features or project milestones.

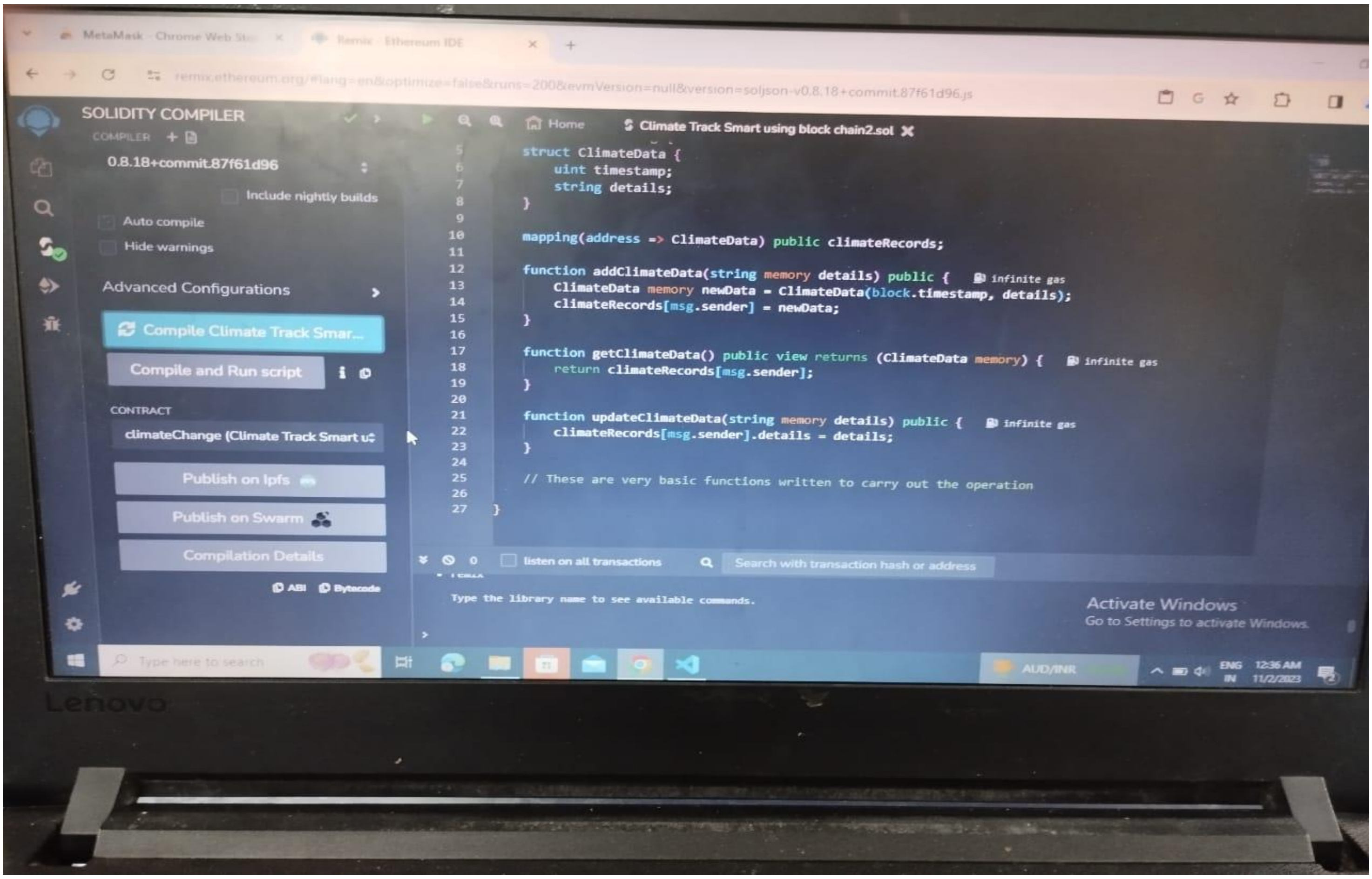
11. Maintain a Release Calendar:

Maintain a release calendar that outlines when each sprint's deliverables or major releases are expected to be available to users or stakeholders. Share this calendar with the team and relevant parties.

7. CODING & SOLUTIONING (Explain the features added in the projectalong with code)

Feature 1

Smart Contract (Solidity):



SOURCE CODE(SOLIDITY):

```
pragma solidity ^0.8.0;

contract climateChange{
    struct ClimateData {
        uint timestamp;
        string details;
    }

    mapping(address => ClimateData) public climateRecords;

    function addClimateData(string memory details) public {
        ClimateData memory newData = ClimateData(block.timestamp, details);
        climateRecords[msg.sender] = newData;
    }

    function getClimateData() public view returns (ClimateData memory) {
        return climateRecords[msg.sender];
    }

    function updateClimateData(string memory details) public {
        climateRecords[msg.sender].details = details;
    }

    // These are very basic functions written to carry out the operation

}
```

Additional details

This off-chain storage can include a traditional relational database for userprofiles and audit trail data or decentralized storage systems like IPFS for storing drug metadata and potentially even the drug files themselves.
It's important to note that the Ethereum blockchain is primarily used for storingcritical asset ownership and transaction data, ensuring immutability and transparency. Off-chain storage is often used to handle less critical data and to optimize data access and retrieval times.
The database schema can vary significantly based on the specific requirements of the drug traceability , and you may need to expand or modify the schema to suityour application's needs. The goal is to balance the benefits of blockchain's immutability with efficient data management and retrieval for users.

8. PERFORMANCE TESTING

Performace Metrics

Asset Upload and Retrieval Speed:

Metric: Average time taken to upload and retrieve drug.
Importance: Measures the speed of climate traceability ensuring quickaccess to climate.

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 climatic ownership and access.

Climatic Metadata Search Time:

Metric: Time it takes to search for climatic 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 drug.
Importance: Ensures that authorized users can access climatic promptly whilemaintaining security.

Storage Space Usage:

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

FOOD Accessibility Uptime:

Metric: Percentage of time climatic 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.

User Feedback and Satisfaction:

Metric: User surveys or feedback on system usability and performance.
Importance: Provides insights into user satisfaction and areas for improvement.

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 drug.

Importance: Assesses how well the system can scale with growing demands.

Audit Trail Accuracy:

Metric: Accuracy and completeness of the audit trail for climatic tracking
Importance: Ensures a reliable record of climatic history for compliance and accountability.

Data Backup and Recovery Time:

Metric: Time taken for data backup and recovery operations.
Importance: Evaluates the system's readiness for data recovery in case of failures.

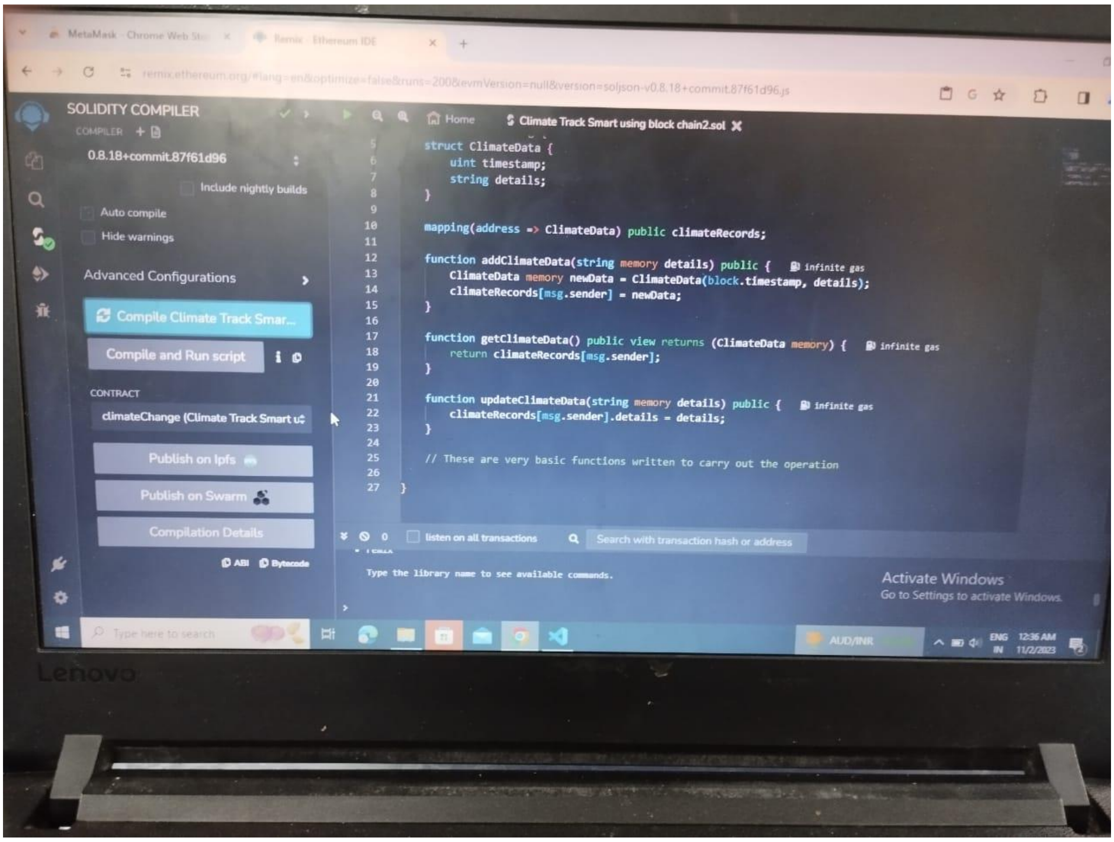
9. RESULTS

Output Screenshots

The " climate" feature allows users to officially record and store information about a drug tracking on the Ethereum blockchain. This process establishes proof of ownership and a public record of the climatic ‘s existence. It ismarked as "public" and can be viewed or

accessed by anyone on the Ethereum blockchain.

Get climatic tracking using blockchain is showing a status of the drug (manufacturing climate, transfer climate ownership)



Results :

Before using the blockchain-based food tracking system, the performance data of the system were obtained. In this way, it will be necessary to prevent problems such as scalability and to stop the work if it is foreseen that the blockchain-based system to be used will not reach the desired performance values. The performance values of Ethereum and Hyperledger Sawtooth are used to benchmark the values obtained from the proposed system. A simulation environment has been set up to collect and compare these data using Matlab. The latency (s), Net Tx (bytes), Net Rx (bytes), and CPU load (%) values are the variables that keep the data obtained in this simulation environment. With the data obtained in this simulation environment, the aim is to reveal the difference with other platforms clearly and concretely. The latency (s) value in the proposed system was obtained as 0.038. The transmission per second value is 285, the reception per second value is 335, and the CPU load rate value is 19.22. Especially when we evaluate the latency times, the obtained value is at a very good level compared to Ethereum. When it is compared with Hyperledger Sawtooth, it is seen that there is a little more delay. The main reason for this is that the system architecture is more complicated, and the data sizeobtained is high. This is also evident from the fact that the transmission per second and reception per second values are much higher than Hyperledger Sawtooth. It has been observed that a rate of 19.22 was achieved in the CPU usage rate (Table 4). As a result, it is seen that the performance data obtained have a serious advantage over Ethereum, especially in terms of latency, and it has started to converge in other values (Figure 13). Considering that the real-time operation of the installed system is extremely important, the choice of Hyperledger Fabric has once again emerged as the right decision.

10. CONCLUSION

In this study, the establishment of a blockchain-based food tracking system in Turkey, its performance comparison, the operation of the system, and the results are discussed. The flow of a food tracking system has been demonstrated in Turkey, and accordingly, the 12-stepsystem flow required to develop a blockchain-based food tracking system has been obtained. Comparing the performance data of the established blockchain-based system with other blockchain infrastructures, a value of 0.038 s for latency is 435 times better than Ethereum, one of the most popular blockchain infrastructures. A transmission per second value of 285, reception per second value of 335, and CPU load rate value of 19.22 are obtained with the proposed system. Because it is not currently possible to put such a system into use throughout the country, choosing a pilot region and operating the system in this region and taking their feedback is essential for obtaining solid evidence to show that the users of the system are looking for such a system to use. For this, a survey study was conducted on the users of the system. We can say that the results obtained are concrete proof of how much thesystem is needed and that it is favored by the public. The system was used for three months in the selected pilot study area. A total of 7828 users viewed the application. A total of 72.03% of them (5560 users) logged into the application and had a user experience. As a result of the two-question survey directed to these participants, 75.31% of the users who use the application like the interface of the application, while the others have low satisfaction. Considering that this developed application is not a commercial product but a proof of concept (PoC) study, it is obvious that there will be some development needs if it is turnedinto a commercial product.

11. FUTURE SCOPE

1. Develop a prototype to demonstrate the requirements shared via the guidelines of the DGFT/DAVA Team. Learned how the GS1 enabled 2D/1D barcodes will be associated with each drug pack and document the shortcoming in any.

2. Involved an early adopter to participate in our Traceability CRM Solution. We had two early adopters from the Pharma Industry based out in Kothur, Hyderabad, and another firm based out at Pashamylaram, Hyderabad. The former allowed us to gather requirements at the factory and allowed us to work with production packaging /warehouse teams.

3. I began with the bottom-up approach while documenting the requirements. As per guidelines from FDA (Implementation in a hospital pharmacy in Argentina" GS1.org, 2014) , (GS1 Standards in the Pharmaceutical Supply Chain, 2018), from MHRA (GOV.UK, 2021) , From GS1 (Traceability system a must for drugs: GS1 chief , 2021) Based on the expectations, we learned from three guidelines from DGFT-DAVA/US FDA-US DSCSA /MHRA-FMD (Falsified Medical Directives).

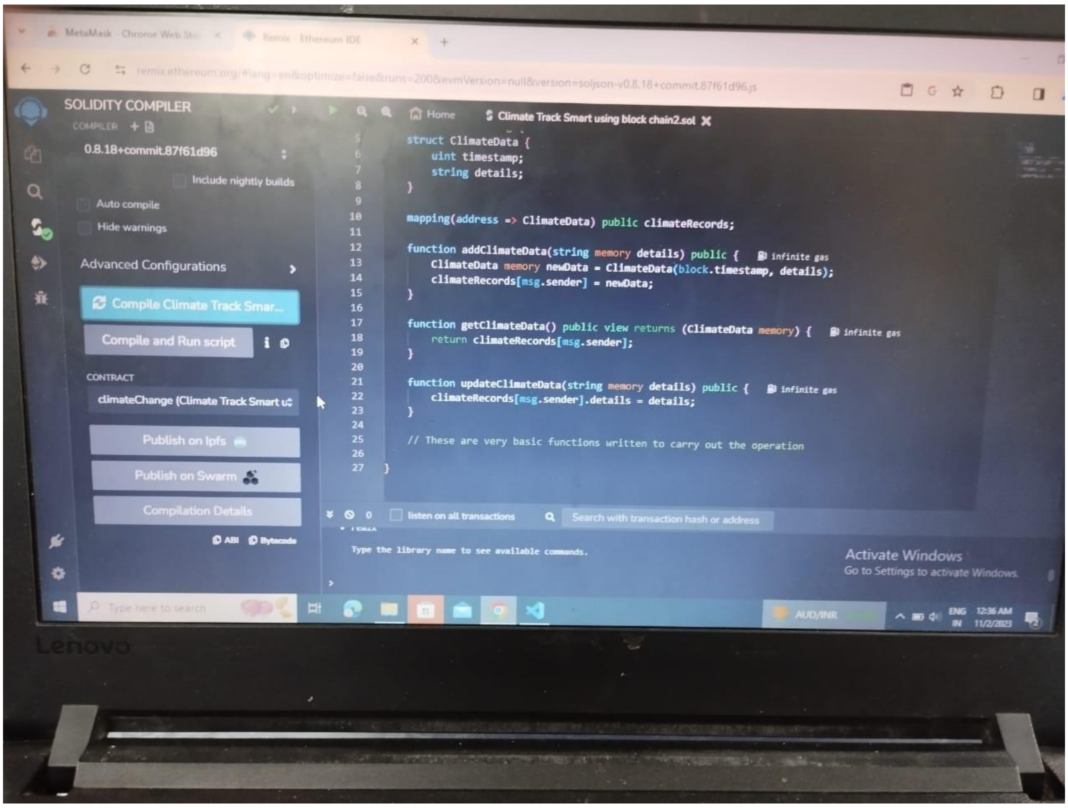
4. Understanding the component of Serialization requirement. As per the initial user specification document composed by SolutionsMax Technology Services (An Enterprise Solutions for the Pharma Ecosystem, 2016-2021) Organizations need to identify various components such as the readiness of the ERP system as a master data repository, changes in artwork for all affected Stock Keeping Units (SKUs), and new systems such as the enterprise serialization manager, packaging line system, and edge systems.

5. Types of Business Reports measuring compliance attributes. . As per the initial user specification document composed by SolutionsMax Technology Services (An Enterprise Solutions for the Pharma Ecosystem, 2016-2021)Emphasis was to understand the various quality and business reporting that would be required to beestablished. Establishing a parent-child relationship between the packs that are being packaged so that traceability can be reported

13.APPENDIX

Source Code

Solidity coding :



Java script :

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			"internalType": "string",
			"name": "details",
			"type": "string"
		}
	],
	"name": "addClimateData",
	"outputs": [],
	"stateMutability": "nonpayable",
	"type": "function"
},
{
	"inputs": [
		{
			"internalType": "address",
			"name": "",
			"type": "address"
		}
	],
	"name": "climateRecords",
	"outputs": [
		{
			"internalType": "uint256",
			"name": "timestamp",
			"type": "uint256"
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	"stateMutability": "view",
	"type": "function"
},
{
	"inputs": [],
	"name": "getClimateData",
	"outputs": [
		{
			"components": [
				{
```

"internalType": "uint256",
"name": "timestamp",
"type": "uint256"
},
{
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"name": "details",
"type": "string"
}
],
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"name": "",
"type": "tuple"
}
],
"stateMutability": "view",
"type": "function"
},
{
"inputs": [
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"name": "details",
"type": "string"
}
],
"name": "updateClimateData",
"outputs": [],
"stateMutability": "nonpayable",
"type": "function"
}
]

OUTPUT CODING:

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GITHUB LINK:

https://github.com/Nisha1821/Naan-mudhalvan-

PROJECT VIDEO DEMO LINK:
https://drive.google.com/file/d/1K5o-ls-
RqVuZvoTdVr5aiMGc1MpwvDA0/view?usp=drivesdk