Blockchain-Based Supply Chain Transparency for Agricultural Produce

SMART INDIA HACKATHON 2025

NFSU '25

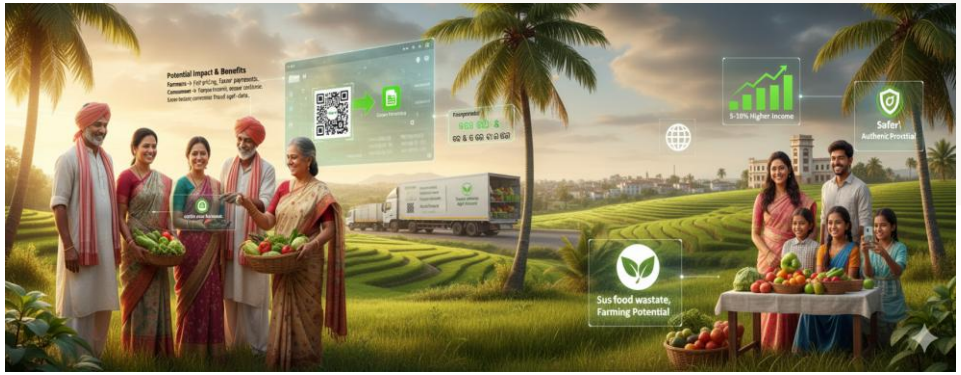
Problem Statement Title : Blockchain-Based Supply Chain Transparency for Agricultural Produce

Organization : Government of Goa

Category : Software

Problem Statement Number : 25045

Development Team Name : TRACEAGRI



Description

Create a blockchain-based system to track agricultural produce from farm to consumer, ensuring transparency in pricing, quality, and origin. The solution should allow stakeholders (farmers, distributors, retailers) to verify transactions and reduce exploitation in the supply chain.

Expected Outcome

A decentralized platform with a user-friendly interface for farmers and consumers to trace produce, reducing fraud and ensuring fair pricing, deployable on low-cost hardware or cloud infrastructure.

Technical Feasibility

Leverages existing blockchain frameworks like Ethereum or Hyperledger, with smart contracts for automated tracking and QR code integration for consumer access.

PROPOSED SOLUTION

- **Web application** with two portals – one for **farmers/distributors/retailers** and one for **consumers**.
- **Smart contracts (Ethereum/Polygon)** ensure tamper-proof lifecycle tracking with **role-based access**.
- **Off-chain storage (IPFS/Cloud)** for large/sensitive data; **hash references** stored on-chain.
- Each produce batch has a **QR code**, which consumers can **scan on the web portal** to see full verified history.

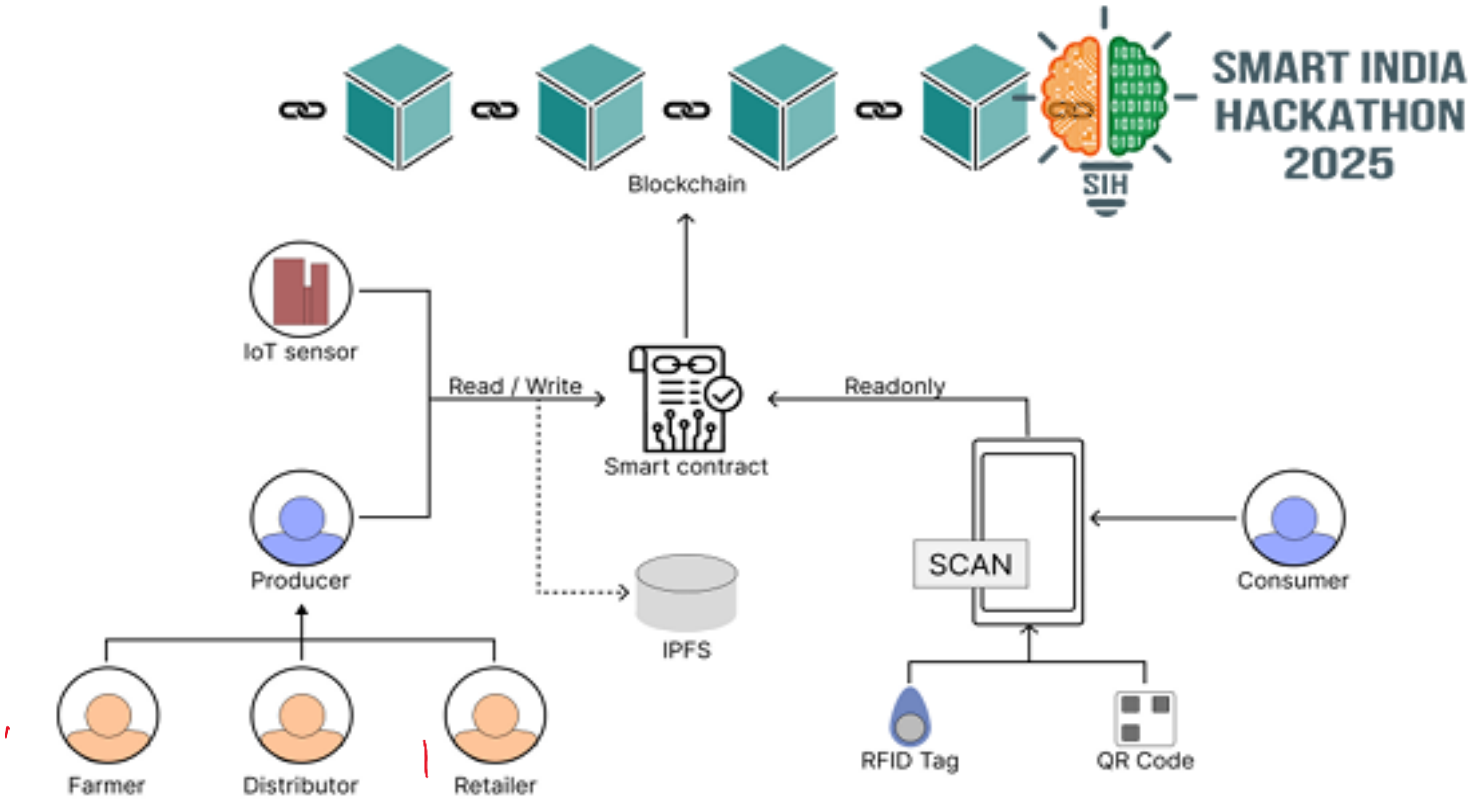
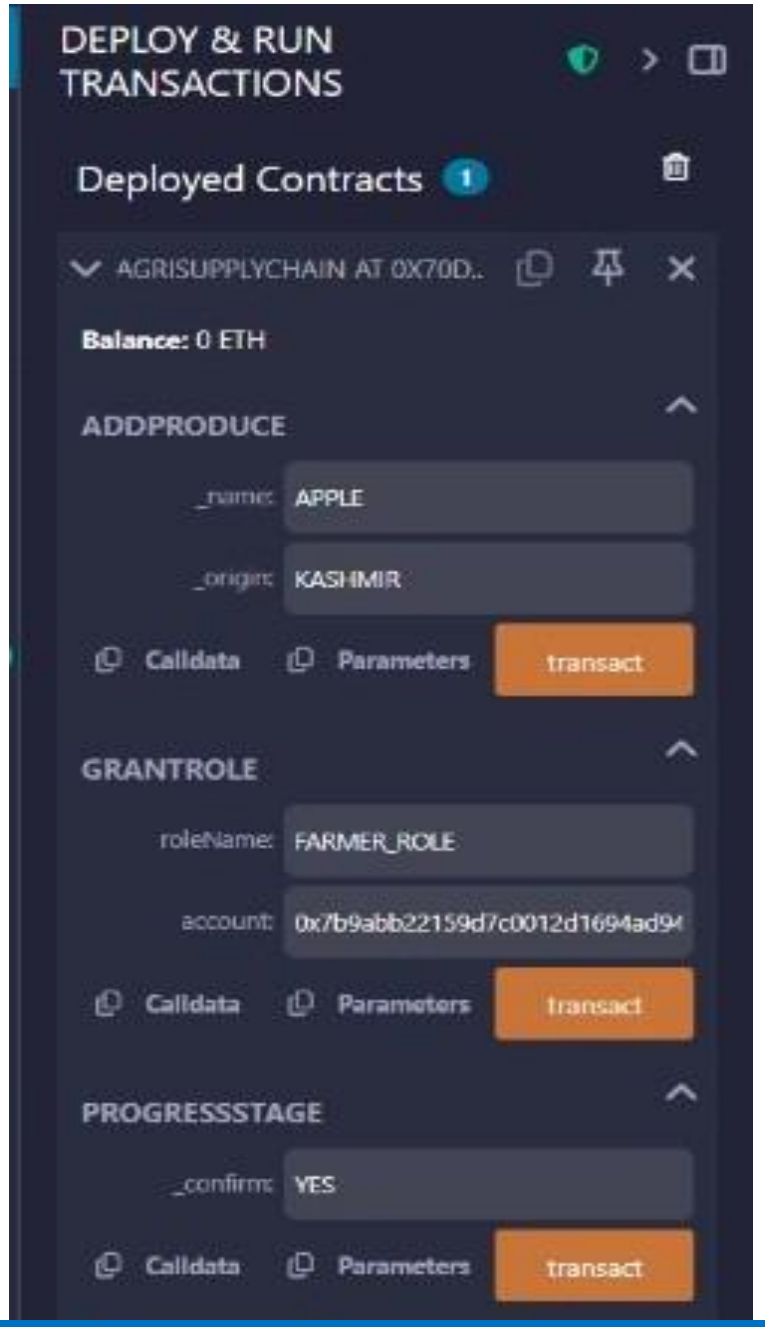
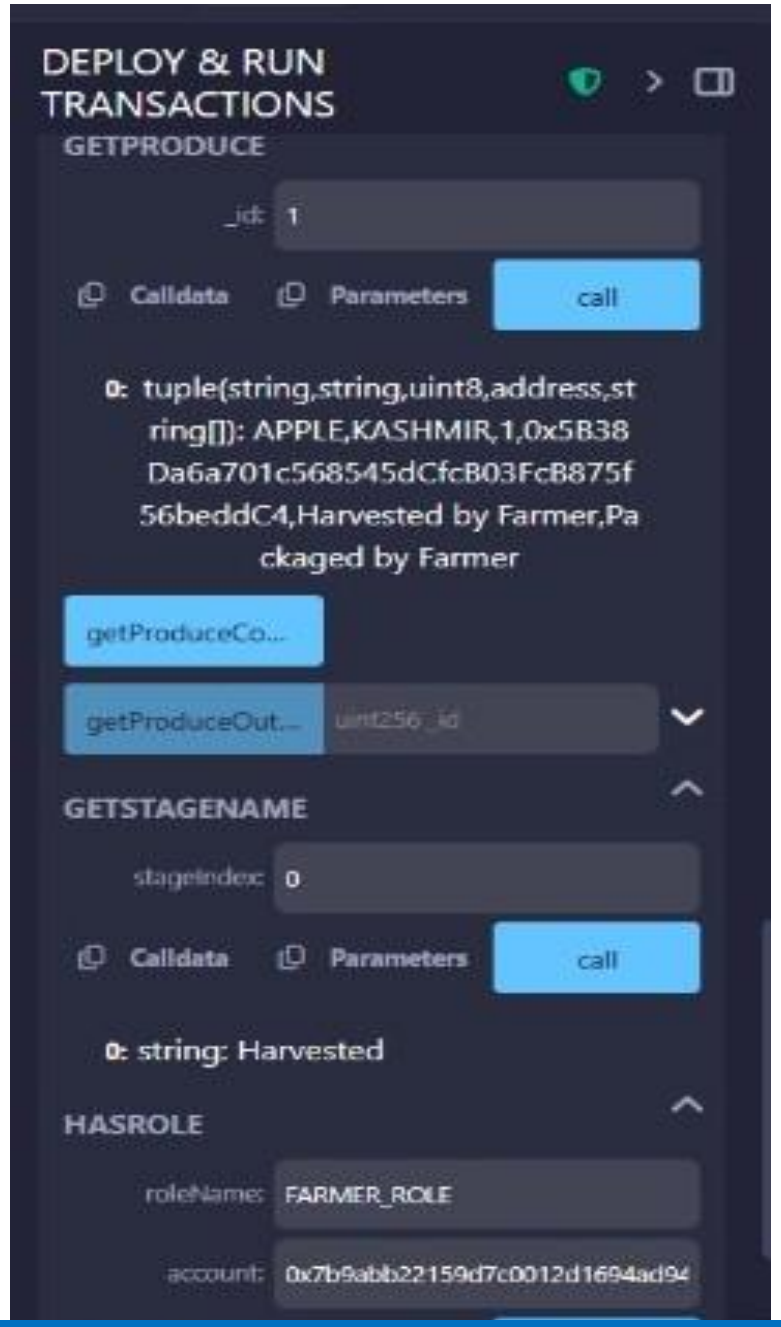


FIGURE 1. An architecture with all the components presented in different works.

INNOVATION & UNIQUENESS

End-to-end blockchain traceability of produce (farm → consumer), ensuring tamper-proof records.
Role-based smart contracts give each stakeholder controlled access, preventing unauthorized updates.
QR-code integration lets consumers instantly verify origin, quality, and lifecycle.
Hybrid on-chain + off-chain design (IPFS/Cloud) reduces c6ost while preserving integrity.
Farmer-centric and low-cost solution using **Polygon (L2)** for affordable deployment.
Transparent consumer web portal directly connected to blockchain, removing intermediaries.





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dApp Frontend
UI that integrates libraries
to interact with contracts

Solidity
Smart contract language for EVM chains (Ethereum, Polygon)

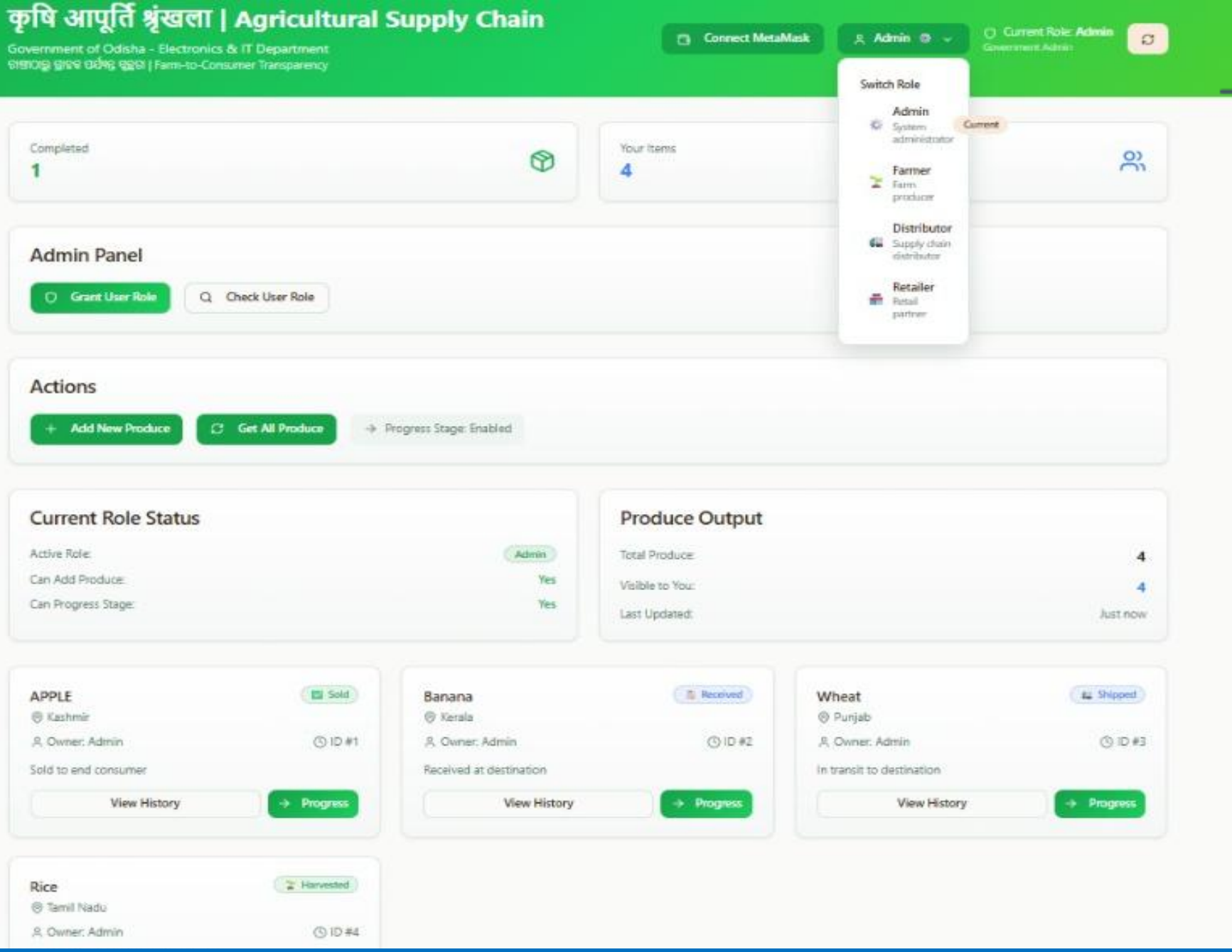
web3.js / ethers.js
JS libraries to read data, call functions, send transactions

Remix IDE
Browser IDE to write, compile, test, debug, and deploy Solidity

MetaMask
Self-custodial wallet and injected provider for accounts

Deploy to Ethereum/Polygon EVM networks for deployment; Polygon PoS has lower fees

User Accounts & Signatures



Tech Stack Flow

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- React + Next.js
- TypeScript
- Tailwind CSS
- shadcn/ui
- lucide-react
- MetaMask
- useToast

Feasibility

✓ **High Readiness**: 96% mobile coverage + 64% smartphone ownership
✓ **Policy Support**: Samrudhi, Ama Krushi, Farmer ID provide foundation
✓ **Economic Viable**: 5-10% price gain outweighs system costs
✓ **Clear Adoption Path**: Start with FPO pilots, integrate existing platforms

Challenges

- High gas fees during peak usage.
- Data privacy concerns.
- Tech literacy of farmers.

Strategies

- Layer-2 solutions (Polygon) for cost efficiency.
- Off-chain storage of sensitive data with hashed references on-chain.
- Intuitive UI design for non-tech-savvy users.

Impact & Benefits

Stakeholder Gains:
Farmers: Better prices, instant payments
Supply Chain: Trusted records, compliance ease
Consumers: Food transparency, safety assurance
Key Advantages:
Economic: 5-10% income boost, export growth
Social: Farmer empowerment, rural inclusion
Environmental: Reduced waste, sustainable practices

Research and Referance work:

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Research Papers:

1.Blockchain Technology to Support Agri-Food Supply Chains: A Comprehensive Review-IEEE ACCESS

2. Blockchain-driven Agricultural Product Traceability and Supply Chain Management-IEEE ACCESS

GIT repos references:

https://github.com/kerala-blockchain-academy/AgroChain

https://github.com/anotherwebguy/Agri-SupplyChain

https://github.com/ac12644/Supply-Chain-Smart-Contract