



Blockchain-Based Supply Chain Transparency for Agricultural Produce



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

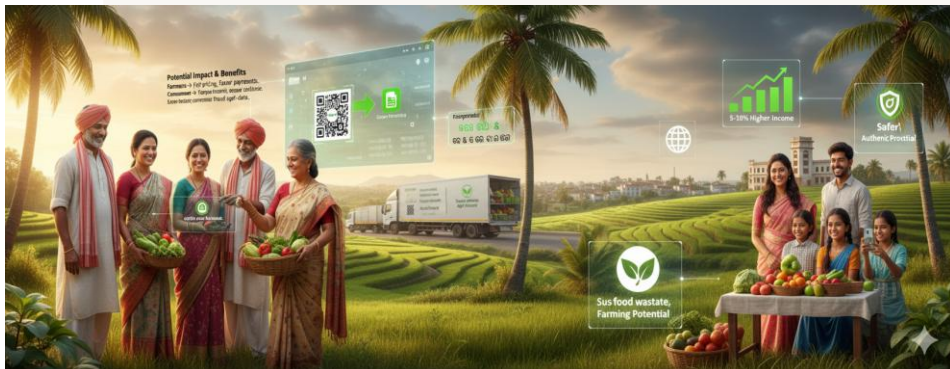
Create a blockchain-based system to track agricultural produce from farm to consumer, ensuring transparency in pricing, quality, and origin. The solution should allow stakeholders (farmers, distributors, retailers) to verify transactions and reduce exploitation in the supply chain.

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.

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 cost 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.

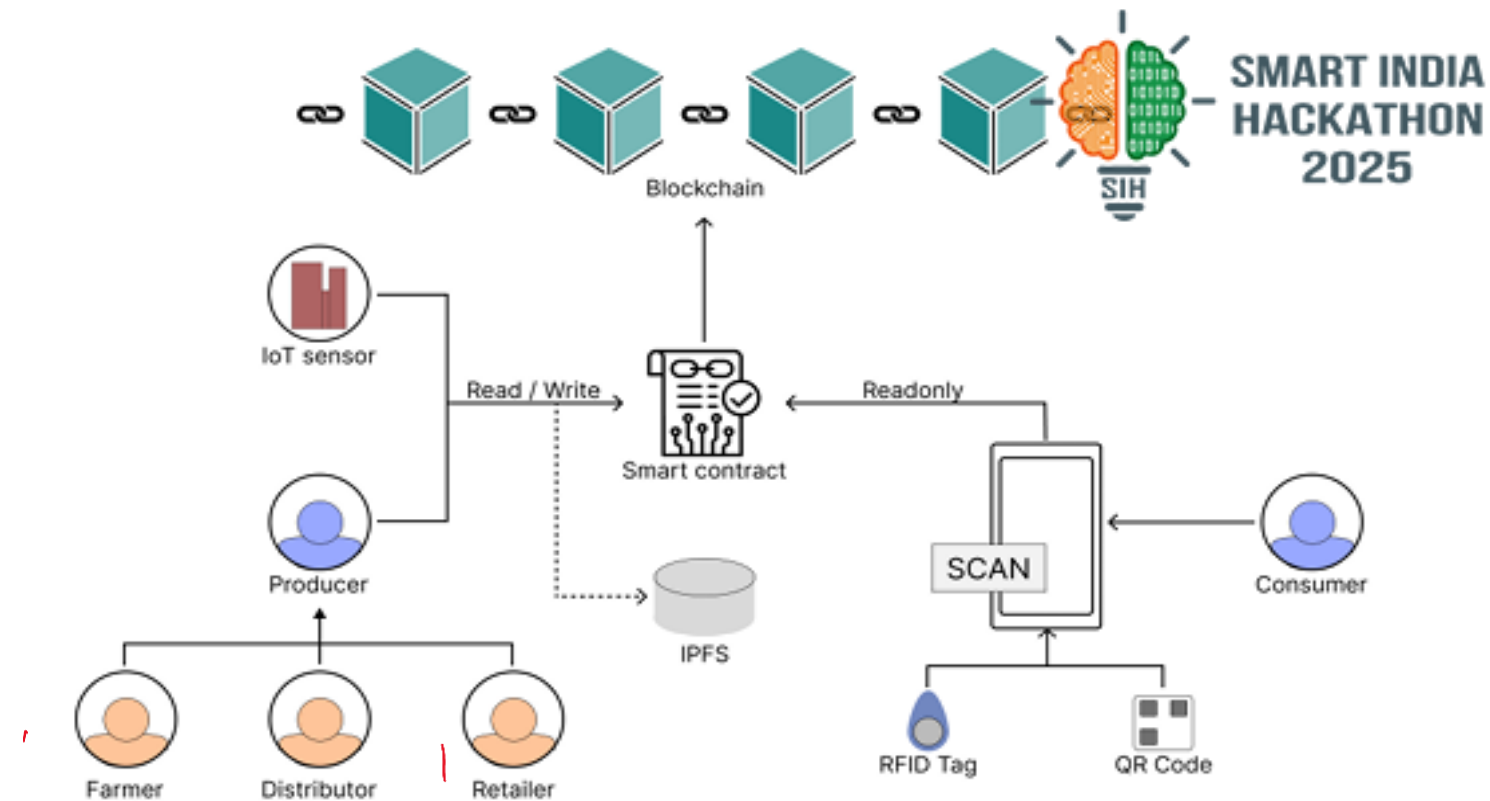


FIGURE 1. An architecture with all the components presented in different works.

DEPLOY & RUN TRANSACTIONS

Deployed Contracts 1

AGRISUPPLYCHAIN AT 0X70D...

Balance: 0 ETH

ADDPRODUCE

_name: APPLE

_origin: KASHMIR

Calldata Parameters transact

GRANTROLE

roleName: FARMER_ROLE

account: 0x7b9abb22159d7c0012d1694ad94

Calldata Parameters transact

PROGRESSSTAGE

_confirm: YES

Calldata Parameters transact

DEPLOY & RUN TRANSACTIONS

GETPRODUCE

_id: 1

Calldata Parameters call

0: tuple(string,string,uint8,address,string[]): APPLE,KASHMIR,1,0x5B38Da6a701c568545dCfcB03FcB875f56beddC4,Harvested by Farmer,Packaged by Farmer

getProduceCo...

getProduceOut... uint256 _id

GETSTAGENAME

stageIndex: 0

Calldata Parameters call

0: string: Harvested

HASROLE

roleName: FARMER_ROLE

account: 0x7b9abb22159d7c0012d1694ad94



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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

Switch Role

- Admin**
System administrator
- Farmer**
Farm producer
- Distributor**
Supply chain distributor
- Retailer**
Retail partner

Completed
1



Your Items
4



Admin Panel

Grant User Role

Check User Role

Actions

Add New Produce

Get All Produce

Progress Stage: Enabled

Current Role Status

Active Role: Admin
 Can Add Produce: Yes
 Can Progress Stage: Yes

Produce Output

Total Produce: 4
 Visible to You: 4
 Last Updated: Just now

APPLE

Kashmir
 Owner: Admin
 ID #1
 Sold to end consumer

View History

Progress

Banana

Kerala
 Owner: Admin
 ID #2
 Received at destination

View History

Progress

Wheat

Punjab
 Owner: Admin
 ID #3
 In transit to destination

View History

Progress

Rice

Tamil Nadu
 Owner: Admin
 ID #4
 Harvested

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:

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>