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School: .... Campus: ....

Academic Year: .... Subject Name: .... Subject Code: ....

Semester: .... Program: .... Branch: .... Specialization: ....

Date: ....

Applied and Action Learning

(Learning by Doing and Discovery)

Name of the Experiement : Build a Use Case - Tokenized Supply Chain Prototype

Objective/Aim:

Create a simple prototype that tokenizes physical product batches as unique tokens (NFTs) to enable immutable tracking, ownership transfer, and status updates across supply-chain participants (Farmer → Distributor → Retailer → Consumer). Demonstrate minting, metadata storage (IPFS), transfers, and an on-chain status history.

Apparatus/Software Used:

1. Solidity (Smart contract language)
2. Hardhat (development & testing) or Remix for quick tests
3. OpenZeppelin contracts (ERC-721)
4. Ganache / Hardhat node (local blockchain)
5. MetaMask (wallet testing)

Theory/Concept:

Tokenization maps a real-world product or batch to a unique on-chain token (NFT). Token metadata holds product details and an IPFS URI for richer data (certificates, photos). Smart contracts record transfers and status updates; combined with QR codes, consumers can verify history and provenance.

Benefits: immutable audit trail, secure ownership transfer, automated checks with smart contracts, tamper- evident product history.

Procedure:

Prepare environment: -

1. **Install Node.js, Hardhat, OpenZeppelin.**
2. **Start local blockchain: npx hardhat node or Ganache.**

Create contract

3.Copy the above Tokenized Supply Chain.sol into contracts/.

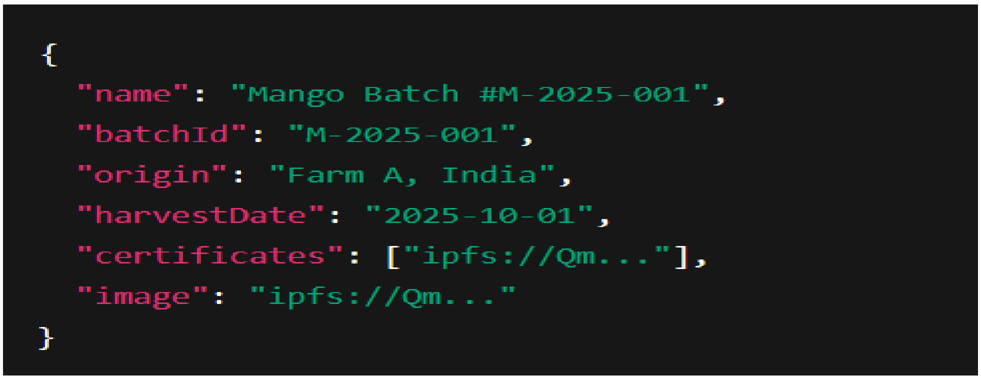
Compile & Deploy

4.Use Hardhat or Remix to compile.

5.Deploy to local node. Save contract address & ABI.

Prepare product metadata

6.Create JSON metadata:



```
{
  "name": "Mango Batch #M-2025-001",
  "batchId": "M-2025-001",
  "origin": "Farm A, India",
  "harvestDate": "2025-10-01",
  "certificates": ["ipfs://Qm..."],
  "image": "ipfs://Qm..."
}
```

7.Upload JSON to IPFS/Pinata → get ipfs://Qm... URI.

Mint token

8. **Owner (manufacturer) calls mintProduct(to, batchId, ipfsURI, Stage.Manufactured, "Harvested & Packed").**
9. **Note returned tokenId.**

Simulate supply chain actions

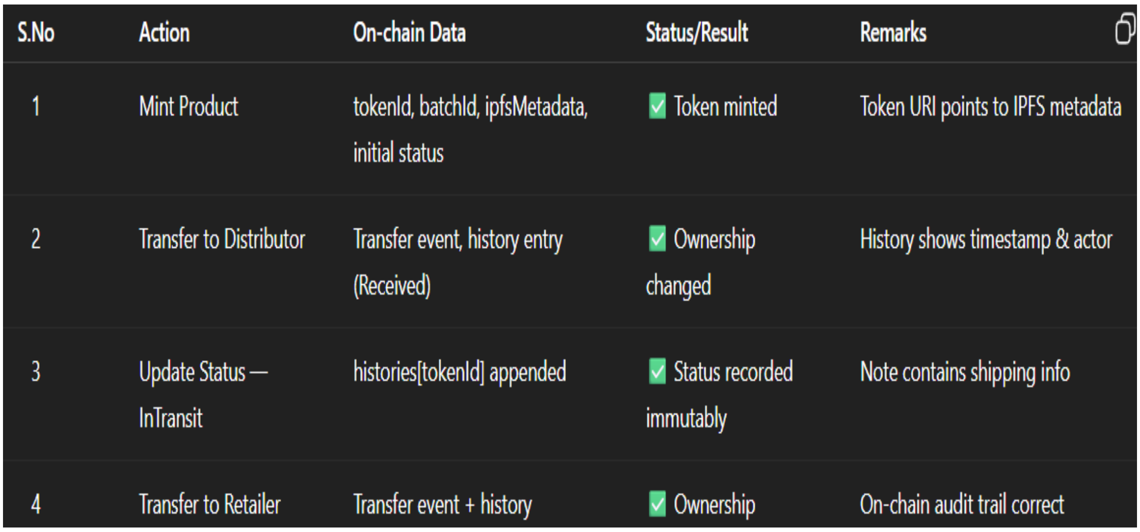
10.Distributor receives token (owner transfers token or transferFrom).

11.Call updateStatus(tokenId, Stage.InTransit, "Shipped via Truck").

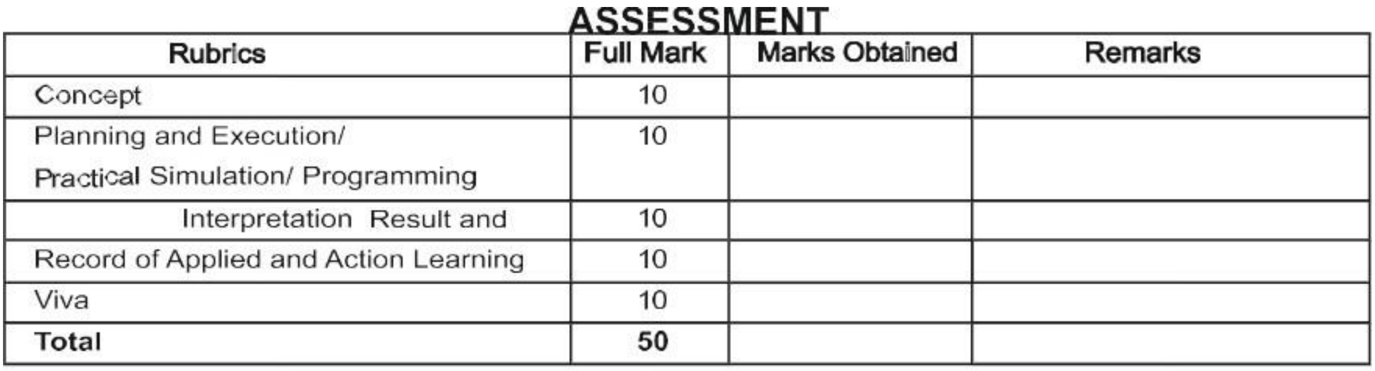
12.Retailer receives and sets updateStatus(tokenId, Stage.ForSale, "Arrived at Warehouse").

13.Optionally, consumer purchase triggers transferFrom to buyer.

Observation Table:



S.No	Action	On-chain Data	Status/Result	Remarks
1	Mint Product	tokenId, batchId, ipfsMetadata, initial status	✅ Token minted	Token URI points to IPFS metadata
2	Transfer to Distributor	Transfer event, history entry (Received)	✅ Ownership changed	History shows timestamp & actor
3	Update Status — InTransit	histories[tokenId] appended	✅ Status recorded immutably	Note contains shipping info
4	Transfer to Retailer	Transfer event + history	✅ Ownership	On-chain audit trail correct



ASSESSMENT

Rubrics	Full Mark	Marks Obtained	Remarks
Concept	10		
Planning and Execution/ Practical Simulation/ Programming	10		
Interpretation Result and	10		
Record of Applied and Action Learning	10		
Viva	10		
Total	**50**		

Signature of the Student:

Name :

Regn. No.

Signature of the Faculty: