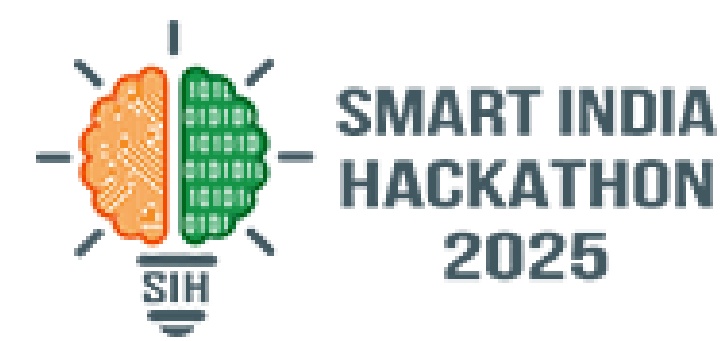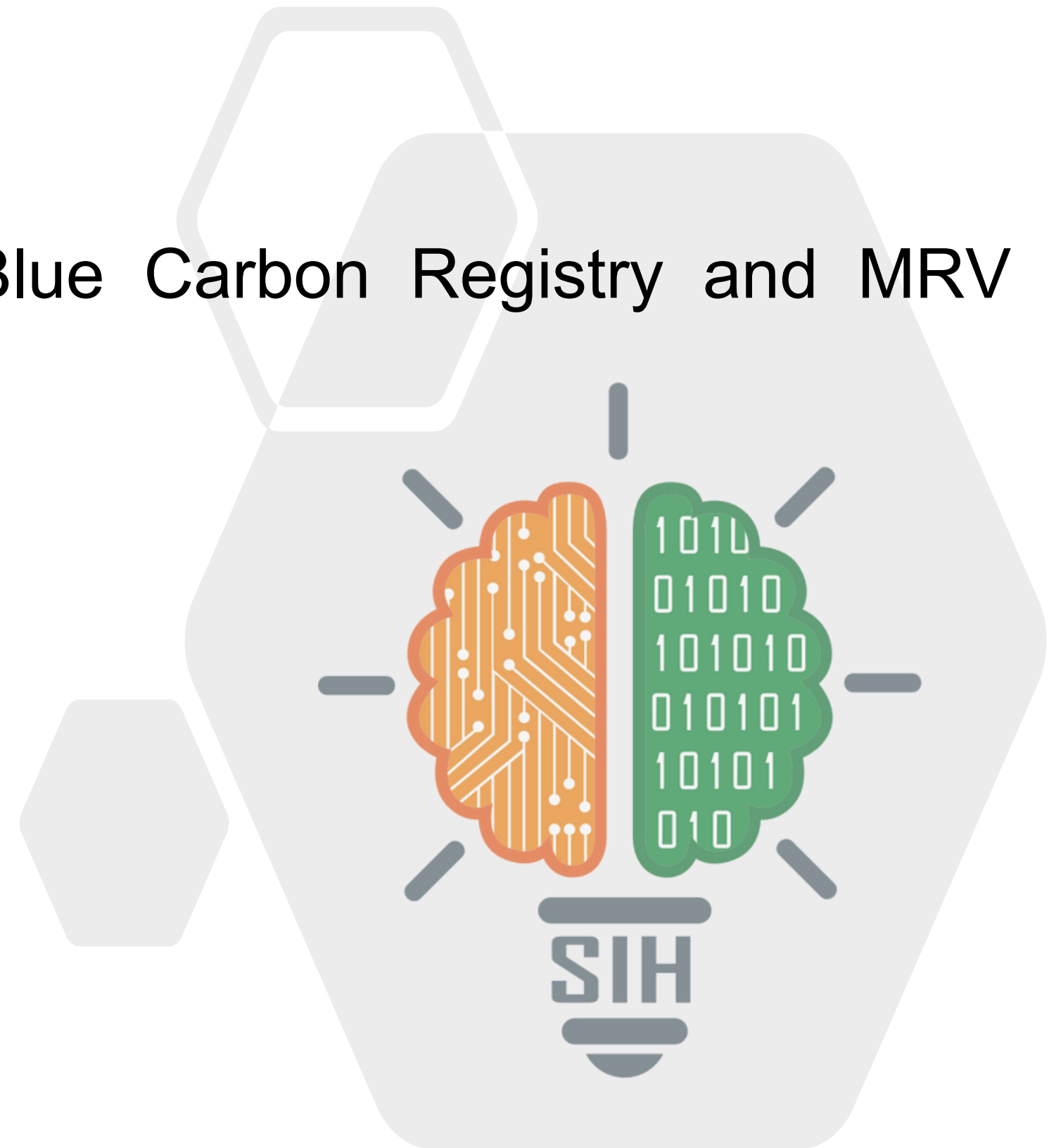# SMART INDIA HACKATHON 2025

- **Problem Statement ID –** SIH25038

- **Problem Statement Title-** Blockchain-Based Blue Carbon Registry and MRV System

- **Theme-** Clean & Green Technology

- **PS Category-** Software

- **Team ID-** 55372

- **Team Name-** HASH_FOREST

Mangrova-A Decentralized MRV System for Blue-Carbon Project

MANGROVA: A Blockchain-based MRV system that leverages **satellite**, **drone**, and **IoT** data for tamper-proof carbon monitoring. Verified credits are tokenized into Carbon Credits (CC) with dual-token economics enabling transparent trading and automated stakeholder payouts.

Decentralized MRV ➜ Blockchain-integrated Monitoring using satellite imagery, drone feeds, and IoT sensors for real-time, tamper-proof project validation.

Tokenized Carbon Credits ➜ Carbon Coin (CC) tokens minted on blockchain registry, ensuring transparent verification and trading of carbon offsets.
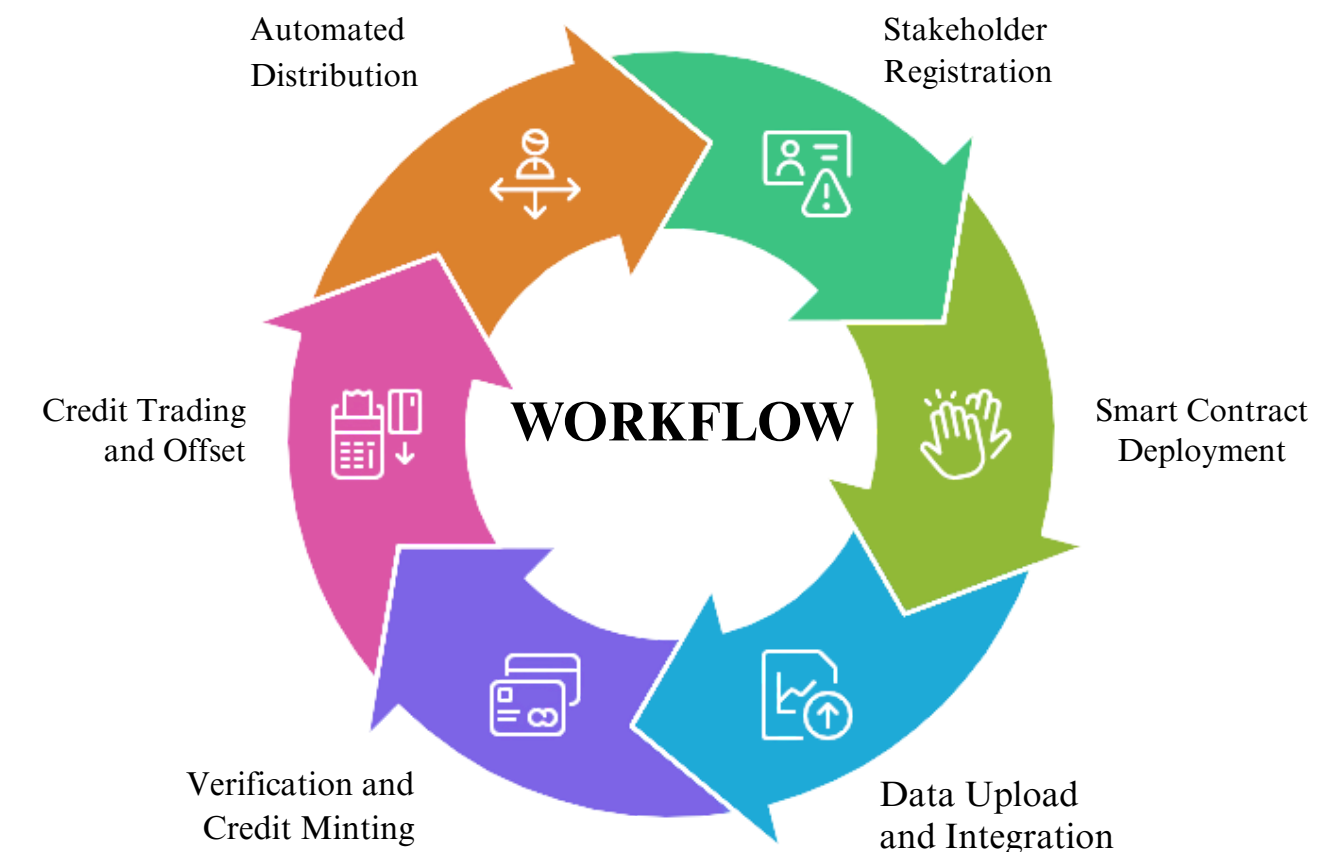
Dual-Token Economic Model ➜ **Carbon Coin** represents verified carbon credits.
Forest Coin represents stakeholder equity, enabling automated revenue distribution via **smart contracts**.

Immutable Audit Trail ➜ Blockchain ledger ensures traceability, prevents double-counting, and guarantees data integrity.

Inclusive Market Access ➜ Aggregation of small projects into blockchain ecosystem, enabling **NGOs**, **communities**, and **panchayats** to tokenize restoration efforts and access **global carbon finance**.
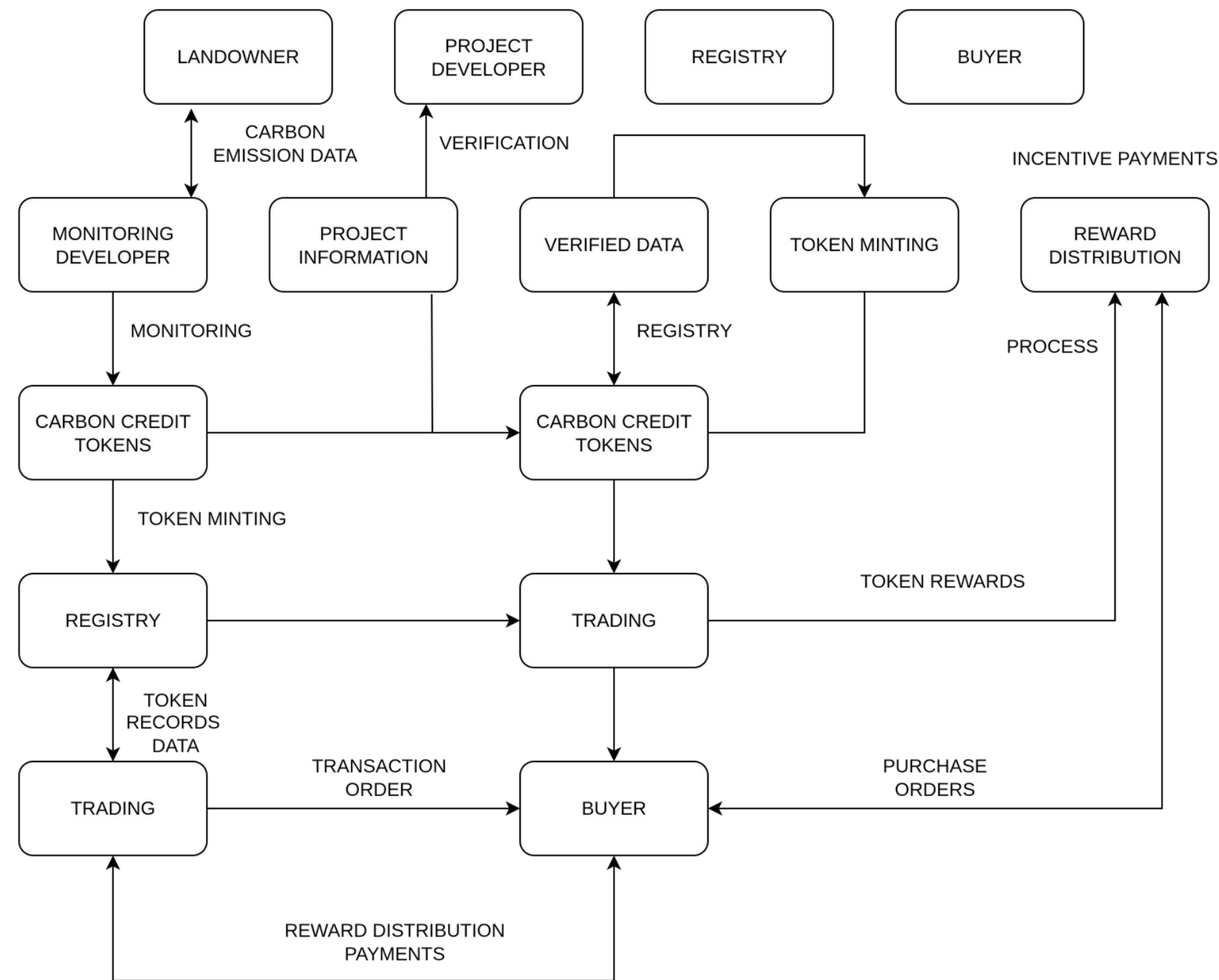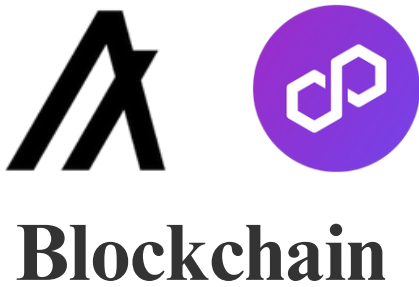
Blockchain-Based MRV System Cycle

Automated Distribution

Stakeholder Registration

Credit Trading and Offset

WORKFLOW

Smart Contract Deployment

Verification and Credit Minting

Data Upload and Integration

Mangrova-A Decentralized MRV System for Blue-Carbon Project

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PROCESS FLOW

LANDOWNER

PROJECT DEVELOPER

REGISTRY

BUYER

CARBON EMISSION DATA

VERIFICATION

INCENTIVE PAYMENTS

MONITORING DEVELOPER

PROJECT INFORMATION

VERIFIED DATA

TOKEN MINTING

REWARD DISTRIBUTION

MONITORING

REGISTRY

PROCESS

CARBON CREDIT TOKENS

CARBON CREDIT TOKENS

TOKEN MINTING

TOKEN REWARDS

REGISTRY

TRADING

TOKEN RECORDS DATA

TRADING

TRANSACTION ORDER

BUYER

PURCHASE ORDERS

REWARD DISTRIBUTION PAYMENTS

TECH STACK

Blockchain

Smart contracts

PyTeal

Frontend

Backend

node JS + Express

Storage

IPFS

mongoDB

MRV Data Processing

Wallet Integration

Cloud Infrastructure

aws

Mangrova-A Decentralized MRV System for Blue-Carbon Project

FEASIBILITY STUDY

Mature Blockchain Protocols
(**Polygon** and **Algorand** support **smart contracts** and **tokenization** efficiently)

Established MRV Data Technologies
(**Satellite**, **drone**, and **IoT** monitoring integrated with **blockchain** for automated, **real-time verification** of carbon projects)

Growing Carbon Market & Community Demand
(**Decentralized** system meet the demand of **underserved communities**, **smallholders**, and **NGOs** for transparent, inclusive climate finance mechanisms)

VIABILITY STUDY

Technical Viability
01
Blockchain combined with **satellite**, **drone**, **IoT** data enable tamper-proof, scalable MRV.

Economic Viability
02
Automated **tokenization** and incentive distribution through **smart contracts** lower overheads.

Operational Viability
03
Community-driven aggregation approaches **reduce** entry barriers for **smallholders** and **local groups**.
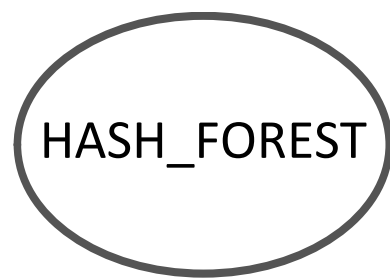
Impacts & Benefits of Our Solution:

Transparency & Trust: Blockchain ensures full traceability, preventing fraud and double counting.

Efficiency & Empowerment: Smart contracts cut costs, automate processes, and ensure fair revenue sharing.

Inclusivity & Scale: Opens global carbon markets to smallholders, NGOs, and communities with real-time monitoring.

Challenges & Strategic Approach:

Data Accuracy: Inconsistent MRV data → AI validation, anomaly detection, community checks.
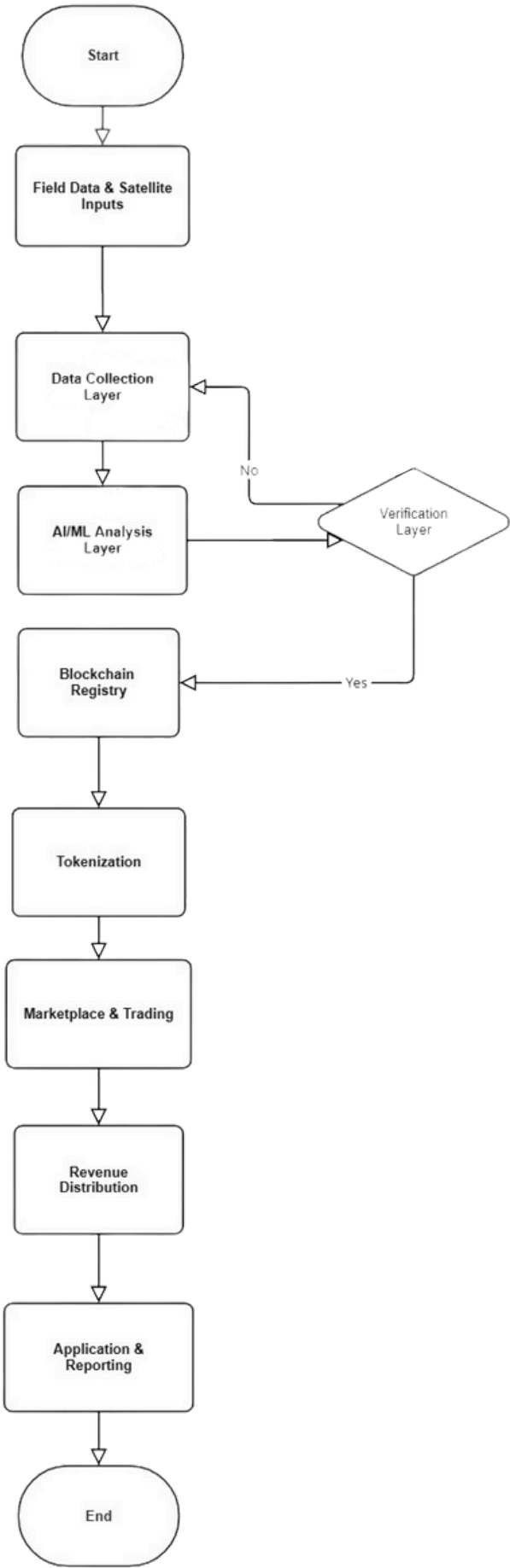
Regulatory Risks: Evolving compliance → Early regulator engagement, flexible system design.

Accessibility: Low digital literacy → Simple multilingual apps, training, offline capture.

Integration: Registry interoperability → Open APIs, global standards, partnerships.

Scalability & Cost: High infra costs → Low-cost blockchains, batching, optimized sensors.

FLOWCHART

Start
↓
Field Data & Satellite Inputs
↓
Data Collection Layer
↓
AI/ML Analysis Layer
↓
Verification Layer (No → Data Collection Layer; Yes → Blockchain Registry)
↓
Blockchain Registry
↓
Tokenization
↓
Marketplace & Trading
↓
Revenue Distribution
↓
Application & Reporting
↓
End

HASH_FOREST

Mangrova-A Decentralized MRV System for Blue-Carbon Project

SMART INDIA HACKATHON 2025

Scan to explore our complete research, technical specs and pilot data for Mangrova.Access detailed documentation, architecture diagrams, and source files directly from your device.

Direct Link

Impact Metrics

- Forest monitoring coverage: 5 lakh hectares.
- Carbon credits issued: 2,50,000 tons CO_2e.
- Community stakeholders onboarded:120 villages and 15 NGOs.

Impact Stories/Events

- 2024 pilot – Rajasthan: 5 villages received direct carbon revenue.
- Smart contracts auto-distributed 10,000+ credits for verified restoration after monsoon floods.

As India faces extreme weather in 2025, digital MRV brings real-time visibility and incentives to climate stewards through blockchain.