SMART INDIA HACKATHON 2025

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- **Problem Statement ID – SIH25038**
- **Problem Statement Title- Blockchain-Based Blue Carbon Registry and MRV System**
- **Theme- Clean & Green Technology**
- **PS Category- Software**
- **Team ID-**
- **Team Name - Matrix-Sutra**

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IDEA TITLE

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PROBLEM STATEMENT

India’s vital blue carbon ecosystems—mangroves, seagrasses, and salt marshes—are rapidly degrading due to human activities, threatening their ability to sequester carbon and protect coastlines. Despite their importance, there is no transparent, decentralized system to monitor restoration efforts, verify carbon sequestration, and issue credible carbon credits. This lack hampers climate goals and limits funding for conservation. The challenge is to develop a trusted, tamper-proof platform that ensures accurate restoration data, tokenizes carbon credits, and enables fair, transparent trading and community participation.

Proposed Solution

- Uses blockchain to immutably store verified restoration data, ensuring trust and tamper-proof records among stakeholders.
- Employs smart contracts to tokenize carbon credits, automating issuance, preventing double counting, and enabling transparent credit tracking and trading.
- Integrates mobile app inputs with drone and satellite data to create a comprehensive, verifiable dataset enhancing monitoring accuracy and stakeholder participation.
- Features a decentralized ledger for transparent data storage and smart contract-based tokenization to reduce fraud.
- Utilizes a hybrid AI-human validation system to improve accuracy and scalability of data verification.
- Provides an inclusive platform allowing direct participation of NGOs, communities, and panchayats.
- Represents a first-of-its-kind digital ecosystem tailored for India’s blue carbon restoration needs.

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TECHNICAL APPROACH

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Blockchain Layer :

- Polygon PoS or Avalanche network
- Solidity smart contracts (ERC-1155)
- IPFS for off-chain storage
- Wallets: MetaMask, WalletConnect

Backend :

- Django (Python) with built-in authentication
- Database: SQLite3 (db.sqlite3) as default Django database
- Blockchain interaction via web3.py or Ethers.js
- REST APIs for communication
- Optional Python microservices for image/ML processing

Frontend :

- React.js for admin interface
- GIS & visualization: Mapbox, Leaflet.js, Chart.js, D3.js

Deployment :

- CI/CD: GitHub Actions
- Cloud hosting: AWS/Azure

IPFS nodes : Pinata or Web3.Storage

Scientific Standards:
Align with global protocols (IPCC, Verra VM0033, Gold Standar) for credile blue carbon crediting.

MRV Methodology:
Combine field data, drone/satellite imagery, and AI validation with blockchain for secure, transparent reporting.

Credit Issuance:
Calculate net carbon capture after adjustments; issue traceable Carbon Credit Tokens via smart contracts.

Digital System Design:
Use decentralized data submission, AI-powered anomaly detection, tokenization frameworks (ERC-20/ERC-1155).

Governance & Ecosystem:
Administered by NCCR/MoEFCC, involving NGOs, communities, universities; tradable credits on regulated exchanges.

FEASIBILITY AND VIABILITY

Feasibility :

- Uses proven blockchain and AI technologies; aligns with India's climate goals; scalable with cloud and IPFS.

Challenges :

- Data quality and fraud risks, technical integration complexity, user adoption barriers, regulatory compliance, scalability limits with SQLite.

Mitigation Strategies :

- Hybrid AI-human validation for data accuracy; modular architecture; training for stakeholders; close regulatory coordination; plan scalable DB migration and cloud scaling.

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IMPACT AND BENEFITS

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Potential Impact on Target Audience :

- Empowers local communities, NGOs, and panchayats with transparent blue carbon restoration participation.
- Builds trust with verified restoration data for carbon credit buyers and investors.
- Supports India’s climate goals by strengthening coastal ecosystem resilience and carbon capture.

Benefits of the Solution :

- Social: Creates jobs, boosts community involvement, and enhances coastal protection.
- Economic: Generates revenue via verified carbon credits, attracting investment and eco-tourism.
- Environmental: Conserves mangroves, seagrasses, and salt marshes, enhancing carbon sequestration and biodiversity.

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RESEARCH AND REFERENCES

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FLOWCHART OF OUR PROJECT

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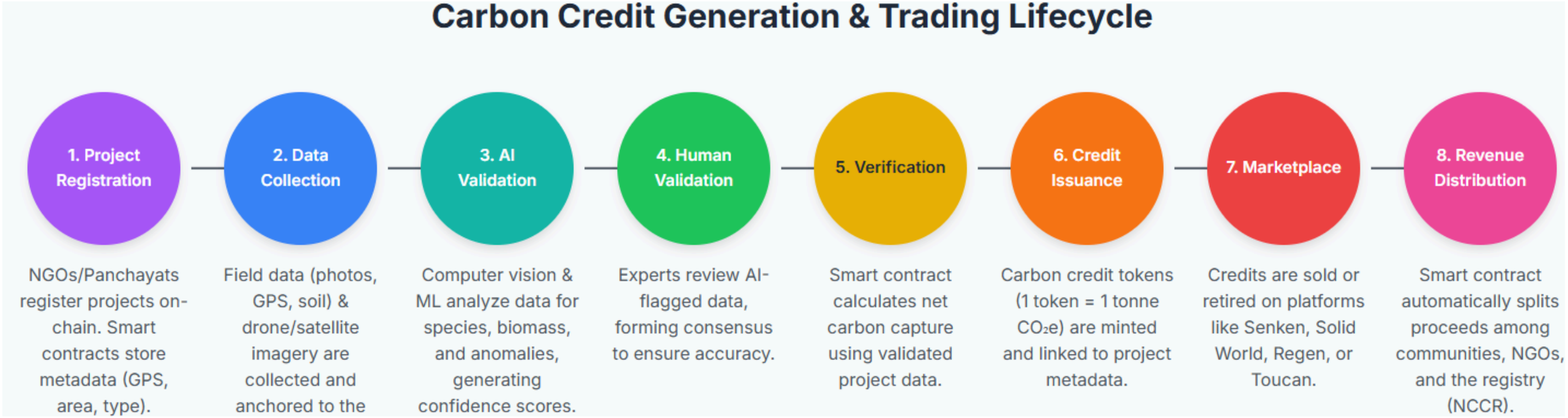

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