24CYS333 Internet of Things

Lab 1: Fine-Tuning Project Topic, Hardware Resource Mapping, and Literature Survey

Team Number: IoT#4

Project Title:

Empowering Volunteerism with Blockchain and IoT: NFT Rewards for NGO Campaigns.

1. Fine-Tune Project Topic

"Addressing Transparency and Real-Time Participation Challenges in Volunteer-Driven NGO Campaigns with IoT and Blockchain"

The management of volunteer-driven NGO campaigns faces significant challenges in ensuring transparency, accountability, and engagement.

- Volunteers often lack a streamlined and secure system to log their contributions in real-time, leading to inefficiencies in tracking and rewarding their efforts.
- NGOs struggle with maintaining accurate data on participation and impact, especially in remote or resource-limited areas where connectivity and manual tracking methods are unreliable.

The current absence of IoT integration in these systems limits the ability to collect, process, and verify data in real-time. Issues such as connectivity in **remote locations**, **lack of secure participation logging**, and **delayed impact measurement** hinder the scalability and efficiency of such campaigns.

Blockchain, powered by **Hyperledger Besu, Ethereum** and **Solidity-based smart contracts**, will securely store this data and facilitate token-based rewards for volunteers. These tokens can be redeemed for SHG products, creating an incentivized and seamless connection between volunteers, NGOs, and SHGs.

2. Hardware Resource Mapping

Hardware Component	Function	Reason for Use
Raspberry Pi 4 Model B	Acts as the central processing unit for IoT and Blockchain integration.	High computational power to handle data processing and smart contract interactions.
ESP32 Board	Captures and transmits sensor data to the central system.	Cost-effective microcontroller with Wi-Fi and Bluetooth capabilities for IoT integration.
GSM Module (SIM800L)	Provides network connectivity in remote areas.	Ensures real-time data transmission where Wi-Fi is unavailable.
DHT11/DHT22	Measures environmental conditions like temperature and humidity.	Provides relevant on-ground environmental data for campaign monitoring.
GPS Module (NEO-6M)	Tracks the geographical location of volunteers and events.	Enables accurate location tracking for real-time participation verification.

3. Literature Survey

Research Paper:

NFT-IoT Pharma Chain: IoT Drug Traceability System Based on Blockchain and Non-Fungible Tokens (NFTs)
Source: Journal of King Saud University – Computer and Information Sciences 35 (2023)

Existing Solutions:

Current systems addressing transparency, traceability, and incentivization in volunteer and supply-chain management include:

- **Blockchain-Based Systems:** Implemented for traceability and data integrity in healthcare supply chains. Examples include MediLedger and Hyperledger Fabric, but these systems are predominantly transaction-centric and lack volunteer-driven campaign models.
- **IoT-Enhanced Models**: Utilized for environmental tracking in supply chains, yet limited in decentralized real-time updates and scaling to low-resource volunteer networks.
- **NFT-Enabled Traceability**: NFTs are employed for uniquely identifying assets, as seen in pharmaceutical supply chains, but their potential for volunteer recognition and rewards remains unexplored.

Research Gaps:

1. **Community-Centric Rewards:** Limited focus on recognition-based rewards like NFTs for incentivizing volunteerism.
2. **Unified Ecosystem**: Absence of an integrated platform connecting volunteers, NGOs, and SHGs to streamline efforts and amplify grassroots impacts.
3. **Real-Time Data Logging:** Existing models inadequately incorporate IoT for transparent and immediate activity tracking, critical for decision-making in remote areas.

Relevance of Proposed Work:

1. **Encouraging Volunteer Engagement:** By integrating NFT rewards, the project provides recognition that extends beyond monetary incentives, motivating sustained volunteer participation.
2. **Empowering Grassroots Communities:** The redemption of blockchain-secured tokens for SHG products supports local economies and builds a direct connection between stakeholders.
3. **Enhancing Transparency and Trust:** Blockchain ensures immutable logs of volunteer efforts and NGO resource use, fostering trust among participants.
4. **Real-Time Activity Monitoring:** IoT integration enables real-time tracking of volunteer activities, increasing efficiency in campaign management.