**Blockchain-Based Supply Chain System for Product Traceability**

**Paper Draft**

**Title**

Blockchain-Based Supply Chain System for Fresh Produce Traceability Using QR Code Technology

**Abstract**

The lack of transparency and traceability in agricultural supply chains presents a significant challenge to both farmers and consumers. This project proposes a blockchain-based system that ensures transparent product traceability from the point of collection to the consumer. The system leverages blockchain technology to store verified product information, making it accessible to all stakeholders through QR code scanning. This solution aims to promote trust, reduce disputes, and ensure fair pricing for farmers while offering consumers the ability to verify the origin and quality of products.

**Introduction**

Agricultural supply chains, particularly in developing regions like Kenya, suffer from a lack of transparency in product sourcing. Farmers often face unfair pricing, while consumers are unable to verify the origin or quality of their purchases. This creates trust issues, limits market competitiveness, and reduces overall supply chain efficiency. This project proposes the development of a **Blockchain-Based Supply Chain System** to address these issues by providing **immutable, transparent, and accessible records** of fresh produce through **QR code technology**.

**Problem Statement**

The primary challenge in the agricultural supply chain is the **lack of traceability of products**, which results in:

* Unfair pricing for small-scale farmers
* Inconsistent quality checks
* Disputes between farmers and manufacturers due to packaging differences
* Limited consumer trust in product origin
* Difficulty in verifying product authenticity

**Objectives**

1. To develop a **blockchain-based supply chain system** that enhances transparency.
2. To implement **QR code-based traceability** for consumers to verify product origins.
3. To ensure that all product quality information is **verified and immutable** on the blockchain.
4. To simplify the application by focusing on blockchain as the core technology.
5. To provide a **minimal AI module** that summarizes product information.

**Methodology**

The project will follow a structured approach to design, develop, and test the supply chain system:

1. **Requirements Analysis:** Gather system requirements from stakeholders.
2. **System Design:** Develop architecture diagrams and smart contract structures.
3. **Blockchain Implementation:** Use Ethereum to create immutable transaction records.
4. **Web & Mobile Application Development:** Build interfaces for data entry and QR code generation.
5. **QR Code Integration:** Generate QR codes linked to blockchain data.
6. **Testing and Debugging:** Ensure system functionality and data integrity.
7. **Deployment:** Launch the MVP on cloud infrastructure.

**System Architecture**

The system consists of the following components:

* **Blockchain Network:** Stores product data and transaction history.
* **Web and Mobile Application:** Provides interfaces for data input and QR code scanning.
* **QR Code Generator:** Links product batches to blockchain data.
* **AI Summary Module:** Generates brief product descriptions for consumer transparency.

**Expected Outcome**

The system will:

* Provide **transparent produce traceability**.
* Enable consumers to verify product origins via **QR code scanning**.
* Reduce disputes between farmers and manufacturers.
* Ensure **fair pricing models** by increasing trust.
* Improve supply chain efficiency.

**Challenges**

* Network latency in blockchain transactions
* Adoption by farmers and collection agencies
* Initial implementation costs
* Data security and privacy concerns

**Conclusion**

The proposed blockchain-based system addresses the critical issue of product traceability in agricultural supply chains. By combining **immutable blockchain records** and **QR code traceability**, the system enhances transparency, builds trust, and promotes fair pricing. The project provides a scalable solution that can improve the efficiency and reliability of supply chains in Kenya and similar regions.

**References**

* Ethereum Documentation
* Blockchain Traceability in Agriculture Research Papers
* QR Code Technology in Supply Chain Systems
* Agricultural Supply Chain Challenges in Kenya Reports