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**MINI PROJECT SYNOPSIS**

**Name of Guide: Dr. Sagargouda Patil Batch No:**

**Date of Submission: Subject Code:**

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| **Project Title:** | Blockchain-Based Supply Chain Transparency for Agricultural Produce |
| **Project Execution Place (Inhouse /Industry (Details of The Industry and External Guide (Name, Designation, Mail-Id, Contact No, Acceptance Letter to be enclosed ))** | Inhouse |
| **Project Category/Area( Research, Environmental and Societal, Product development , Industrial Live Project, Application Project, Case Study)** | Environmental and Societal  Product Development |
| **Mapping the mini project to mentioned SDG goals**  **1. No poverty**  **2. Zero hunger**  **3. Good health and well-being**  **4. Quality Education**  **5. Gender equality**  **6. Clean water and sanitation**  **7. Affordable and clean energy**  **8. Decent work and economic growth**  **9. Industry, innovation and infrastructure**  **10. Reduced inequalities**  **11. Sustainable cities and economies**  **12. Responsible consumption and production**  **13. Climate action**  **14. Life below water**  **15. Life on land**  **16. Peace, justice and strong institutions**  **17. Partnership for the goals** | 1. No poverty 2. Zero Hunger   8. Decent work and economic growth  9. Industry, innovation and infrastructure  12. Responsible consumption and production  16. Peace, justice and strong institutions |
| **Impact Areas:**   1. **Societal Impact** 2. **Economic Consideration** 3. **Environmental Context** 4. **Health & Safety** 5. **Legal & Ethical Framework** 6. **Cultural Relevance** | 1. Societal Impact 2. Economic Consideration 3. Legal & Ethical Framework |

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| **[Instructions:**  **Body :**Font : Times New Roman, Font Size : 12, Spacing 1.5 Lines  **Abbreviations :** Expanded for the first use  **( 1 paragraph not more than 300 words)**  **Heading/Titles :**Font : Times New Roman ,Font Size : 14 (Bold)  **Body :** Font : Times New Roman ,Font Size : 12,Spacing 1.5 Lines.  **Figures & Equations :** Captioned and Numbered.  **Abbreviations :** Expanded for the first use]  **Abstract**  This project proposes a blockchain-based system to track agricultural produce from farm to consumer, aiming to ensure transparency in pricing, quality, and origin. By leveraging decentralized ledger technology, the platform allows farmers, distributors, and retailers to securely record and verify each transaction, reducing fraud and exploitation in the supply chain. The solution integrates smart contracts for automated tracking and QR code-based access for consumers, enabling them to trace produce in real time. Designed with a user-friendly interface and deployable on low-cost hardware or cloud infrastructure, this system promotes fair pricing, accountability and trust across the agricultural ecosystem.  **Introduction**  Blockchain is an emerging technology that provides a decentralized, secure, and tamper-proof way of recording transactions. Unlike traditional centralized systems, blockchain operates on a distributed ledger where every transaction is verified by multiple participants, ensuring transparency and trust. Each record, stored in a block and linked to the previous one, makes the system resistant to tampering or fraud. Beyond finance, blockchain has found applications in diverse sectors, including healthcare, logistics, and especially agriculture. In the agricultural supply chain, blockchain can ensure that every step—from the farmer to the consumer—is recorded and verified, enabling greater transparency, fair pricing and accountability.  **Existing System – Literature Survey**  **Problem Statement**  Agriculture forms the primary livelihood for nearly 58% of India’s population and contributes significantly to the nation’s GDP. However, the agricultural supply chain continues to suffer from inefficiencies, lack of transparency, and exploitation by intermediaries. Farmers often receive unfair compensation for their produce, while consumers face inflated prices and uncertainty regarding the quality, authenticity, and origin of the products they purchase. Existing centralized systems are vulnerable to manipulation, fraud, and data tampering, offering little accountability or trust among stakeholders. This creates a critical gap between producers and consumers, ultimately weakening the agricultural economy. Therefore, there is a need for a decentralized, blockchain-based solution that ensures end-to-end traceability of agricultural produce, establishes transparency in pricing and quality, and provides all stakeholders— armers, distributors, retailers, and consumers—with a secure and verifiable  platform to conduct transactions fairly and efficiently.  **Objectives**   * **Enhance Traceability:** Implement a system to track agricultural products from farm to consumer, ensuring transparency and enabling quick recalls. * **Prevent Fraud:** Maintain immutable records to protect against falsification of certifications such as organic, fair trade, or pesticide-free. * **Improve Market Access for Farmers:** Provide verified product and compliance data to help smallholders access premium markets. * **Build Consumer Trust:** Enhance buyer confidence in product authenticity and quality. * **Empower Farmers:** Strengthen farmers’ income stability and bargaining power through transparency and prompt payments. * **Support Economic Growth:** Reduce inefficiencies and disputes to boost rural economies   **Proposed System**  The proposed system introduces a blockchain-enabled agricultural supply chain traceability solution integrated with an intelligent callbot interface. Farmers can conveniently provide details about their crops through a voice-based callbot, which converts speech into text and securely records the data on the blockchain. This ensures transparency, immutability, and trust throughout the supply chain. In addition, the callbot provides real-time market insights by retrieving and communicating prevailing crop prices back to the farmer using text-to-speech conversion. Once the interaction is completed, all recorded crop information is transformed into a QR code, which is attached to the harvested product. Retailers, distributors, and consumers can scan this QR code to access detailed traceability information such as crop type, variety, quality, location, fertilizer usage, and harvest period. This system strengthens farmer empowerment, ensures fair pricing, and enhances consumer trust by offering end-to-end visibility across the agricultural value chain.  **Methodology**  The methodology of the proposed system is structured as follows:  1. Farmer Interaction via Callbot – Farmers interact with an AI-powered callbot in their local language to provide crop details such as type, variety, acreage, quantity, quality, location, fertilizer usage, and harvest date.  2. Speech-to-Text Conversion – The callbot employs automatic speech recognition to convert the farmer’s voice input into text for further processing.  3. Blockchain Integration – The captured data is encrypted and stored in a blockchain ledger, ensuring immutability, transparency, and secure data sharing among stakeholders in the supply chain.  4. Real-Time Price Retrieval – The callbot fetches real-time market prices from reliable sources and communicates the information back to the farmer using text-to-speech technology, enabling informed decision-making.  5. QR Code Generation – After the call session, the system generates a QR code containing all recorded crop details. The QR code is then attached to the product packaging.  6. Supply Chain Access – Distributors, retailers, and consumers can scan the QR code to instantly retrieve crop traceability data, including its origin, variety, quality parameters, and harvest timeline.  **System Requirement Specifications**  **Hardware Requirements**   |  |  |  | | --- | --- | --- | | **Component** | **Minimum Specification** | **Justification** | | Development Machine (Laptop/PC) | **Processor:** Intel i5 or equivalent (quad-core) | Required for running IDEs, simulators, and local blockchain environment (e.g., Ganache). | | **RAM:** 8 GB | Necessary for multitasking, running virtual machines, and memory-intensive IDEs like VS Code or Android Studio. | | **Storage:** 256 GB SSD (Solid State Drive) | Faster read/write speeds for efficient compilation and testing. | | QR Code Generation/Printing | Mobile Device or Desktop PC with Printer | Device to generate/display the QR code on the farmer/collection side, and a basic printer for physical labels (if required). | | Blockchain Node/Server | Cloud VM (e.g., AWS/GCP/Azure) | Required for hosting the live smart contracts and the application backend (e.g., the Call Bot service). |   **Software Requirement**   |  |  |  | | --- | --- | --- | | **Category** | **Component / Tool** | **Justification** | | Blockchain Platform | **Ethereum** (Public Testnet/Ganache) **OR Hyperledger Fabric** (Private/Permissioned) | The core technology for establishing a decentralized, immutable ledger and running Smart Contracts. Hyperledger is often preferred for enterprise supply chains. | | Solidity | The programming language required to write and compile the **Smart Contracts**. | | Web3.js/Ethers.js | JavaScript libraries for connecting the frontend (User Interface) and the backend to the Blockchain network. | | Backend / API | Python (Django/Flask) OR Node.js (Express) | Used to build the main application logic, manage the off-chain database, and handle API requests from the mobile/web interface. | | PostgreSQL / MongoDB | Database Management System (DBMS) to store non-critical and frequently changing data, such as user profiles and market price data. | | Call Bot / NLP | Google Dialogflow OR AWS Lex | Cloud-based services for developing the conversational interface (the Farmer Call Bot). | | **Python Libraries** (e.g., NLTK, spaCy) | Used for Natural Language Processing/Understanding (NLP/NLU) if a custom or more complex local bot is developed. | | User Interface (Frontend) | **React / Angular / Vue.js** (for Web) **OR Android Studio / Flutter** (for Mobile App) | Framework for building the farmer/distributor web portal and the consumer mobile application for QR code scanning. | | Development Tools | Visual Studio Code (VS Code) | A lightweight and feature-rich Integrated Development Environment (IDE) suitable for web and blockchain development. | | **Git** and **GitHub/GitLab** | Version control system for collaborative development and managing code changes. |   **Applications of the Project**  The project is designed to deliver a high societal impact and achieve several key outcomes:   * **Farmer Empowerment:** Improves income security and bargaining power by ensuring fair compensation and reducing the role of exploitative intermediaries. * **Consumer Trust:** Provides consumers with real-time, verifiable information on the authenticity, quality, and origin of the agricultural produce. * **Food Safety**: Enhances accountability in the supply chain, which in turn reduces the risks of adulteration and mislabeling. * **Economic Growth:** Contributes to a more equitable and robust rural economy by reducing disputes and inefficiencies in logistics.   **Conclusion**  This project successfully proposes a model for a transparent and accountable agricultural supply chain using blockchain technology. By integrating innovative components like a farmer call bot for secure data capture and leveraging smart contracts for fair pricing, the system effectively addresses the critical issues of farmer exploitation and lack of consumer trust. The implementation of end-to-end traceability via QR codes is expected to modernize the AgriTech sector, empower smallholder farmers, and contribute significantly to global sustainable development goals.  **References : (IEEE format)**  I. Academic Papers (Literature Survey)  These are the full bibliographic citations for the research papers reviewed in the project's literature survey.  Blockchain and Traceability  Ellahi, R. M., Wood, L. C., & Bekhit, A. E.-D. A. (2024). Blockchain-Driven Food Supply Chains: A Systematic Review for Unexplored Opportunities. *Applied Sciences, 14*(19), 8944.  Vignesh, B., Chandrakumar, M., Divya, K., Prahadeeswaran, M., & Vanitha, G. (2025). 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Zanardi, S., & Rossi, M. (2025). From farm to fork: Blockchain’s impact on agri-food distribution. *International Journal of Logistics Management, 36*(4), 789-810.  AI/Voice Bot Integration  Anekar, D., et al. (2023). Farmer's Assistant using AI Voice Bot. *International Journal of Advanced Research in Science, Communication and Technology, 3*(2), 224–230.  Smart Contracts/Fair Trade  Jain, A., & Singh, V. (2025). Smart Contracts Automating Fair Wage Payments in Agriculture. *IEEE Transactions on Computational Social Systems*.  Tsolakis, N., et al. (2024). Modeling the blockchain-enabled traceability in agriculture supply chain. *International Journal of Information Management, 54*, 102142.  II. Technical Standards & Platforms  These references cover the technical components necessary for the project's implementation.  QR Code Standard  ISO/IEC 18004:2015: Information technology — Automatic identification and data capture techniques — QR Code bar code symbology specification. (Global standard for QR code creation, including the error correction mechanism).  Data Encoding  Reed-Solomon Error Correction Algorithm: The fundamental mathematical technique used in QR codes to ensure data integrity despite physical damage or dirt on the label.  Blockchain Platforms  Hyperledger Fabric Documentation: The official documentation and white papers for the permissioned enterprise blockchain framework recommended for governance and privacy.  Solidity Documentation: The official documentation for the contract-oriented, high-level language used for implementing smart contracts on Ethereum and Polygon. |

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