## Final Year Project Proposal

**(Fall 2023)**

1. **Project Title**

Supply chain Application for Pharmaceutics: An Integrated RFID and Blockchain Solution for Enhanced Security and Transparency in the Pharmaceutical Supply Chain"

1. **Names and IDs of Students**

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1. **Project Advisor (Name, Email Address)**

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1. **Nomination of 5 Evaluation Committee members by the advisor (FYP Committee will select two of them)**
2. M Billal
3. Arslan Asif
4. Asad Arshad
5. Ahtsham Ali
6. Muhammad Nabeel
7. **External Collaboration/Funding (if any) + Paid or Unpaid (Confirmed or Expected)**

Expected

1. **Project Description (Brief Introduction)**

**Overview of topic/domain:**

Our project delves into the intricate world of pharmaceuticals and medicine supply, with a primary focus on optimizing the journey your medicines take from production to your hands. In the vast and complex landscape of the pharmaceutical industry, we aim to introduce innovations that enhance transparency, security, and efficiency in the supply chain.

**Description of project/problem:**

Navigating the pharmaceutical sector reveals a set of challenges that demand innovative solutions. From ensuring the pristine quality and authenticity of medicines to tackling issues like theft during transportation and the persistent threat of counterfeit medicines flooding the market, the pharmaceutical industry faces multifaceted challenges. Additionally, responding promptly to safety incidents, such as unintentional use of harmful chemicals leading to adverse effects, is crucial in ensuring consumer well-being.

Our proposed solution involves a multi-pronged approach leveraging cutting-edge technologies. We plan to introduce Radio-Frequency Identification (RFID) tags on each medicine batch, providing a unique identifier akin to a personalized ID card. For temperature-sensitive medicines, we're incorporating sensors to act as vigilant guardians, ensuring that these medicines are maintained under optimal conditions throughout their journey.

To fortify the integrity of the supply chain, we're turning to blockchain technology. This is like a super-secure ledger that chronicles every step of a medicine's journey, rendering the entire process tamper-proof. Additionally, in our battle against fake medicines, each medicine pack will carry a QR code. This code is not just a label; it's a shield against counterfeit medicines. Unique serial numbers, scratchable covers for added security, and a mechanism for users to report scanned codes contribute to a robust defense against unauthorized replication.

**Expected results/product:**

The envisioned outcomes of our project include the establishment of a resilient and secure pharmaceutical supply chain system. By integrating RFID technology, temperature monitoring, blockchain, and QR code authentication, we anticipate real-time tracking, heightened quality control, theft prevention, and enhanced transparency in the pharmaceutical industry. Ultimately, our project strives to redefine the standards of pharmaceutical supply chain management, contributing to increased safety, traceability, and authenticity for the benefit of consumers worldwide.

1. **Major Features/Requirements/Objectives (Tentative)**

**Functional Requirements:**

**1. RFID Integration:**

- Each batch of medicine must be equipped with an RFID tag for unique identification and tracking throughout the supply chain.

**2. Temperature Monitoring:**

- Temperature-sensitive medicines should include sensors to monitor and ensure adherence to specified temperature ranges, promoting quality control.

**3. Blockchain Integration:**

- Implement blockchain technology to secure and tamper-proof the recording of every step in the supply chain, ensuring transparency and data integrity.

**4. QR Code Authentication:**

- Generate a unique QR code for each medicine pack, employing features like unique serial numbers, scratchable covers, and a reporting mechanism for scanned codes to prevent counterfeit medicines.

**5. Real-time Tracking:**

- Provide a real-time tracking system to monitor the movement of medicines from manufacturing to delivery, enhancing visibility and control.

**6. Theft Prevention:**

- Incorporate security measures to prevent theft during transportation or any stage of the supply chain.

**7. Recall Management:**

- Implement a recall mechanism to efficiently manage and record product recalls due to quality issues or safety concerns.

**8. Transaction Fee Only:**

- Restrict payment transactions to traditional methods, eliminating the use of cryptocurrencies for added financial security. Only transaction fees should be applicable.

**Non-functional Requirements:**

**1. Security:**

- Ensure robust security measures to safeguard sensitive pharmaceutical data and prevent unauthorized access.

**2. Scalability:**

- Design the system to handle potential growth and increased data volume within the pharmaceutical supply chain.

**3. Reliability:**

- Establish a reliable system that minimizes downtime and ensures continuous functionality to meet the demands of the pharmaceutical industry.

**4. Usability:**

- Create an intuitive and user-friendly interface for stakeholders at different stages of the supply chain, ensuring ease of use and accessibility.

**5. Performance:**

- Optimize system performance to provide real-time tracking and responsiveness, meeting industry standards for efficiency.

**6. Compliance:**

- Ensure that the system complies with relevant regulations and standards governing pharmaceutical supply chain management.

**7. Auditability:**

- Enable a transparent and auditable system, allowing stakeholders to trace and verify the history of each medicine batch within the supply chain.

**8. Data Backup and Recovery:**

- Implement robust data backup and recovery mechanisms to prevent data loss and ensure business continuity in case of unforeseen events.

1. **Scope of the Project/Proposed System**

The scope of the proposed project encompasses a comprehensive overhaul of the existing pharmaceutical supply chain, introducing a technologically advanced system to address critical challenges and enhance various aspects of the industry. The proposed system aims to:

**1. End-to-End Tracking:**

- Implement a robust tracking mechanism that covers the entire lifecycle of pharmaceutical products, from manufacturing to distribution, ensuring visibility and accountability at every stage.

**2. Quality Control:**

- Incorporate temperature sensors for temperature-sensitive medicines, facilitating real-time monitoring and adherence to specified temperature ranges to ensure product quality.

**3. Security Measures:**

- Integrate RFID technology and blockchain to establish a secure and tamper-proof environment, preventing unauthorized access, alterations, and enhancing the overall security of the pharmaceutical supply chain.

**4. Authentication System:**

- Introduce a QR code authentication system with unique serial numbers, scratchable covers, and a reporting mechanism to combat the circulation of counterfeit medicines, ensuring the authenticity of pharmaceutical products.

**5. Real-time Incident Response:**

- Develop a system for recording and responding to safety incidents promptly, such as cases involving the misuse of chemicals, with the ability to trace and recall affected products efficiently.

**6. Recall Management:**

- Implement an effective recall management system to streamline the process of recalling products due to quality issues, safety concerns, or other critical reasons.

**7. Theft Prevention:**

- Integrate security measures to prevent theft during transportation or any stage of the supply chain, safeguarding pharmaceutical products from unauthorized access and potential loss.

**8. Financial Security:**

- Restrict payment transactions to traditional methods, ensuring financial security by eliminating the use of cryptocurrencies and only allowing transaction fees.

**9. User-Friendly Interface:**

- Design an intuitive and user-friendly interface to cater to stakeholders at various levels of the supply chain, promoting ease of use and accessibility.

**10. Compliance and Auditability:**

- Ensure that the proposed system complies with industry regulations and standards, providing an auditable environment for stakeholders to verify the history of each medicine batch within the supply chain.

1. **Target Users/Beneficiaries of the Proposed System**

**1. Pharmaceutical Manufacturers:**

- Manufacturers will benefit from the end-to-end tracking system, ensuring visibility into the production process and facilitating real-time monitoring of product quality, especially for temperature-sensitive medicines.

**2. Distributors and Logistics Providers:**

- Distributors and logistics providers will gain from the enhanced tracking and security features, minimizing the risk of theft during transportation and providing a transparent supply chain for optimized logistics operations.

**3. Pharmaceutical Retailers:**

- Retailers will benefit from the QR code authentication system, assuring the authenticity of pharmaceutical products and reducing the circulation of counterfeit medicines in the market.

**4. Regulatory Authorities:**

- Regulatory bodies will find value in the system's compliance with industry regulations and standards, as well as its auditability, enabling them to monitor and enforce pharmaceutical industry standards effectively.

**5. Consumers:**

- End consumers will be assured of the safety and authenticity of the medicines they purchase, thanks to the QR code authentication system and the overall transparency of the supply chain.

**6. Government Health Agencies:**

- Government health agencies can leverage the system to enhance public health by ensuring the traceability of pharmaceutical products, responding to safety incidents, and preventing the circulation of fake medicines.

**7. Auditors and Inspectors:**

- Auditors and inspectors can efficiently verify the history of each medicine batch through the auditable blockchain, ensuring compliance with industry standards and regulations.

**8. Supply Chain Analysts:**

- Professionals analyzing supply chain data will find value in the system's real-time tracking and reporting capabilities, enabling them to make informed decisions and optimize supply chain processes.

1. **Tools/Technologies (Tentative Listing)**

**Front-End Development:**

- React

- Tailwind Css

- Poimandres

- Redux

- Radix UI

- Sonner

- Next.js

**Back-End Development:**

- Node.js

- TypeScript

- Express

- MongoDB

**Blockchain Integration:**

- Ethereum

- Solidity

- Ether.js

- Web3.js

- Hardhat

- IPFS (InterPlanetary File System)

- Alchemy Provider

**Authorization**:

- MetaMask

- Trust Wallet