

| **Title: Chapter No:7 Conclusion and future work** |
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**Expected Outcome of Experiment:**

**CO3: Implement and prototype creation for the specified application.**

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**Books/ Journals/ Websites referred:**

*[Students can mention websites/ books used in their project implementation]*

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**This write-up will expect students to prepare Chapter no 7 in the format given below**

**Chapter 7**

**Conclusion and future work**

### 6.1 Conclusion

This project successfully implemented a blockchain-based pharmaceutical supply chain management system, addressing major industry challenges such as inefficiency, lack of transparency, and the spread of counterfeit drugs. The prototype demonstrated that decentralized technologies, particularly blockchain, can effectively:

* Track drugs from manufacturer to end-consumer.
* Prevent counterfeiting through immutable, verifiable transaction logs.
* Improve stakeholder trust by enabling transparent role-based interactions.
* Enhance inventory management through real-time updates and distributed data control.

Testing and evaluation using metrics such as accuracy, efficiency, usability, and reliability confirmed that the system meets its core functional goals. Comparative analysis with traditional systems and existing blockchain-based models further highlighted the innovations introduced—particularly in consumer-side verification and seamless wallet-based interactions.

The implementation validates the feasibility and practicality of the proposed approach, showing that blockchain, paired with technologies like Wagmi, RainbowKit, GraphQL, and IPFS, can bring measurable improvements to pharmaceutical supply chain operations.

### 6.2 Limitations

Despite its success, the prototype has some limitations:

* Limited to Ethereum Sepolia Testnet: Real-world deployment would require gas cost optimizations and potential layer-2 solutions.
* No mobile optimization: The current version is desktop-first and requires adaptation for mobile users.
* Static role approval: Role assignments are manually verified in the backend, which could be automated in future iterations.
* Scalability testing was limited to small user groups and simulated loads.

### 6.3 Future Work

To enhance the system’s performance and readiness for broader deployment, future work can focus on:

* Performance Optimization: Implementing Layer 2 solutions like Polygon or Optimism for reduced gas costs and faster transaction finality.
* Mobile Compatibility: Designing a responsive or native mobile application for broader accessibility.
* Decentralized Identity Integration: Using DIDs for user roles and access control without relying on backend verification.
* Cross-Chain Interoperability: Supporting other blockchain networks for greater flexibility and resilience.
* AI Integration: Leveraging machine learning for predictive inventory management, demand forecasting, or anomaly detection in drug movement.
* Regulatory Compliance Modules: Incorporating compliance standards (like FDA, WHO) into smart contract validation workflows.