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PROJECT PROPOSAL

Intelligent Pharmacy Inventory Management System (IPIMS)

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1. Summary

This project proposes the development of an **Intelligent Pharmacy Inventory Management System (IPIMS)**, a web-based application designed to modernize and optimize drug inventory processes within pharmacies. The primary purpose of this software is to enhance efficiency, reduce waste from expired medications, and improve patient safety by providing real-time, proactive insights into drug stock levels and expiry dates.

The main deliverables will include a fully functional web application prototype, comprehensive source code adhering to modern development standards, and detailed project documentation covering design, implementation, and testing. This project aligns directly with the course objectives by demonstrating proficiency in conceiving, designing, implementing, and evaluating a software solution to a real-world problem. Key benefits include streamlined inventory operations, automated alerts for critical stock conditions, and a reduction in manual errors, showcasing a novel approach to pharmacy management.

2. Introduction

Traditional pharmacy inventory management often relies on manual tracking or outdated systems, leading to significant challenges such as drug expiry, stockouts, inefficient reordering, and potential dispensing delays. These issues not only result in financial losses for pharmacies but also pose risks to patient health due to the unavailability of critical medications or the accidental dispensing of expired drugs.

This project, the Intelligent Pharmacy Inventory Management System (IPIMS), aims to address these critical real-world issues by leveraging modern software development practices. The motivation behind choosing this project stems from a recognized need for more intelligent and automated solutions in the healthcare sector, particularly in pharmacy operations where precision and timeliness are paramount.

The primary target users for this software are pharmacists, pharmacy technicians, and inventory managers who require an efficient, accurate, and proactive tool to manage their drug stock. By developing IPIMS, this project supports my academic goal of applying theoretical knowledge to practical problem-solving. It contributes to my career aspirations of becoming a proficient software developer capable of building robust, scalable, and impactful enterprise applications using cutting-edge technologies.

3. Problem Statement

The current landscape of pharmacy inventory management is frequently plagued by inefficiencies stemming from manual or semi-automated processes. The specific issues include:

- **Drug Expiry and Waste:** Medications often expire on shelves due to inadequate tracking and a lack of proactive alerts, leading to significant financial losses and unnecessary disposal.
- **Stockouts and Overstocking:** Inaccurate inventory counts or reactive reordering practices result in critical drug shortages, impacting patient care, or excessive stock, tying up capital, and increasing expiry risks.
- **Manual Error Proneness:** Human error in manual data entry or stock checking can lead to discrepancies, incorrect dispensing, and operational delays.
- **Lack of Real-time Visibility:** Pharmacists often lack immediate, accurate insight into current stock levels, batch details, and expiry dates, hindering efficient decision-making.

These problems directly affect pharmacy profitability, operational efficiency, and most importantly, patient safety and access to necessary medications. Solving these issues through an intelligent, automated system is crucial for modernizing pharmacy operations and ensuring optimal healthcare delivery. This problem is worth solving for this final project as it allows for the application of advanced architectural patterns and real-time data processing to a domain with a clear societal and economic impact.

4. Goals and Objectives

The overarching goal of the Intelligent Pharmacy Inventory Management System (IPIMS) project is to develop a robust and intelligent web application that streamlines pharmacy inventory operations, reduces waste, and enhances overall efficiency and patient safety. I intend to include the following specific and measurable objectives for this project:

- **Develop** a web application utilizing Spring Boot (backend) and Angular (frontend), aligning with modern web standards.
- **Implement** an event-driven microservice architecture to support core inventory management, enhancing modularity and scalability.
- **Design and build** a robust drug item management module with features for categorization, batch tracking, and supplier details.
- **Integrate** a real-time expiry alert system to notify pharmacists of near-expiry drugs proactively.
- **Deploy** a predictive reorder suggestion feature using simulated historical dispensing data to optimize stock replenishment.
- **Ensure** the system meets performance benchmarks for responsiveness and efficient data processing.
- **Enforce** strong security protocols, including authentication, input validation, and secure inventory data handling.
- **Deliver** comprehensive documentation comprising ER Diagrams, Use Case Diagrams, System Architecture, API details, and a user guide.

5. Technical Requirements

The Intelligent Pharmacy Inventory Management System will be developed as a web application, leveraging a modern technology stack to ensure robustness, scalability, and a responsive user experience.

- **Programming Language(s) and Framework(s):**
  - **Backend:**

    Java with **Spring Boot** (mandatory). This choice provides a powerful and flexible foundation for developing robust RESTful APIs and enterprise-grade microservices, simplifying configuration and enhancing productivity.

  - **Frontend:**

    TypeScript with **Angular/React**. Angular is chosen for its comprehensive framework, strong community support, and capabilities for building complex, single-page applications with a focus on component-based architecture and reactive programming, ensuring a responsive and maintainable UI.

- **Development Tools:**
  - **Integrated Development Environment (IDE):**

    IntelliJ IDEA (for Spring Boot) and **Visual Studio Code** (for Angular).

  - **Version Control:**

    Git, managed via a platform like **GitHub/GitLab**, for collaborative development and tracking changes.

  - **Build Automation:**

    Maven (for Spring Boot) and **npm/Yarn** (for Angular).

- **External Dependencies:**
  - **Database:**

    MySQL, a robust and widely used relational database for persistent storage of inventory data.

  - **Message Broker:**

    Kafka (or RabbitMQ), to facilitate asynchronous communication between microservices, is crucial for the event-driven architecture (e.g., triggering alerts upon events).

  - **Styling Library:**

    Angular Material or **Tailwind CSS** for building a responsive and aesthetically pleasing user interface.

These selections are justified by their industry relevance, strong community support, ease of integration with each other, and their ability to fulfill the project's requirements for an event-driven microservice architecture and a responsive UI. They also align with personal development goals to gain hands-on experience with enterprise-grade web application development.

6. Timetable

Agile-inspired with milestone tracking for timely delivery.

Phase	Description	Start Date	End Date
Project Proposal	Submission of project topic, objectives, scope, and methods.	July 15, 2025	July 19, 2025
ER & Use Case Diagrams	Submission of Entity-Relationship & Use Case diagrams for IPIMS.	July 20, 2025	July 26, 2025
UI/Wireframe Design	Submission of user interface mockups or wireframes for the IPIMS dashboard.	July 27, 2025	July 31, 2025
Backend Core Development	Implementation of Spring Boot Inventory Service (CRUD, basic APIs).	Aug 1, 2025	Aug 7, 2025
Frontend Core Development	Implementation of Angular UI for basic inventory management.	Aug 1, 2025	Aug 7, 2025
Innovative Features & Integration	Development of expiry alerts, predictive reorder logic, and eventing.	Aug 8, 2025	Aug 12, 2025
Testing, Refinement & Documentation	Comprehensive testing, bug fixing, and finalization of all documentation.	Aug 13, 2025	Aug 15, 2025
Final Project Submission	Submission of the completed documentation and project files.	Aug 16, 2025	

7. Resources

The successful completion of this project will rely on a combination of software tools, dedicated time commitment, and available support resources.

- **Software:**
  - Operating System: **Windows**/macOS/Linux
  - IDEs: **IntelliJ IDEA Community Edition**, **Visual Studio Code** (free/open-source)
  - Version Control: **Git** (free/open-source)
  - Database: **MySQL Community Server** (free/open-source)
  - Message Broker: **Apache Kafka** (free/open-source)
  - Web Browser: **Google Chrome**/**Mozilla Firefox** (for testing)
- **Time Commitment:**
  - An estimated 15-20 hours per week will be dedicated to this project, divided across design, development, testing, and documentation phases.
- **Support:**
  - Instructor guidance and feedback.
  - Peer collaboration and code reviews.
  - Extensive online documentation for Spring Boot, Angular, MySQL, and Kafka.
  - Online communities and forums (e.g., Stack Overflow, official framework forums) for troubleshooting and best practices.

8. Appendix

The appendix will include supplementary materials that support the main document and provide further detail on the project's design and implementation. Potential inclusions are:

- Preliminary wireframes or mockups of the IPIMS user interface.
- Pseudocode or algorithms illustrating the logic for automated expiry alerts and predictive reordering.
- Initial ER Diagram sketch for the core inventory entities.
- References to research papers or articles that support the problem statement or innovative approaches.