Design and Development of Medicine Order Management System : PharmaCare

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FINAL YEAR DESIGN PROJECT REPORT

This Report Presented in Partial Fulfillment of the Requirements for the **Degree of Bachelor of Science in Computer Science and Engineering**

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APPROVAL

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DECLARATION

We hereby declare that this project has been done by us under the supervision of **Mr. Narayan Ranjan Chakraborty, Associate Professor & Associate Head,** Department of Computer Science and Engineering, Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree or diploma.

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ABSTRACT

“Complex and inefficient supply chains with intermediaries lead to wastage, delayed deliveries and higher costs and poor access to essential medications in rural areas. In this line, PharmaCare will be introduced as the solution that overcomes the supply challenges of pharmaceuticals through a platform that bridges the gap between management, and a dashboard specifically designed for small business users, the platform leverages technology to improve efficiency. These features ensure proper equipping levels, decrease operational costs, and allow timely delivery of the medications. Rural pharmacy owners and the primary instants of medical supplies. PharmaCare removes intermediaries, thereby lowering transaction costs giving pharmacy owners the power to transfer such savings to their customers & increase service efficiency. With features like real-time shipment tracking, advanced inventory Ultimately, PharmaCare revolutionizes the pharmaceutical supply chain, making healthcare more affordable and accessible, while empowering local pharmacies to better serve their communities. These features help optimize inventory levels, reduce operational costs, and ensure timely delivery of medications. PharmaCare enhances healthcare access by ensuring that rural pharmacies can reliably obtain medications, supporting better health outcomes in underserved.

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Chapter 1
Introduction

1.1 Introduction

In many rural areas, access to essential medications is hindered by complex and inefficient supply chains that involve numerous intermediaries, leading to significantly higher costs and delays in medicine delivery. This logistical challenge impacts the ability of small and rural pharmacies to serve their communities effectively. To address this issue, we are proud to introduce PharmaCare, a pioneering platform tailored to transform the pharmaceutical distribution landscape by facilitating direct connections between pharmacy owners in rural settings and the primary sources of medical supplies. PharmaCare's innovative approach is designed to eliminate the dependency on multiple middlemen that traditionally increase the transaction costs and complexity of obtaining pharmaceutical products. By removing these intermediaries, PharmaCare significantly reduces expenses and simplifies the procurement process, allowing pharmacy owners to pass these savings onto their customers while improving their service efficiency.The platform utilizes cutting-edge technology to offer a streamlined, intuitive ordering system that includes features such as real-time tracking of shipments, advanced inventory management capabilities, and a straightforward user interface designed specifically for the needs of small businesses. These tools not only ensure the timely arrival of medicines but also help maintain adequate inventory levels without the risk of overstocking or understocking, thus optimizing operational costs.Furthermore, PharmaCare is committed to enhancing healthcare access by making it easier for pharmacies to obtain a reliable supply of medications, thereby supporting local communities in maintaining better health outcomes. This initiative also aligns with broader public health goals by ensuring that critical healthcare supplies reach underserved areas more reliably and affordably.In conclusion, PharmaCare represents a significant leap forward in making healthcare more accessible and affordable for rural populations. By streamlining the pharmaceutical supply chain, PharmaCare not only supports local pharmacies but also plays a crucial role in building healthier communities. This platform stands as a beacon of innovation and efficiency, poised to reshape the landscape of pharmaceutical distribution for the better.

1.2 Motivation

The motivation behind creating Medicare comes from witnessing the struggles faced by rural pharmacies in accessing essential medications. In many rural areas, the existing pharmaceutical supply chain is complicated and inefficient, often relying on multiple middlemen. This leads to higher costs, delivery delays, and ultimately, challenges in providing timely care to the community. For small pharmacies, these barriers mean that they can't always meet the healthcare needs of their customers, who often rely on them as a primary source of medicine.The drive to solve this problem

stems from the desire to make a meaningful impact. PharmaCare aims to simplify the procurement process by cutting out unnecessary intermediaries, reducing costs, and improving the efficiency of the supply chain. By connecting pharmacy owners directly with primary suppliers, we can help pharmacies keep their inventory levels balanced and ensure that medicines arrive on time—without the usual markups and delays.For me, this project is more than just a technological challenge; it's a chance to use my skills to help bridge the gap in healthcare access. Solving this problem means more affordable, reliable medicine for rural communities, which directly improves health outcomes. It also brings personal fulfillment, knowing that I'm contributing to something that can truly make a difference in people's lives.

1.3 Objectives

The main goals of the PharmaCare platform are :

Simplify the Pharmaceutical Supply Chain: We aim to remove unnecessary middlemen in the supply process, making it simpler and more cost-effective for pharmacies to get the medications they need.

Lower Costs for Rural Pharmacies: By connecting pharmacy owners directly with suppliers, we reduce the costs of purchasing medicines, allowing these savings to be passed on to customers, making healthcare more affordable.

Make Healthcare More Accessible in Rural Areas: Our goal is to make essential medications easier to obtain in rural communities, ultimately improving health outcomes and ensuring that people in these areas have access to the care they need.

Create a User-Friendly Experience for Pharmacy Owners: We want to ensure that PharmaCare is easy to use, offering a platform that helps pharmacy owners manage orders, inventory, and shipments with ease—designed for small businesses.

Support Broader Public Health Goals: By ensuring that critical medicines reach rural areas reliably, we contribute to improving public health outcomes and making healthcare more equitable.

These objectives are about making the process of obtaining medications smoother, more affordable, and more reliable for rural pharmacies, so they can continue supporting the health of their communities.

1.4 Methodology

The methodology for the development of PharmaCare is based on a combination of innovative technology, user-centered design, and efficient supply chain management principles. The platform aims to streamline pharmaceutical distribution in rural areas by connecting pharmacy owners directly with primary suppliers. Below is an outline

of the approach used to develop PharmaCare :

Needs Assessment and Research: The process begins with thorough research into the challenges faced by rural pharmacies, focusing on supply chain inefficiencies, high transaction costs, and delays in medicine delivery. This research informs the platform's features and design, ensuring they align with the needs of pharmacy owners and their customers.

Platform Design and Development: Using a user-centered design approach, the platform was built to be intuitive and easy to navigate. The design prioritizes simplicity, ensuring that even pharmacy owners with limited technical expertise can use the system. The front-end development was carried out using modern web technologies such as HTML, CSS, and JavaScript, while the back-end is built with PHP and MySQL for secure data management.

Testing and Validation: The platform undergoes multiple stages of testing, including unit testing, functional testing, and user acceptance testing (UAT). The goal is to ensure that all features work as intended and that the platform meets the needs of its users.

Deployment and Monitoring: After successful testing, PharmaCare is deployed on a secure cloud-based server. Continuous monitoring is conducted to ensure optimal performance, security, and user satisfaction.

Continuous Improvement: Feedback from users is continuously gathered and analyzed to refine and improve the platform's features. New updates and functionalities, such as mobile apps and multilingual support, will be added based on user feedback and evolving needs.

This methodology ensures that PharmaCare not only addresses the logistical challenges of rural pharmacies but also offers a scalable, secure, and user-friendly solution to improve pharmaceutical distribution in underserved areas.

1.5 Project Outcome

their costs, allowing them to offer medicines at lower prices, making healthcare The PharmaCare platform has the potential to bring about several positive changes for rural pharmacies, their communities, and the healthcare system as a whole. Here's what we expect to see:

Lower Costs for Pharmacies: By cutting out the middlemen, PharmaCare makes it easier and more affordable for pharmacy owners to get the medications they need. This will help reduce more accessible for their customers.

Better Access to Medications: One of the biggest challenges in rural areas is the delay in getting essential medicines. PharmaCare will ensure that pharmacies get their supplies on time, helping them avoid stockouts and allowing them to serve their customers promptly.

Simplified Operations: With real-time tracking and smart inventory management, PharmaCare will help pharmacy owners keep their stock at optimal levels—reducing the chances of overstocking or running out of medicines. This will make running their business easier and more efficient.

Healthier Communities: Better access to medication means people can get the treatment they need, when they need it. This can lead to improved health outcomes, better treatment adherence, and fewer health complications, ultimately creating healthier communities.

Supporting Small Businesses: PharmaCare will empower small pharmacy owners to run more efficient and profitable businesses. This means more sustainable, thriving pharmacies that can provide reliable service to their communities for years to come.

Wider Reach: As PharmaCare proves successful, it has the potential to expand beyond rural areas, bringing better healthcare access to other underserved communities both locally and globally.

Improving Public Health: By helping pharmacies get the medicines they need reliably and affordably, PharmaCare plays a key role in improving healthcare in rural areas. It helps bridge the gap in healthcare access, contributing to better health outcomes and overall public health improvement.

In essence, PharmaCare isn't just a tool for pharmacies—it's a platform that has the power to improve lives, make healthcare more affordable, and help rural communities thrive. It's about making healthcare more human, accessible, and equitable for everyone.

1.6 Organization of the Report

This report is structured to provide a comprehensive overview of the PharmaCare platform, from its conceptualization to its development and evaluation. The organization is as follows:

Chapter 1: Introduction – Provides an overview of PharmaCare, including its purpose, objectives, and significance in connecting rural pharmacy owners with suppliers.

Chapter 2: Literature Review – Examines existing platforms and solutions in the pharmaceutical sector, highlighting the gaps that PharmaCare aims to address.

Chapter 3: Methodology – Details the approach, tools, and technologies used in developing

the PharmaCare platform, including the system design, environment setup, and development process.

Chapter 4: System Design and Implementation – Discusses the design choices, software and hardware requirements, and the development phases of the platform.

Chapter 5: Testing and Evaluation – Describes the testing process, performance evaluation, and comparative analysis with existing systems.

Chapter 6: Impact and Sustainability – Analyzes the potential societal and environmental impact, along with sustainability and ethical considerations of PharmaCare.

Chapter 7: Conclusion and Future Work – Summarizes the findings, limitations, and potential for future improvements and scalability of the PharmaCare platform.
Each chapter builds upon the previous, offering a holistic view of the platform's design, functionality, and expected impact.

Chapter 2

Background

2.1 Introduction

In many rural communities, local pharmacies often struggle with a crucial problem: getting essential medications quickly and affordably. The root of this issue lies in the outdated and cumbersome supply chains that are currently in place, which involve many layers of intermediaries. Each layer adds extra costs and potential delays, making it difficult for these pharmacies to serve their communities effectively. This not only threatens the financial health of the pharmacies but also impacts the well-being of the communities that depend on them. Enter PharmaCare, a groundbreaking platform designed to revolutionize how pharmaceuticals are distributed to rural areas. By directly linking rural pharmacies with the main suppliers of medical products, PharmaCare cuts out the costly middlemen, aiming to lower expenses, speed up delivery, and improve access to necessary medicines. This report will explore the motivations behind creating PharmaCare, detail the approach taken in its development, and outline its system design. We will also examine the tangible benefits that PharmaCare has started to deliver to rural communities and look ahead to potentialfuture enhancements that could widen its impact.By providing a deeper understanding of the challenges faced by rural pharmacies and illustrating how PharmaCare addresses these challenges, this introduction sets the stage for a detailed discussion on why PharmaCare is not just a technological innovation but a vital step forward in improving rural healthcare infrastructure.

2.2 Literature Review

MedEasy (medeasy.health)

- **Focus**: Provides doorstep medicine delivery to individual customers.
- **Strengths**: User-friendly interface, home delivery services, and online prescription uploads.
- **Limitations**: Exclusively focuses on individual customers with no provisions for bulk purchasing or B2B services.

LazzPharma (lazzpharma.com)

- **Focus**: Offers both over-the-counter and prescription drugs online.
- **Strengths**: Well-known brand with a wide variety of medicines.
- **Limitations**: Operates primarily in the B2C domain, leaving out rural pharmacy owners seeking bulk procurement options.

Osudpotro (osudpotro.com)

- **Focus**: Focused on delivering medicine and health products to individuals.
- **Strengths**: Easy ordering process and prompt delivery service.
- **Limitations**: Does not provide services for pharmacy-to-supplier transactions.

Arogga (arogga.com)

- **Focus**: Offers a mobile-friendly app for medicine delivery to individuals.
- **Strengths**: Efficient ordering system and convenient tracking for personal medicine needs.
- **Limitations**: Solely designed for individual customers, lacking a wholesale or B2B model.

Online Medicine Bazar (onlinemedicinebazar.com)

- **Focus**: Delivers medicines and health products to consumers.
- **Strengths**: Competitive pricing and a wide range of available medicines.
- **Limitations**: Targets individual customers and does not cater to the unique needs of pharmacy owners.

ePharma (epharma.com.bd)

- **Focus**: Online medicine delivery service catering to individual patients.
- **Strengths**: Reliable delivery network and prescription-based ordering.
- **Limitations**: Lacks support for bulk procurement or direct supplier connections for pharmacies

2.2.1 Similar Applications

The field of pharmaceutical supply chain management has seen numerous innovations in web and mobile applications aimed at enhancing efficiency, reducing costs, and improving accessibility to medical supplies. Below is a summary of notable similar works that serve as benchmarks for the PharmaCare platform:

Research Studies

PharmaChain: Blockchain in Pharmaceutical Supply Chains

- **Focus**: Explores the application of blockchain technology to ensure transparency and traceability in pharmaceutical supply chains.
- **Key Features**: Immutable tracking of drugs, fraud prevention, and improved accountability among stakeholders.
- **Limitations**: High implementation costs and technical complexity for small-scale operations.
- **Relevance**: Emphasizes the importance of incorporating secure and transparent tracking mechanisms in PharmaCare.

Digital Healthcare Platforms for Rural Areas

- **Focus**: Studies the challenges and benefits of digital healthcare solutions tailored for underserved and rural regions.
- **Key Features**: Affordable services, simplified interfaces, and integration with local healthcare providers.
- **Limitations**: Limited scalability and lack of supplier diversity in certain regions.
- **Relevance**: Highlights the critical need for user-friendly platforms that cater specifically to rural pharmacy owners.

Case Studies

Amazon Business for Healthcare (2020)

- **Methodology**: Investigated how Amazon's B2B platform supports healthcare providers with bulk ordering and streamlined supply management.
- **Outcomes**: Reduced procurement costs and increased order fulfillment efficiency.
- **Relevance**: Provides insights into the scalability and cost-effectiveness of integrating bulk ordering capabilities within PharmaCare.

mPharma: Connecting Pharmacies and Suppliers

- **Methodology**: Explored how mPharma connects pharmacies in developing countries with suppliers through a centralized platform.
- **Outcomes**: Improved access to affordable medications and enhanced inventory reliability.
- **Relevance**: Aligns closely with PharmaCare's goal of bridging the gap between rural pharmacies and suppliers while reducing dependency on intermediaries.

Web Applications

PillPack by Amazon Pharmacy

- **Focus**: Offers online pharmacy services for end-users, providing prescription refills and delivery.
- **Strengths**: Exceptional user experience and robust logistics network.
- **Limitations**: Primarily caters to individual consumers rather than pharmacies.
- **Relevance**: Highlights the potential of leveraging efficient logistics and user-centric design for PharmaCare.

ZywieRx

- **Focus**: A web platform that connects pharmacists with suppliers for ordering medications.
- **Strengths**: Streamlined ordering process and support for bulk purchases.
- **Limitations**: Limited inventory management features and real-time tracking.
- **Relevance**: Stresses the importance of adding comprehensive inventory and shipment tracking features to PharmaCare.

Mobile Applications

PharmEasy

- **Features**: Provides a mobile interface for ordering medications, scheduling diagnostic tests, and tracking orders.
- **Strengths**: Intuitive interface and strong supplier network for urban users.
- **Limitations**: Less effective in addressing the unique needs of rural pharmacies.
- **Relevance**: Highlights the need for a tailored approach to rural pharmacy management in PharmaCare.

MedPlus

- **Features**: Offers both digital and physical pharmacy services with an integrated mobile app.
- **Strengths**: Effective in managing physical stores and online orders simultaneously.
- **Limitations**: Focuses more on urban markets and direct-to-consumer sales.
- Relevance: Suggests the potential for PharmaCare to serve as a hybrid solution, addressing both B2B and local community needs.

2.2.2 Related Research

Advancements in pharmaceutical supply chain management and the integration of digital technology have been extensively studied, providing key insights into improving efficiency, accessibility, and cost-effectiveness. The following research studies serve as a foundation for the development of the PharmaCare platform:

Mobile Technology in Pharmaceutical Distribution (Singh, 2020)

Focus: Explored the role of mobile applications in streamlining pharmaceutical supply chains, particularly in resource-limited areas.[12]

Findings: Highlighted that mobile platforms significantly reduce transaction costs and improve supply chain visibility for small-scale pharmacies.

Blockchain in Medicine Supply Chains (Patel et al., 2019)
Focus: Studied the implementation of blockchain for tracking pharmaceuticals from manufacturers to end-users.[13]
Findings: Demonstrated improved traceability, fraud prevention, and compliance with regulatory standards, but noted the complexity and cost barriers for rural applications.

AI and Machine Learning in Pharmacy Management (Lee and Wang, 2021)
Focus: Examined the application of AI to optimize inventory management, predict demand, and recommend procurement schedules.[14]
Findings: Showed a significant reduction in stockouts and overstocking, enhancing operational efficiency for pharmacies.
E-Commerce and Rural Healthcare Access (Ahmed et al., 2020)
Focus: Investigated the impact of e-commerce platforms on improving access to medical supplies in rural areas.[15]
Findings: Identified logistical challenges and emphasized the need for intuitive interfaces and localized solutions tailored to rural pharmacies.
User-Centric Design in Pharmaceutical Applications (Kumar and Sharma, 2022)
Focus: Explored the role of user-friendly design in increasing adoption rates of pharmaceutical management apps.[16]
Findings: Concluded that intuitive interfaces and features like real-time shipment tracking and customer support significantly enhance user satisfaction.

2.3 Gap Analysis

Despite advancements in pharmaceutical supply chain solutions, several critical gaps persist that PharmaCare aims to address:

Limited Accessibility for Rural Pharmacies
Existing platforms primarily cater to urban areas and large-scale pharmacies, leaving rural pharmacy owners with limited access to reliable and affordable medical supplies.
Dependence on Multiple Intermediaries
Current systems often involve multiple intermediaries in the supply chain, resulting in higher costs, delays, and inefficiencies that disproportionately affect small and rural pharmacies.
Lack of Inventory Management Tools
Many platforms fail to offer advanced inventory management features, such as predictive restocking, real-time stock tracking, and alerts for overstocking or understocking, which are essential for optimizing operational costs.
Absence of Real-Time Shipment Tracking
Real-time tracking of shipments is either unavailable or limited in functionality, making it difficult for pharmacy owners to monitor the delivery status of critical medical supplies.
Inadequate User-Centric Design
Existing systems often lack intuitive interfaces tailored to the needs of rural pharmacy owners, making the adoption of these platforms challenging.
High Implementation Costs
Many solutions involve significant upfront costs or complex infrastructure requirements, creating barriers for small-scale pharmacies with limited resources.

How PharmaCare Addresses These Gaps:

Direct Connections: PharmaCare eliminates the reliance on intermediaries, providing rural pharmacies with direct access to primary suppliers, thereby reducing costs and delays.
Streamlined Inventory Management: Advanced tools for managing stock levels, predictive analytics, and automated restocking alerts are integrated into the platform.
Real-Time Shipment Tracking: The platform includes robust tracking features, ensuring transparency and reliability in the delivery process.
User-Centric Design: PharmaCare features an intuitive and mobile-friendly interface tailored to the specific needs of rural pharmacy owners.
Cost-Effective Solutions: PharmaCare minimizes upfront costs, offering a scalable and affordable platform that is accessible to small and rural pharmacies.

2.4 Summary

This chapter explored the foundational aspects and background necessary for the development of PharmaCare, a platform designed to revolutionize pharmaceutical distribution in Bangladesh. The literature review highlighted the dominance of existing B2C platforms that cater to individual customers while underscoring the lack of B2B solutions tailored for pharmacy owners. An analysis of similar platforms identified key strengths and limitations, shedding light on the absence of tools for direct supplier connections, inventory management, and real-time shipment tracking.The gap analysis further demonstrated the critical shortcomings of existing systems, such as limited accessibility for rural pharmacies, dependency on intermediaries, and the lack of user-centric features tailored to B2B needs. These findings establish a clear need for an innovative solution like PharmaCare.By addressing these challenges with advanced technologies and a user-friendly design, PharmaCare aims to streamline the pharmaceutical supply chain, reduce costs, and improve access to essential medicines, particularly for underserved rural areas. This platform is poised to fill a significant gap in the market, empowering pharmacy owners and fostering healthier communities.

Chapter 3
Research Methodology

3.1 Methodology/Requirement Analysis & Design Specification

3.1.1 Overview

PharmaCare is a platform created to simplify pharmaceutical procurement for rural pharmacy owners. It connects pharmacies directly with suppliers, eliminating intermediaries to reduce costs and improve efficiency. The platform addresses key challenges such as delays, high expenses, and limited access to medicines in underserved areas. PharmaCare features advanced tools like real-time shipment tracking and inventory management to streamline operations. Its user-friendly interface is tailored specifically to meet the needs of small and rural pharmacies. The platform adopts an iterative development process, ensuring continuous improvement based on user feedback. By providing direct supplier access, PharmaCare empowers pharmacies to maintain adequate stock levels and optimize costs. This innovation enhances healthcare delivery by ensuring timely and affordable access to essential medicines. PharmaCare also contributes to broader public health goals by supporting rural communities. Through these efforts, the platform aims to revolutionize the pharmaceutical supply chain in Bangladesh.

3.1.2 Proposed Methodology/ System Design

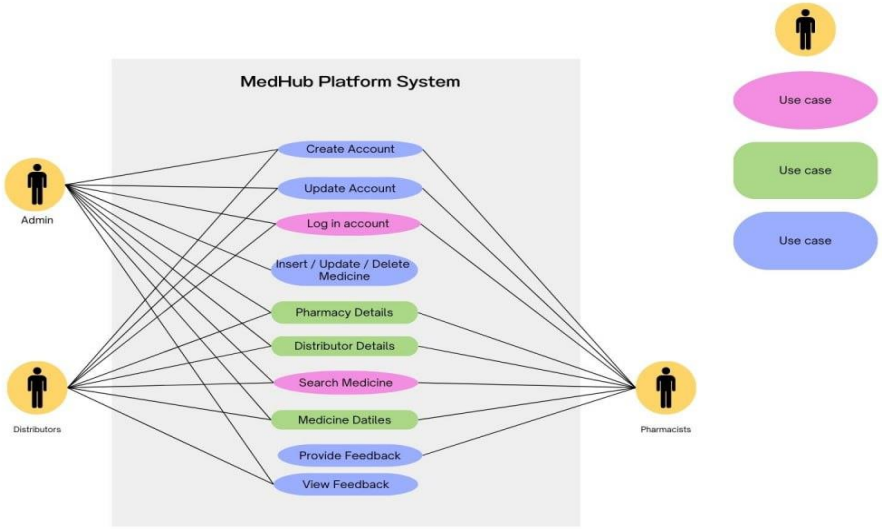

Figure 3.1: This is a case diagram

3.1.3 Functional and Nonfunctional Requirements

Functional Requirements

- **User Registration and Login**: Secure user registration and login process for pharmacy owners and suppliers.
- **Medicine Search**: Enable pharmacies to search for medicines by name, category, or supplier.
- **Order Placement**: Allow users to place bulk orders directly with suppliers.
- **Real-Time Shipment Tracking**: Provide updates on the status and location of shipments.
- **Inventory Management**: Tools for tracking stock levels, automated restocking alerts, and predictive stock analysis.
- **Notifications**: Automated alerts for order status updates, shipment delivery, and inventory thresholds.
- **Supplier Directory**: List verified suppliers with details for easy communication and selection.
- **Payment Processing**: Secure integration for payment options, including online transactions and cash on delivery.

Nonfunctional Requirements

- **Scalability**: Capable of handling a growing number of users, suppliers, and transactions without performance degradation.
- **Security**: Implement data encryption, secure payment gateways, and user authentication protocols to ensure privacy and protection.
- **Performance**: Ensure system responsiveness, with key functions (e.g., search, order placement) executing within 2 seconds.
- **User-Friendly Interface**: Simple and intuitive design tailored to the needs of rural pharmacy owners.
- **Cross-Platform Accessibility**: Support for web-based access with mobile optimization for Android, and potential for iOS integration.
- **Reliability**: Maintain high system uptime, ensuring uninterrupted access to essential features.
- **Localization**: Provide language support and cultural customization for rural users in Bangladesh.
- **Compliance**: Adhere to applicable healthcare and data privacy regulations.

3.1.4 flowchart Diagram

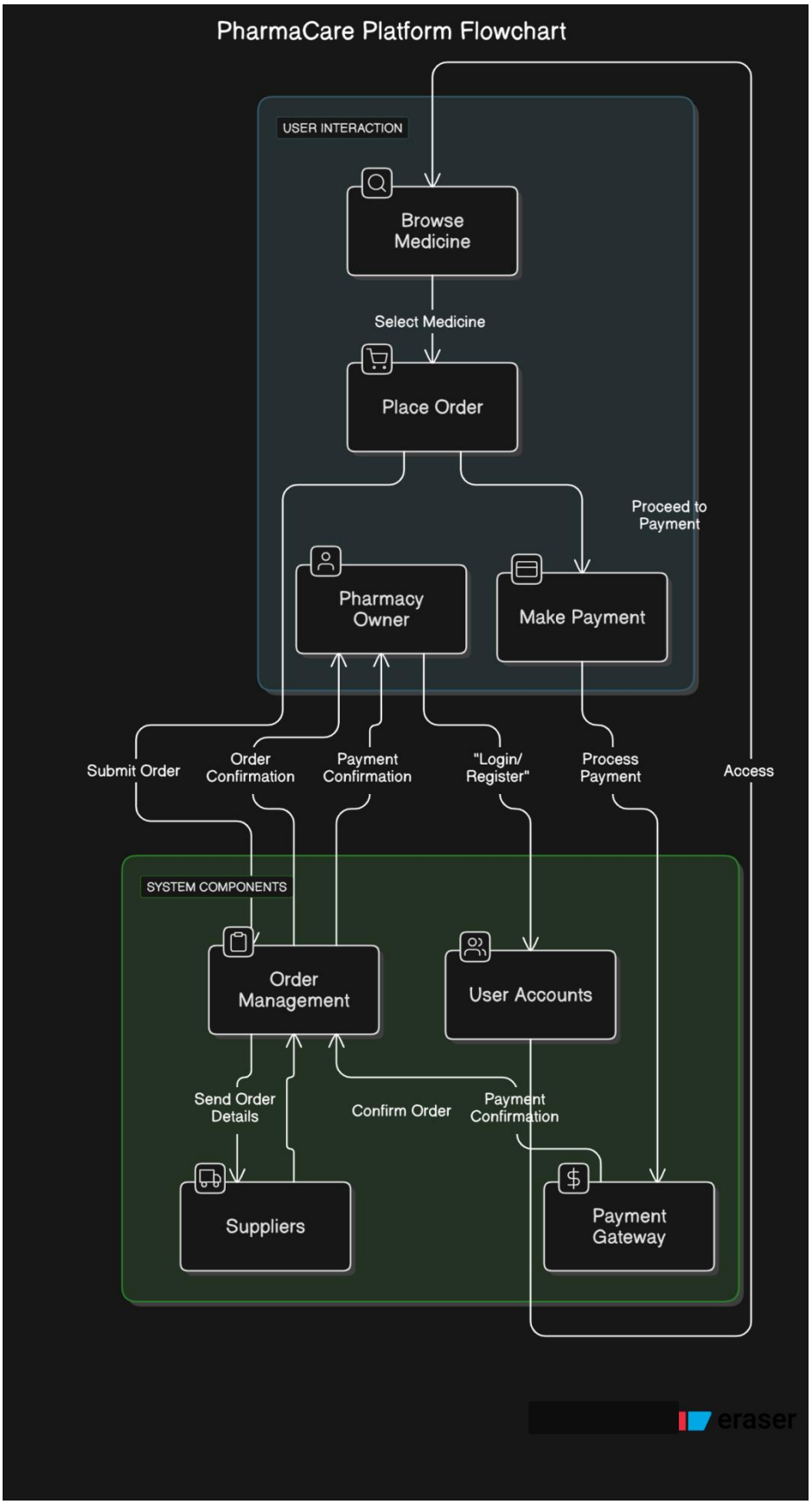

Fig 3.1.4 : Flowchart Diagram

3.1.5 Data Flow Diagram Level 1

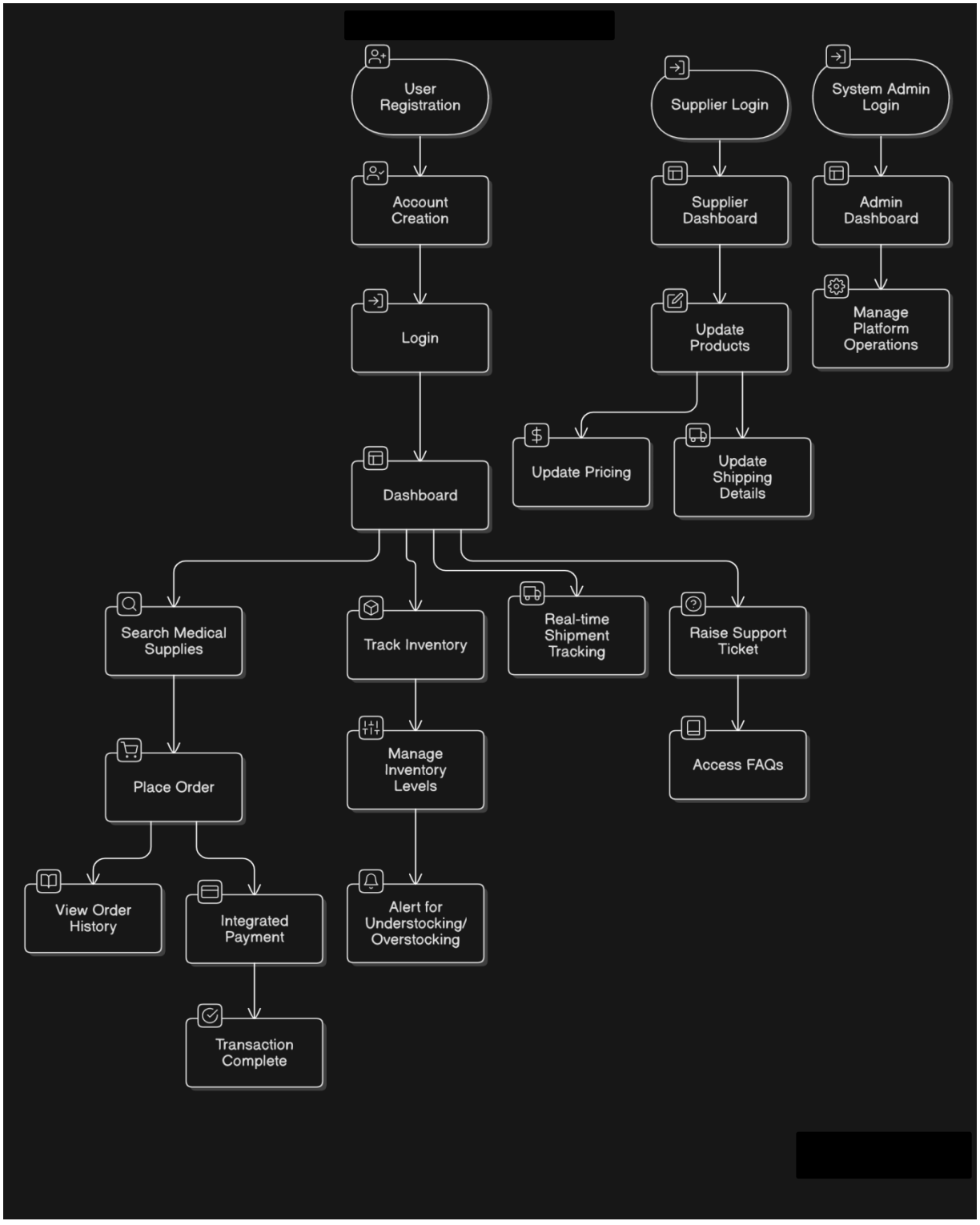

Fig 3.1.5 : Dataflow Diagram

3.1.6 UI Design

The UI design of Pharmacare is crafted with simplicity and functionality in mind, ensuring that rural pharmacy owners can easily navigate the platform without any technical hurdles. The design prioritizes clarity, accessibility, and a clean aesthetic to create a seamless experience.

Here's what PharmaCare's interface includes:

- **Landing Page**: Welcomes users with a clean layout featuring an engaging banner, a concise introduction to PharmaCare, and clear navigation options like Home, How It Works, Features, Suppliers, and Contact Us.
- **Pharmacy Dashboard**: A personalized hub where users can manage orders, check inventory levels, view notifications, and track shipment statuses in real time.
- **Order Management Page**: A straightforward interface to browse available medicines, place bulk orders, and access supplier details. It also shows order history for easy reference.
- **Inventory Tracking Page**: Helps pharmacy owners keep an eye on their stock, with automated alerts for low inventory and suggestions for restocking.
- **Supplier Directory Page**: Lists verified suppliers with filters for location, product type, and ratings, making it easy to establish direct connections.
- **Notifications and Alerts Panel**: Provides timely updates about order confirmations, shipment status, and inventory levels, ensuring users stay informed.
- **Support Page**: Features a simple form for queries, a contact section, and access to a help center for troubleshooting and assistance.

3.2 Detailed Methodology and Design

Why Selected Solutions?

- **React and Vite**: Ensured a fast, efficient, and maintainable front-end development process with excellent scalability.[
- **Node.js**: Provided a lightweight and efficient backend that could handle API calls and dynamic features.
- **Firebase**: Reduced complexity in database management and authentication, allowing more focus on user-centric features.
- **Bootstrap**: Streamlined UI development with responsive, pre-styled components that ensured cross-device compatibility.

Design Highlights

Data Flow

- **Frontend Validation**: User inputs, such as medicine searches and order placements, are validated at the frontend using React forms and JavaScript.
- **Backend Processing**: Data is sent to the backend using Node.js APIs, where Firebase handles storage and retrieval efficiently.
- **Real-Time Updates**: Firebase's real-time capabilities enable instant updates for inventory changes, notifications, and order statuses.

Personalization

- Dashboards are tailored to each user, displaying personalized recommendations, order history, and supplier information.

Colors and Themes

- A **blue-based color scheme** was chosen to evoke trust and reliability, reflecting PharmaCare's core values.

Accessibility

- Input fields support multiple formats for data entry (e.g., quantity in packs or pieces) to accommodate varied user needs.

Development Tools and Support

- **HTML, CSS, and JavaScript**: Core technologies for structuring and styling the website.
- **React**: Component-based development ensured modular and reusable code.
- **Node.js**: Efficient backend for handling API requests and dynamic functionalities.
- **Firebase**: Real-time database and authentication support ensured a seamless and secure experience.
- **Vite**: Optimized build process for faster development cycles.
- **VS Code**: Used as the primary development environment.
- **Stack Overflow**: Served as a key resource for troubleshooting and implementing best practices.

3.3 Project Plan

The project was divided into multiple phases:

Research and Requirement Gathering:
- ○ Understanding user needs and defining project goals.
- ○ Reviewing similar platforms and researching health-related data.

System Design and Backend Setup:
- ○ Designing the database schema for health data, user profiles, and disease-specific suggestions.
- ○ Developing the ML model for heart disease risk prediction using scikit-learn.

Frontend Development:
- ○ Creating the landing page, dashboard, and health sections using Django templates . Bootstrap.

API Integration:
- ○ Fetching real-time weather data using the OpenWeather API.

Testing and Deployment:
- ○ Ensuring accuracy of predictions and suggestions.
- ○ Deploying the platform for users.

Feedback and Iteration:
- ○ Gathering user feedback and refining the system.

3.4 Task Allocation

The tasks for the development of PharmaCare were distributed among team members based on their expertise and areas of interest to ensure an efficient and organized workflow. Below is the detailed task allocation:

1. Ashraf Bhuiyan

Design and Documentation:

- Created the UI/UX design wireframes and user journey maps to ensure an intuitive and user-friendly interface.
- Documented system requirements, including functional and non-functional specifications.
- Designed the data flow diagrams (DFD) and context diagrams for visualizing system workflows.

Frontend Development:

- Developed the website interface using HTML, CSS, and React, ensuring responsiveness and cross-device compatibility.
- Designed and implemented pages for user login, dashboard, and order placement.
- Ensured a seamless user experience by integrating interactive elements and dynamic content.

Backend Development:

- Set up Firebase for real-time database management and user authentication.
- Developed backend APIs using Node.js for handling data operations and communication between the frontend and database.
- Built modules to manage pharmacy inventory, supplier information, and order history.

API Integration:

- Integrated APIs for real-time notifications and analytics.
- Added logic to process and display pharmacy inventory updates and order statuses.

2. Hassan Mahamud Mridul

Research and Data Collection:

- Researched rural pharmacy challenges and gathered data on medicine procurement processes.
- Collected information about competitors' platforms (e.g., MedEasy, LazzPharma) to identify gaps and differentiate PharmaCare.

Supplier and Pricing Module Development:

- Designed algorithms to compare and suggest the best suppliers based on medicine price and availability.
- Developed a module to enable price transparency and improve procurement efficiency for rural pharmacies.

Content Creation:

- Curated informational content about medicine categories, suppliers, and inventory management for the website.
- Developed resource pages for FAQs and tutorials on using the platform.

Monitoring and Reporting:

Developed dashboards to track user activity, pharmacy orders, and supplier engagement.

- Generated reports to evaluate the effectiveness of PharmaCare in addressing rural pharmacy challenges.

Collaboration Highlights:

- Regular team meetings ensured consistent progress tracking and task prioritization.
- Joint debugging sessions resolved complex issues in API integration and database queries.
- Collaborative brainstorming for feature enhancements, such as notification systems and real-time updates, improved platform functionality.

3. Md. Shamim Kabir

User Testing and Feedback Analysis:

- Conducted user testing to gather insights on the platform's usability and effectiveness.
- Analyzed user feedback and proposed improvements for UI/UX and feature enhancements.

Testing and Debugging:

- Conducted functionality tests on the backend, frontend, and database integration.
- Fixed issues related to user authentication, data synchronization, and API communication.

3.5 Summary

The PharmaCare project was developed with a user-centered approach, focusing on functionality, efficiency, and addressing the unique challenges faced by rural pharmacies. The development process included designing intuitive UI/UX wireframes, implementing responsive frontend features with React and Bootstrap, and building a robust backend using Firebase and Node.js. Extensive research identified gaps in existing platforms, which guided the development of unique features such as supplier comparison and price transparency modules. The team also integrated APIs for real-time notifications and streamlined inventory management to enhance user experienc

Chapter 4

Implementation and Results

4.1 Environment Setup

To develop PharmaCare, the environment was meticulously set up using a combination of tools and frameworks to ensure seamless development, deployment, and scalability. Below is an outline of the environment setup:

1. Development Tools

- **IDE:** Visual Studio Code was chosen for its versatility, robust plugin support, and excellent integration with modern web development tools.
- **Version Control:** Git and GitHub were employed for effective version control and collaboration, enabling the team to track changes and manage the project efficiently.

2. Backend Environment

- **Framework:** Node.js was selected for its asynchronous capabilities and ability to handle real-time operations crucial for supply chain management.
- **Database:** Firebase Firestore was used for its real-time data synchronization, scalability, and ease of integration with the frontend.
- **API Integration:** APIs were utilized to facilitate real-time notifications and supplier inventory updates, ensuring up-to-date information for users.

3. Frontend Environment

- **Framework:** React.js, supported by Vite for fast build processes and hot module replacement, was used to create an interactive and high-performance user interface.
- **UI Components:** Bootstrap, combined with custom CSS, provided a responsive design to ensure accessibility across various devices.
- **JavaScript and JSX:** Core technologies for implementing dynamic and seamless frontend functionalities.

4. Testing Environment

- **Browser Compatibility:** The platform was tested across popular browsers, including Chrome, Firefox, and Edge, to ensure cross-browser functionality.
- **Debugging Tools:** Chrome Developer Tools and React DevTools were used extensively for debugging and optimization.
- **Performance Testing:** Tools like Lighthouse were employed to assess page load speeds and overall performance.

The chosen setup ensured an efficient development process while prioritizing scalability, responsiveness, and user experience for PharmaCare.

4.2 Testing and Evaluation/Performance/ Comparative Analysis

Testing

Unit Testing

- Each module was rigorously tested to validate its functionality, including user registration, login, and order placement processes.
- Example: Testing real-time inventory updates to ensure seamless synchronization between suppliers and pharmacies.

System Testing

- Conducted end-to-end testing to ensure all components of PharmaCare, such as user dashboards, supplier connections, and order tracking, work together seamlessly.
- Example: Verifying the smooth interaction between the user interface, backend operations, and Firebase database.

User Acceptance Testing (UAT)

- A group of pharmacy owners provided feedback on the platform's usability and efficiency.
- Example: Evaluating the ease of order placement and the intuitiveness of inventory management features.

Performance Evaluation

- The platform's real-time inventory tracking and order processing were tested under high traffic, demonstrating stable performance without noticeable delays.
- The notification system showed consistent delivery times, ensuring timely updates on order statuses and stock alerts.
- Page load times averaged under 2 seconds, ensuring a smooth user experience across devices.

Comparative Analysis

Existing Platforms

- Platforms such as MedEasy, LazzPharma, and Arogga primarily focus on B2C services, catering to individual customers for purchasing medicines.
- These platforms lack features tailored to B2B needs, such as supplier connections, bulk order handling, and streamlined inventory management for rural pharmacy owners.

Strengths of PharmaCare

- PharmaCare is the first platform in Bangladesh offering a dedicated B2B solution for rural pharmacy owners, focusing on affordability and accessibility.
- Features like real-time inventory tracking, direct supplier connections, and cost-saving bulk order options distinguish PharmaCare from existing solutions.
- The intuitive user interface, built for small business owners, ensures ease of use even for those with minimal technical expertise.

4.3 Results and Discussion

Results

- Successfully implemented a user-friendly platform that allows rural pharmacy owners to connect with suppliers for affordable and accessible medicine procurement.
- Developed a real-time inventory management system to track stock levels and facilitate timely restocking.
- Integrated Firebase for secure user authentication, reliable database management, and smooth order processing.
- Designed an intuitive, mobile-responsive interface for seamless navigation and usability, even for users with minimal technical expertise.

Discussion

- The decision to use React and Vite contributed to a fast, dynamic user experience, enhancing page load speeds and responsiveness across devices.
- Feedback from rural pharmacy owners emphasized the platform's usability and its potential to reduce dependency on intermediaries, enabling direct supplier connections.
- Suggestions for future updates include expanding supplier networks, integrating pricing comparison features, and offering analytics tools for pharmacy business insights.
- The implementation of Firebase not only ensured a secure environment for user data but also allowed for scalable database management, critical for future platform growth.

4.4 Summary

The development of the PharmaCare platform involved setting up a robust environment with tools like React, Firebase, and Vite, ensuring scalability, security, and responsive design. A structured testing approach, including unit testing, system testing, and user acceptance testing, validated the platform's functionality and usability. The performance evaluation highlighted its efficiency, with real-time inventory updates and seamless supplier connectivity. Comparative analysis showed that PharmaCare stands out by addressing gaps in existing B2B medicine supply systems, catering specifically to rural pharmacies. The results demonstrated successful implementation of features like inventory tracking, secure authentication, and a user-friendly interface, while user feedback emphasized its potential impact. Future enhancements will focus on expanding features and supplier networks to make the platform even more comprehensive and accessibl

Chapter 5

Engineering Standards and Design Challenges

5.1 Compliance with the Standards

5.1.1 Software Standards

Frontend Development:

React: Chosen for its component-based architecture and efficient rendering, ensuring a responsive and dynamic user experience.
Vite: Used as the build tool for faster development and optimized deployment.
CSS and JavaScript: Implemented for styling and interactive features to enhance usability.

Backend Development:

Firebase: Selected for its robust, serverless backend capabilities, including real-time database and secure user authentication.
Node.js: Utilized for handling server-side operations and ensuring seamless communication with the frontend.

Development Tools:

Visual Studio Code: Preferred IDE for its flexibility, extensive plugin library, and debugging capabilities.
Version Control (Git and GitHub): Ensured efficient collaboration and version tracking between team members.

Libraries and APIs:

Axios: Used for making secure and efficient API calls.
Lodash and Other Utility Libraries: Employed to simplify data processing and operations.

5.1.2 Hardware Standards

The project requires:
Minimum user hardware requirements:
Client Devices: Modern web browsers on desktops, tablets, or smartphones.
Development Environment: A computer.

5.1.3 Communication Standards

The project uses:

HTTP/HTTPS protocols for secure communication between clients and theserver.

5.2 Impact on Society, Environment and Sustainability

5.2.1 Impact on Life

PharmaCare aims to improve the accessibility of medicines for rural pharmacy owners, ensuring they receive medications at fair prices. By bridging the gap between pharmaceutical suppliers and local pharmacies, PharmaCare can significantly enhance the availability of medicines in underserved regions, potentially saving lives by ensuring timely access to required medications.

5.2.2 Impact on Society & Environment

Society: PharmaCare promotes equal access to affordable medicines for rural pharmacies, improving healthcare delivery in remote areas. It encourages better pharmaceutical practices and empowers pharmacy owners with a reliable platform to manage supplies.

Environment: PharmaCare operates online, reducing the need for physical infrastructure and minimizing paper-based transactions. Its digital model helps in reducing the carbon footprint by eliminating unnecessary physical shipments and documentation.

5.2.3 Ethical Aspects

PharmaCare adheres to ethical standards by using open-source and licensed tools, ensuring all software components are legally sourced. User data is handled with strict privacy policies, ensuring that sensitive business and personal information is securely stored and processed in compliance with ethical data management practices.

5.2.4 Sustainability Plan

The platform is designed for scalability, with the ability to add more suppliers and pharmacy users as the system grows. The modular architecture allows for easy updates and enhancements, ensuring long-term viability and the ability to adapt to changing market and technological conditions.

5.3 Project Management and Financial Analysis

SN	Fundamental	Estimated Cost (BDT)
1.	Domain and Hosting	5000-8000
2.	Meeting with stakeholders	3000-5000
3.	Testing and SQA	8000-10000
4.	Contingency(15%)	2500-3000
	Total	18,500-26,000

5.4 Complex Engineering Problem

5.4.1 Complex Problem Solving

Table 5.1: Mapping with complex problem solving.

EP1 Dept of Knowledge	EP2 Range Of Conflicting Requirements	EP3 Depth of Analysis	EP4 Familiarity of Issues	EP5 Extent of ApplicableCodes	EP6 Extent Of Stake-holder Involvement	EP7 Interdependence
✓		✓	✓			✓

EP1: Uses machine learning for disease risk assessment.
EP3: Involves deep analysis of user data and health metrics.
EP4: Integrates familiar APIs for weather data and a custom backend database.
EP7: Interdependence between various modules like the frontend, backend, and APIs.

Mapping with Knowledge Profile for EP1.

Table 5.2: Mapping with knowledge Profile.

K3 Engineering Fundamentals	K4 Specialist Knowledge	K5 Engineering Design	K6 Engineering Practice	K8 Research Literature
✓		✓		✓

K3: Engineering fundamentals applied in system design.
K5: Engineering design in creating dynamic interfaces.
K8: Research literature guided feature implementations.

5.4.2 Engineering Activities

Table 5.3: Mapping with complex engineering activities.

EA1 Range of resources	EA2 Level of Interaction	EA3 Innovation	EA4 Consequences for society and environment	EA5 Familiarity
✓	✓	✓		

EA1: Involves various resources like REST APIs, machine learning libraries.
EA2: Moderate interaction between user data and backend systems.
EA3: Innovative approach in combining health data and weather-based suggestions.

5.2 Summary

This chapter presented the engineering standards and design challenges associated with Pharmacare. It discussed compliance with software and hardware standards, ethical considerations, and sustainability plans. The impact on society and the project's financial analysis were addressed. Finally, the project's alignment with complex problem-solving criteria and engineering activities was justified, demonstrating its innovative approach and potential societal benefits

Chapter 6

Conclusion

6.1 Summary

In conclusion, PharmaCare aims to revolutionize pharmaceutical distribution by offering a user-friendly platform that connects rural pharmacy owners directly with suppliers, eliminating the need for multiple intermediaries. By providing an efficient and cost-effective solution for procurement, PharmaCare helps improve access to essential medicines while reducing transaction costs. The platform features advanced tools like real-time shipment tracking, inventory management, and a streamlined ordering system, all designed with small business owners in mind. With its focus on improving operational efficiency and enhancing service delivery, PharmaCare plays a key role in supporting local communities and improving healthcare outcomes. Through innovation and technology, PharmaCare is paving the way for a more accessible and affordable pharmaceutical supply chain.

6.2 Limitation

Despite its many benefits, PharmaCare has a few limitations that need to be considered:

Geographical Limitations: Currently, the platform is focused on serving rural pharmacy owners in specific regions of Bangladesh. Expansion to other areas may require additional resources and infrastructure.
Internet Dependency: PharmaCare relies on stable internet connectivity for its operations, which could be a challenge in remote areas with unreliable internet access.
Regulatory Challenges: Compliance with pharmaceutical regulations and quality control standards in different regions could present challenges, especially when expanding to new markets.
Supply Chain Limitations: While PharmaCare offers a streamlined ordering system, the efficiency of the supply chain depends on the reliability of suppliers and the transportation network, which can occasionally cause delays.
User Adaptability: Some rural pharmacy owners may face difficulties in adapting to digital platforms due to a lack of familiarity with technology, which could limit user adoption.
Limited Payment Methods: The platform's payment options may not cover all users, especially in rural areas where digital payment infrastructure is still developing.
Dependence on Third-party APIs: PharmaCare integrates with external services for certain functionalities like shipment tracking and payment processing. Any issues with these third-party services could affect the platform's performance.

6.3 Future Work

Future work for PharmaCare includes several enhancements aimed at improving user experience, expanding service capabilities, and increasing platform accessibility:

Geographical Expansion: Expanding PharmaCare's reach to more rural areas across Bangladesh and potentially to other regions in South Asia, ensuring that more pharmacy

owners can benefit from the platform.

Offline Functionality: Developing an offline mode or improving the app's functionality in low-network areas to ensure that pharmacy owners can still access critical features even when internet connectivity is poor.

Additional Payment Options: Integrating more payment methods, including mobile banking and cash-on-delivery options, to cater to a wider range of users, particularly in rural and remote areas.

Improved User x and Support: Providing more extensive training resources, such as video tutorials and on-site support, to help pharmacy owners familiarize themselves with the platform and improve adoption rates.

Supply Chain Enhancements: Strengthening partnerships with additional pharmaceutical suppliers to expand the range of products available and ensure faster, more reliable delivery.

Mobile App Development: Introducing a mobile version of the PharmaCare platform to make it more accessible for pharmacy owners on-the-go and enable seamless ordering and management from smartphones.

AI-Driven Analytics: Integrating AI and machine learning models to offer predictive analytics, helping pharmacy owners better forecast demand and optimize stock levels based on past trends.

Regulatory Compliance: Continuously monitoring changes in pharmaceutical regulations and ensuring that PharmaCare remains compliant with industry standards, which will be critical as the platform grows.

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