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CSC 490: Software Engineering

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Report License

Meet the Team

I. PREFACE

This document serves as the Software Requirements Specification (SRS) for the creation of an innovative pharmacy information system. The purpose of this SRS is to offer a detailed account of the system's key requirements and a strategic overview of its architecture. By defining both the functional and non-functional requirements, this document aims to provide a solid framework for the development team to design, implement, and rigorously test the system.

Adhering to the IEEE standards for software requirements specification, this document is organized into dedicated chapters covering vital stages of the system's development lifecycle. It begins with an introduction that highlights the necessity of the system and its strategic alignment with the pharmacy's operational objectives. To ensure clarity and consistency, a glossary section has been included, offering precise definitions for technical terms.

The user requirements and system requirements sections delve into the specific services and features expected from the system, outlining both user-centric functionalities and technical specifications. These sections serve as a foundational guide for achieving the system's core objectives.

The system architecture section provides a comprehensive view of the system's structural design, enabling stakeholders to better understand the implementation process and its alignment with intended goals. This is further supported by a system evolution section, which explores the system's capacity for growth, flexibility, and future integration with external solutions.

A dedicated modeling section illustrates the requirements using UML diagrams and structured tables, offering stakeholders a clear visualization of the system's operational workflow. Additionally, the system testing section lays out the various test cases that will be used to verify the system's compliance with its specified requirements.

We anticipate that this document will serve as an essential resource for all stakeholders throughout the development and implementation stages. Our goal is to deliver a reliable, high-quality solution that addresses the pharmacy's needs and enhances its overall efficiency.

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II. Introduction

Pharmacies play a vital role in the heart of healthcare, and with the rapid evolution of technology, it is time for our country Lebanon to embrace a new era of digital health solutions. That is why we as ARZ Devs decided to carry this responsibility and try to revolutionize the pharmacy industry in the country by introducing innovative and creative ideas to lay the basis for a comprehensive electronic system that simplifies operations, enhances accessibility, and improves the patient experience.

ARZ Devs, a pioneer in digital solutions, has long provided its expertise to clients across the MENA region. Now, we're excited to bring our vision to life in Lebanon's healthcare landscape, focusing on electronic health records and seamless, digital interactions within pharmacies. "The future of pharmacy practice clearly lies in the value of the clinical & personalized decisions made by pharmacists with each patient encounter"[1]. This quote highlights the importance of increased pharmacist integration in healthcare decisions and the potential and benefit of tailored care. By implementing features like personalized patient profiles, digital prescription and request management, and an intuitive public discussion board where patients can seek advice from pharmacists, we hope to make healthcare more individualized and efficient for all.

Using our pharmacy management system, patients can easily manage their health records, get tailored treatment, request approval from pharmacists, ask questions, and order medications from the comfort of their homes, while pharmacists gain powerful tools to manage records, respond to patient inquiries, grant approval, ask for documentation, and offer personalized services for the people. All these capabilities are safeguarded by secure authentication, ensuring that sensitive information remains protected.

This software requirements document for the ARZ Devs Pharmacy System covers the key features, user needs, and system requirements that will guide the development team. A glossary has also been included to ensure clarity for readers unfamiliar with pharmacy or digital health terminology. We hope that our vision to create a sustainable, tech-driven future for Lebanese pharmacies comes to light so that we can bring healthcare closer to the people and empower them with tools that truly make a difference.

Finally, our symbol of perseverance and pride, the cedar, is found in our name and logo!

Patient Information Questionnaire

We have included the questionnaire required to create an electronic health record for each customer as a reference. Dr. Ramzi, we would greatly appreciate it if you could fill out this form using the following link: https://docs.google.com/forms/d/e/1FAIpQLSdOUejREqQtosMQp25kTv1z3Y7BQioKiy6Gu26BAWVgnxq0lA/viewform

Text Form

Patient Name: _____

Date of Birth: Chosen on Calendar

_____

1. General Health and Medical History

- Do you have any chronic health conditions? (e.g., cancer, diabetes, hypertension, asthma)

- ☐ Yes

- ☐ No

- If yes, what are your chronic diseases?

☐ Diabetes

☐ Cancer

☐ Hypertension

☐ Asthma

☐ Chronic Kidney Disease

Other: _____

- Do you have any known allergies?

- ☐ Yes

- ☐ No

- If yes, please specify: _____

- What is your current height?

_____ (cm or ft/in)

- What is your current weight?

_____ (kg or lbs)

- Do you have any family members with chronic health conditions? (e.g., diabetes, heart disease, cancer)

- ☐ Yes

- ☐ No

- If yes, please specify the conditions and relationship: _____

_____

2. Medication and Supplement Use

- Are you currently taking any medications?

- ☐ Yes

- ☐ No

- If yes, please list the medication names, dosages, and frequency: _____

- Do you take any over-the-counter medications, vitamins, or supplements?

- ☐ Yes

- ☐ No

- If yes, please specify: _____

_____

3. Lifestyle and Additional Information

- Do you smoke or use tobacco products?

  - ☐ Yes

  - ☐ No

  - If yes, how many per day? _____

- Do you consume alcohol?

  - ☐ Yes

  - ☐ No

  - If yes, how many drinks per week? _____

- How often do you engage in physical exercise?

  - ☐ Daily

  - ☐ 3-4 times per week

  - ☐ 1-2 times per week

  - ☐ Rarely

  - ☐ Never

- On a typical day, how many hours do you spend sitting?

  - ☐ Less than 2 hours

  - ☐ 2-4 hours

  - ☐ 4-6 hours

  - ☐ More than 6 hours

- How would you describe your diet?

  - ☐ Balanced

  - ☐ High in carbohydrates

  - ☐ High in protein

  - ☐ Vegetarian/Vegan

  - ☐ Low-calorie/Low-carb

  - ☐ Other (please specify): _____

- Do you have any dietary restrictions or preferences?

  - ☐ Yes

  - ☐ No

  - If yes, please specify: _____

- How many hours of sleep do you get on average per night?

  - ☐ Less than 5 hours

  - ☐ 5-6 hours

  - ☐ 6-7 hours

  - ☐ 7-8 hours

  - ☐ More than 8 hours

- Do you have any sleep-related concerns?

  - ☐ Difficulty falling asleep

  - ☐ Waking up frequently

- ☐ Feeling tired upon waking up

- ☐ Other (please specify): _____

- On a scale of 1 to 10, how would you rate your current stress level?

- Scale: 1 2 3 4 5 6 7 8 9 10

- Do you have any mental health concerns or conditions? (e.g., anxiety, depression)

- ☐ Yes

- ☐ No

- If yes, please specify: _____

- Is there anything else you would like the pharmacist to know?

_____

_____

4. Immunization Status

- Are your vaccinations up to date?

- ☐ Yes

- ☐ No

- ☐ Not Sure

Upload Vaccination Record.

- Have you received a flu shot this season?

- ☐ Yes

- ☐ No

- ☐ Planning to

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5. Insurance Information

- Do you have health insurance?

- ☐ Yes

- ☐ No

- Insurance Provider Name: _____

- Policy Number: _____

- Group Number (if applicable): _____

Upload Insurance Document.

Emergency Contact Information (Optional)

Name: _____

Relationship: _____

Phone Number: _____

III. Glossary

- Technical Glossary
    1. Domain Name System (DNS): A protocol that defines the mapping between human readable domain names and IP addresses understandable by machines[2].
    2. Database: An organized collection of data that is saved on a computer. Usually used in many applications and websites to store data efficiently and make updating it easier.
    3. Email: Is a way of sending and receiving messages between people registering for email electronically.
    4. Functional Requirements: Requirements that reflect what the system must do, it may also tell what the system must not do.
    5. Hypertext Transfer Protocol (HTTP): An application layer protocol designed to transfer information between networked devices and runs on top of other layers of the network protocol stack[3].
    6. Hypertext Transfer Protocol Secure (HTTPS for short): Protocol that secures communication and data transfer between a user's web browser and a website[4].
    7. Distributed Denial of Service Attacks (DDoS): A malicious attempt to disrupt the usual flow of traffic to a specific server, service, or network by flooding the target or its infrastructure with excessive internet traffic[5].
    8. Two Factor Authentication: Also known as (2FA), or two-step verification. It is a two-step login process, the first is typically an email and password, and the second step is verifying access through means only accessible to the user, such as their phone number or email.
    9. Secure Sockets Layer (SSL): A security protocol that is responsible for transmitting data over the internet securely[6].
    10. My SQL: An instance of a relational database management system developed by Oracle. It is based on the structured query language[7].
    11. Server: A computer or a system used to host websites, databases, and applications by providing resources, data, and services to clients such as other computers or programs.
    12. Transport Layer Security (TLS): A cryptographic tool employed to secure data is transit over the internet. It is an enhanced version of SSL.
    13. SSL/TLS Certificate: A digital certificate that authenticates a website's identity that provides a secure client/server connection.
    14. DNS Spoofing: A cyberattack that manipulates DNS records and replaces IP addresses with misleading ones redirecting the user to a malicious website.
    15. DNSSEC: DNS system security extensions is a collection of protocols meant to secure DNS by encrypting DNS data to ensure its integrity.

- Nontechnical Glossary
    1. Customer/Patient: A person who purchases products or seeks medical services at the pharmacy.
    2. Pharmacist: A healthcare professional responsible for dispensing medications and advising on their safe use.
    3. Electronic Health Record: A digital version of a patient's medical history, including prescriptions and treatments, that can be easily accessed by authorized healthcare providers.
    4. Stock Record (for pharmacy): A record of every available item purchased for a pharmacy saving its type, source, quantity, and many other important details.
    5. Cosmetic: Products with beautifying effects such as skincare products and makeup.
    6. Question Board: A common place where customers ask questions relevant to the pharmacist and receive their answers.
    7. Approval Labels :
        - No Approval Needed: The product can be purchased without any special permissions.
        - Approval From Pharmacist: The product requires a pharmacist's approval for purchase.
        - Prescription Needed: The product requires a doctor's prescription to be uploaded before it can be purchased.
        - Health/Ministry Document Needed: Government or health ministry documentation is required for purchase.

IV. User Requirements Definition

The success and longevity of any pharmacy system rely on delivering users' requirements and serving as a trusted tool for their needs. This section outlines the user requirements, gathered from our survey sent to stakeholders and refined to ensure it covers the basic functionality needed.

A. Sign up, Login, and System Access

• The system user shall log in to the system to access services, provided they already have an account. Otherwise, they must sign up and create an account to use the system.

• For the sign-up process, the system user must enter a valid password that is approved by the system.

• If signing up as a pharmacist, a verification request shall be sent to the system owner before account activation.

• If signing up as a customer, a questionnaire should be filled to create the customer's electronic health record.

• Different user roles, such as owners, pharmacists and customers, shall have unique portal access tailored to their needs and privileges.

B. Inventory Management

• The system shall house a database of information on medications.

• The system shall generate automatic alerts for low stock levels or near-expiry items.

• Pharmacists shall be able to update stock levels after restocking or dispensing medications. They can also add or modify records.

• A "Sales Records" button shall be available to the owner.

C. Information

• The pharmacy's website shall serve as the primary access point for both customers and staff.

• The system database shall be always up to date with all the relevant information regardless of the location of the hosting device.

• The system database shall always be up to date with all the relevant customer information, such as contact details, health records, and order histories.

• The system database shall always be up to date with all the relevant product information and pharmacy records.

D. Order and Delivery Services

• Customers shall be able to place orders for medications and healthcare products directly through the website. Additionally, customers shall be able to request approvals from pharmacists and view their order history.

• The system shall allow customers to track pending requests. Additionally, customers shall be able to track their orders in real time and receive updates on their delivery status.

• Pharmacists shall be able to search and view patient medication history and orders in compliance with relevant privacy laws. Additionally, pharmacists shall be able to check pending requests and give approval or request additional documentation.

E. Administrative Controls

• The owner shall have an Administration page containing profiles of all registered pharmacists.

• From the Administration page, the owner shall have the ability to assign specific tasks to pharmacists daily, supporting effective staff management.

• From the Administration page, the owner shall have the ability to block users if they deem that necessary.

F. Search and Filter Functionality

• Users shall have access to a search bar on the website to look up medicines and cosmetics by entering keywords.

• The system shall display a list of relevant results based on the entered keywords.

• Users shall be able to filter search results by category to simplify and streamline product discovery.

G. Features

• Users shall be able to edit profile information, including contact details, electronic health records, medical documents, and preferred delivery addresses.

• The system shall provide data analysis features such as sales reports and inventory forecasts to assist pharmacy staff.

• Pharmacists shall be able to publish blogs that customers can read.

• An account recovery feature shall be available to help users reset access credentials quickly and securely.

• The system shall be compatible with foreign languages to cater to a diverse customer base.

H. Public Q&A Page

• Customers shall have access to a public page on the website where they can post medical questions for pharmacists.

• Customer identities shall remain anonymous on the Q&A page to protect privacy, displaying only generic identifiers for each question.

• Only pharmacists shall have permission to respond to questions, ensuring that answers are accurate and professionally vetted.

• All posted questions and pharmacist answers shall be visible to the public, serving as a shared medical knowledge resource.

• Pharmacists shall have the ability to pin answers, delete questions, and post tips on the board.

I. Ease of Use, Performance, and Reliability

• The website shall have a clear and easy-to-navigate interface for users of all ages.

• The system shall be able to handle a large number of visits without crashing, especially during peak order hours.

J. Security

• The website shall incorporate updated security practices and technologies to safeguard users' personal and health data.

• The system shall use HTTPS for secure transmission.

• The system shall implement secure session management to ensure authenticated user actions are uniquely associated with valid session identifiers.

• The system shall regenerate session IDs upon login and periodically during user sessions to mitigate session fixation and hijacking risks.

• The system shall use session expiration to log out inactive users automatically.

V. System Requirements Specification

A. Sign up, Login, and System Access

• The system shall display a login page before granting access to any services, ensuring that unauthorized users cannot bypass authentication.

• This page will include fields for both username and password, as well as a clear “Forgot Password” link to assist users in recovering their accounts.

• Users who already have an account shall log in by entering their username and password. Successful login will redirect them to their appropriate dashboard.

• Users without an account shall complete a registration form with fields for an active email address, full name, birth date, phone number, and physical address, ensuring the system has sufficient information to identify and contact the user if needed.

• The system shall enforce a password policy requiring a minimum of 8 characters, including at least one uppercase letter, one lowercase letter, one numeric digit, and one special character.

• If the password entered doesn’t meet the requirements, the system will display an error message, prompting the user to correct it.

• To add a layer of security, the system will employ two-factor authentication for all users. After entering the correct password, users will receive a one-time code sent to their registered email or phone number, which they must enter to complete the login process.

• Role-Based Access Control shall be used to limit access based on user roles. The system will verify the user’s role upon login and grant access to specific pages and features according to the permissions of that role. Customers will access the shopping interface, owners and pharmacists will access the inventory and Q&A sections.

• When a user signs up as a pharmacist, they will check a designated box to request a pharmacist account. This action prompts the system to notify the owner of a pending verification request. The owner can then review the submitted credentials or documents and activate the pharmacist’s account if verified. This ensures that only certified professionals can access pharmacist-only features.

• Customers shall complete a medical questionnaire upon registration, creating a basic electronic health record. The EHR stores essential health data to support personalized service, such as medication recommendations and health tips.

B. Inventory Management

• Pharmacists shall have an “Add Item” option to add new products and an “Update” option to adjust quantities after stock changes or dispensing.

• Pharmacists shall have the “Add Record” option to add stock and supplier records. The system shall present pharmacists with a graphical interface displaying product details like stock levels, expiration dates, suppliers, and prices. This layout should support filtering and sorting options for ease of management.

• The system shall automatically monitor stock levels and expiration dates. Alerts will be triggered when stock falls below a predefined threshold or if items are close to expiration. Notifications will be visible on the pharmacist’s dashboard.

• For owners, an inventory page shall include a “Sales Records” button to access a daily report of sales data. The system will compile all daily transactions into a report, saved as a PDF. Older reports will be stored in a searchable history, allowing the owner to review historical sales data and trends.

C. Information

• The system shall apply all updates to customer data, medication information, and inventory in real time. This ensures accurate, up-to-date records and facilitates real-time data access by pharmacists and owners.

• The system shall ensure consistency by implementing data synchronization protocols across distributed devices or locations. Any modifications made at one access point will propagate to all connected instances to maintain data integrity.

• Data within the system shall be categorized based on type, such as customer profiles, product information, order histories, and health records, each stored in dedicated sections within the database. Organized categorization improves search ability and ensures that information retrieval is efficient for both customers and pharmacy staff.

D. Order and Delivery Services

• Customers shall browse products on the website, select items to add to their cart, and place orders directly. Some medications may require pharmacist approval, in which case customers will receive prompts to upload relevant documents.

• Customers shall access a “My Orders” page to view order history and monitor current order statuses, including notifications when orders are packed, dispatched, and out for delivery.

• Notifications shall be sent to customers via email or SMS for order confirmations, processing updates, and delivery milestones. This ensures customers stay informed throughout the purchasing and delivery processes.

• Customers shall have access to real-time tracking for deliveries, including estimated arrival times.

• Secure online transactions shall be conducted through a trusted third-party payment processor to ensure compliance with financial security standards.

E. Administrative Controls

• Owners shall access an Administration page where all pharmacist profiles are visible. These profiles shall display the pharmacist's name, contact information, certification status, and assigned tasks.

• Owners will have options to assign daily tasks to pharmacists, such as inventory audits, customer consultation responses, or order management..

• Owners shall have the authority to block accounts in cases of misuse or misconduct, helping to maintain system integrity and safety.

F. Search and Filter Functionality

• Users can enter keywords related to products (e.g., "aspirin" or "face cream") into a search bar, and the system will display a list of relevant items.

• Results can be filtered by categories like medication type, supplements, skincare, symptoms, and type of approval needed. This helps users quickly locate desired products and enhances the overall shopping experience.

• Both sales and stock records can be filtered by date.

• Orders for customers can be filtered by date.

G. Features

• Users shall access a profile page where they can edit personal information, including name, address, email, phone number, and profile picture. Pharmacists may additionally update professional details like credentials.

• In case of forgotten credentials, users can reset their password using email or SMS verification. This process shall be secure and involve multiple verification steps to prevent unauthorized access.

• For owners, the system shall include data analytics features, generating sales trends, inventory forecasts, and other performance metrics for informed decision-making.

• The system shall offer language translation options through Google Translate or equivalent. This enables non-native speakers to navigate the interface comfortably.

H. Public Q&A Page

• Customers shall have the option to post anonymous questions to a public Q&A page, with only pharmacist responses allowed.

• Pharmacists shall moderate the page, pinning important responses, deleting inappropriate questions, and posting general health tips, ensuring high-quality content.

• All questions and answers shall be visible to the public, serving as a shared resource for medical information.

I. Ease of Use, Performance, and Reliability

• The system shall feature a user interface optimized for accessibility, including keyboard shortcuts, screen reader compatibility, and adjustable font sizes for visually impaired users.

• The system shall handle high traffic without degradation in performance, especially during peak order times. Performance testing will ensure optimal load handling.

J. Security

• HTTPs shall secure all data transmissions, ensuring encrypted communication and protecting sensitive user information from interception.
• The system shall implement robust session management, including unique session IDs, session regeneration upon login, and automatic session expiration after inactivity.
• The system shall perform regular backups of critical data to facilitate recovery in case of system failure or data corruption.

VI. System Architecture

Three architectural patterns–layered, client-server, and role based access control will be embedded in the system to be developed. This is meant to segregate system components with different roles such as user interface, database, and authentication. The system is intended to be modular ensuring flexibility in integrating new components to the system while preserving its basic structure.

A. Client-Server Architecture:

This Pharmacy System uses a Client-Server Architecture to create a centralized system where users access functionalities through a web interface. The client side is where the actual interaction is initiated between the user's web browser and our system's website, while the server side is the place where the website is hosted, responding to clients' requests.

The server serves as the central part of the system responsible for major processes such as user authentication, data synchronization and management, and user interaction. As the user logs in, the server verifies his/her credentials by retrieving data stored in the database before granting them access to the website. SSL encryption is employed to ensure secure communication through encrypting sensitive data in transit such as user credentials, health records, and order details providing a secure channel for communication between the client and the server. Also, the server uses reverse proxies to protect the system from DDoS attacks by filtering and handling the traffic. Real-Time Synchronization is achieved by storing every interaction with the system on a centralized database. This ensures the system is always updated with every new interaction such as the customer requesting a product and the request appearing on the pharmacists portal in the time the request was sent to be examined, or the pharmacist updating the inventory where changes appear immediately on each customer's portal.

The client side runs the interface layers of the website through the browser. Each interaction initiated on the client side is processed by the server before displaying specific data based on each user's privileges. For example, the client sends a purchase request from the items available for him/her and waits for the pharmacist's response that will occur on his portal. The server actually is responsible for transmitting this request to the pharmacist and his/her response back to the client.

B. Layered Architecture:

Three different layers will constitute the system: Presentation layer, Application layer, and Data layer. Each with different defined functions.

1. Presentation Layer:

The first layer represents the interface of the system. Being associated with user activities, it will provide the ability of initiating data transactions in a well established front-end environment. HTML, CSS, and JavaScript are the front-end programming languages that will be used to develop this interface. Users will be able to access the system's website across different browser types and versions only by requesting the domain name of the website where different portals will be displayed for each distinct user type. Pharmacists will have access to inventory management tools, customers will navigate through the shopping interface, and the owner will have an administrative dashboard view.

2. Application Layer:

This layer is considered as an intermediary between the presentation layer and data layer. The bulk of the system lies in this layer where most of the computational work is done such as validating prescription approvals, processing orders, and enforcing access control. PHP is the scripting language that will be used in designing this tier. It manages the input of the client through the presentation layer and manages to process the output after interacting with the data layer. For example, a pharmacist will need to access the electronic medical record of a customer when they receive a request for a relatively complex medicine. The application layer is responsible for retrieving the intended medical record from the database and delivering it to the pharmacist.

3. Data Layer:

The functioning of any system fundamentally requires the secure storage of large amounts of data. With respect to our system, this data includes users' login credentials and the necessary information of each user type such as the electronic medical records for customers. It will also include every stock information inputted by the pharmacists and all essential associated details such as the arrival date and the overall price. It will also hold instances of products for sale, records of customers' orders, email conversations, questions and answers on the board page, and written blogs. The interaction with the users that is built on this data will happen at the presentation layer with the contribution of the application layer.

Our pharmacy system will be accessed by users through a dedicated website. The succession of the process requires the incorporation of different tools such as dedicated servers, domain name providers, and a cloud based SQL database.

Domain Name and Domain Name Server: Our system will be accessible via the domain name "arzpharmacy.com." The domain will be purchased from a domain registrar and managed by a DNS provider, which will map the domain name to the hosting server's IP using DNS protocol. The DNS server will store records that map our domain name to the server's IP address, allowing users to access the site using the URL instead of memorizing the IP. To secure the DNS records and protect against DNS spoofing, **DNSSEC** will be implemented, adding cryptographic signatures to verify DNS record authenticity. Additionally, **SSL/TLS certificates** will be used to encrypt data transmission between the client and the server, providing a secure channel that protects against IP spoofing and other attacks.

Dedicated Server: serves as the backbone of the website architecture where the application layer is being hosted along with the presentation layer (the actual website). Its IP is stored in the DNS that maps the domain name to it allowing the user to access this server and interact with the website.

SQL Database: A MySQL database will be the storage place of any data that enters this website.

C. Role-Based Access Control (RBAC) Architecture

RBAC is implemented to identify user permissions and assure that each user's access is aligned with his/her roles preserving an organized control over the system operations utilized by the three types of users: owner, pharmacist, and customer. The user's access permissions are dynamically assigned after a verified login according to the user type. This architecture maintains the integrity and confidentiality of data by restricting access to sensitive data only for authorized parties. Each user type will have a different

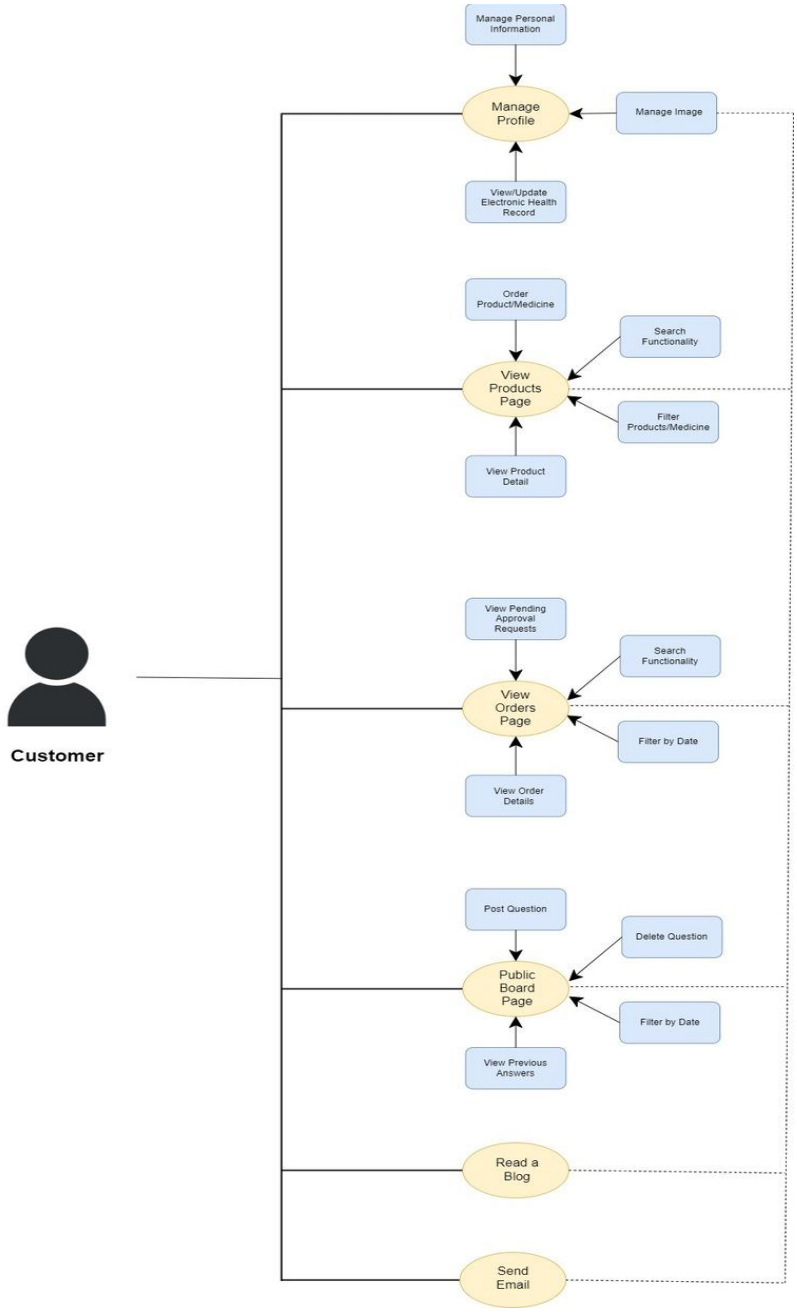
portal in the presentation layer according to his/her type where our system has three types of users with identified roles:

1. Customer: Limited to navigating, searching, and filtering available items for sale. Then issuing a request to order a certain medicine and tracking this order if approved by the pharmacist. The previous orders records of a customer will be available for him even after delivery for a duration of 90 days. Finally, the customer can ask questions, send emails, read blogs, and update his profile
2. Pharmacist: A more privileged user that is able to update inventory, approve customers' requests, request additional documents from the user, view their electronic medical record, update stock records, answer questions and reply to emails, and post blogs. Note that those are the general roles of the pharmacist, each pharmacist will be assigned a portion of those tasks.
3. Owner: The person that has the full access to the system. With respect to the customers, the owner can view every customer and block them for any inappropriate action. The owner is responsible for receiving new pharmacists' licenses and requests for accepting their registration, viewing their accounts, and assigning each one of them some tasks on a regular basis. The owner is the only user with administrative roles. One of the most crucial roles unique to owners is managing the sales records where they can view daily sales and benefit from data analytics to make appropriate business decisions. Owners can also update inventory, reply to customers' emails, and update their own profile.

VII. System Models

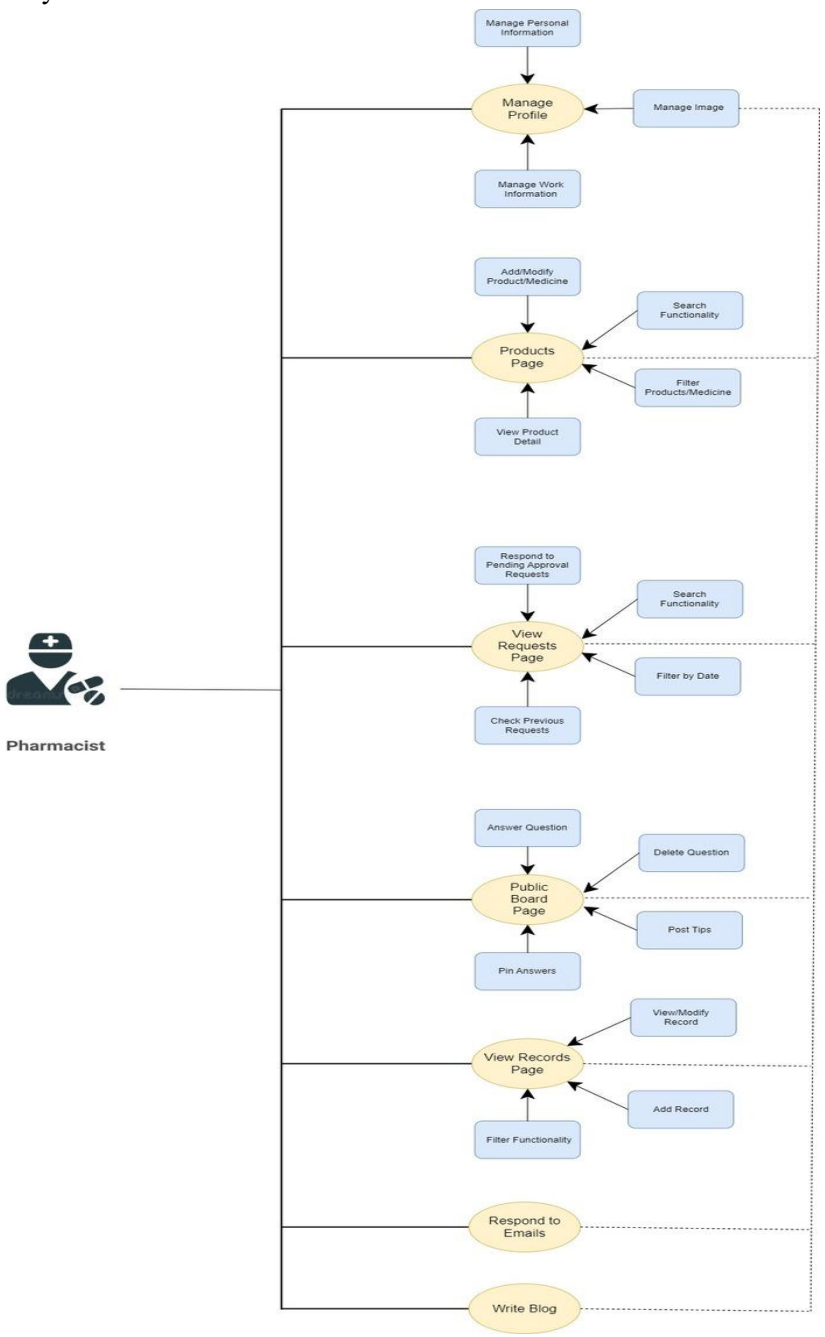
A. Use Case Diagram Customer

The Customer can interact with the system to perform a range of tasks such as managing their profile, which includes updating personal information and health records. They can also order medications/cosmetics, track their orders and pending approval requests, and access detailed product information. Additionally, customers can ask pharmacists questions on a public discussion board and also view previous or pinned answers or tips on the board. An authentication process safeguarded all these actions, ensuring secure and confidential access to the system's functionalities.



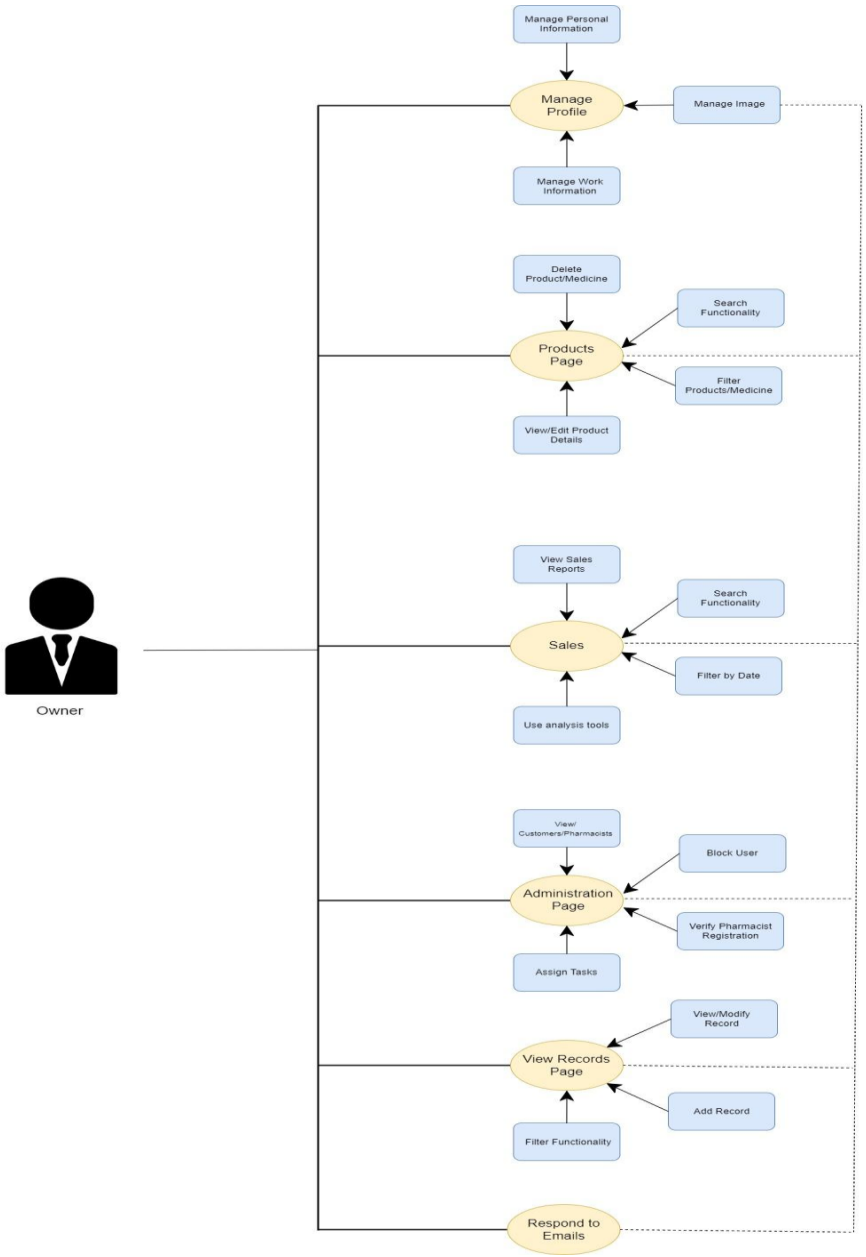
B. Use Case Diagram Pharmacist

The pharmacist can engage with the system to perform various tasks such as managing their profile, including updating personal and work-related information. They can also oversee products, add or modify available medications and cosmetics, and review or address pending approval requests of orders by checking the customer's electronic health records and any uploaded files. Pharmacists can respond to customer questions on a public discussion board, pin important answers, delete questions, and share useful tips. Additionally, they can manage pharmacy records by viewing, modifying, or adding entries. The system also allows pharmacists to respond to emails and write informative blog posts. An authentication process securely protects all actions, ensuring a reliable and confidential interaction with the system's functionalities.



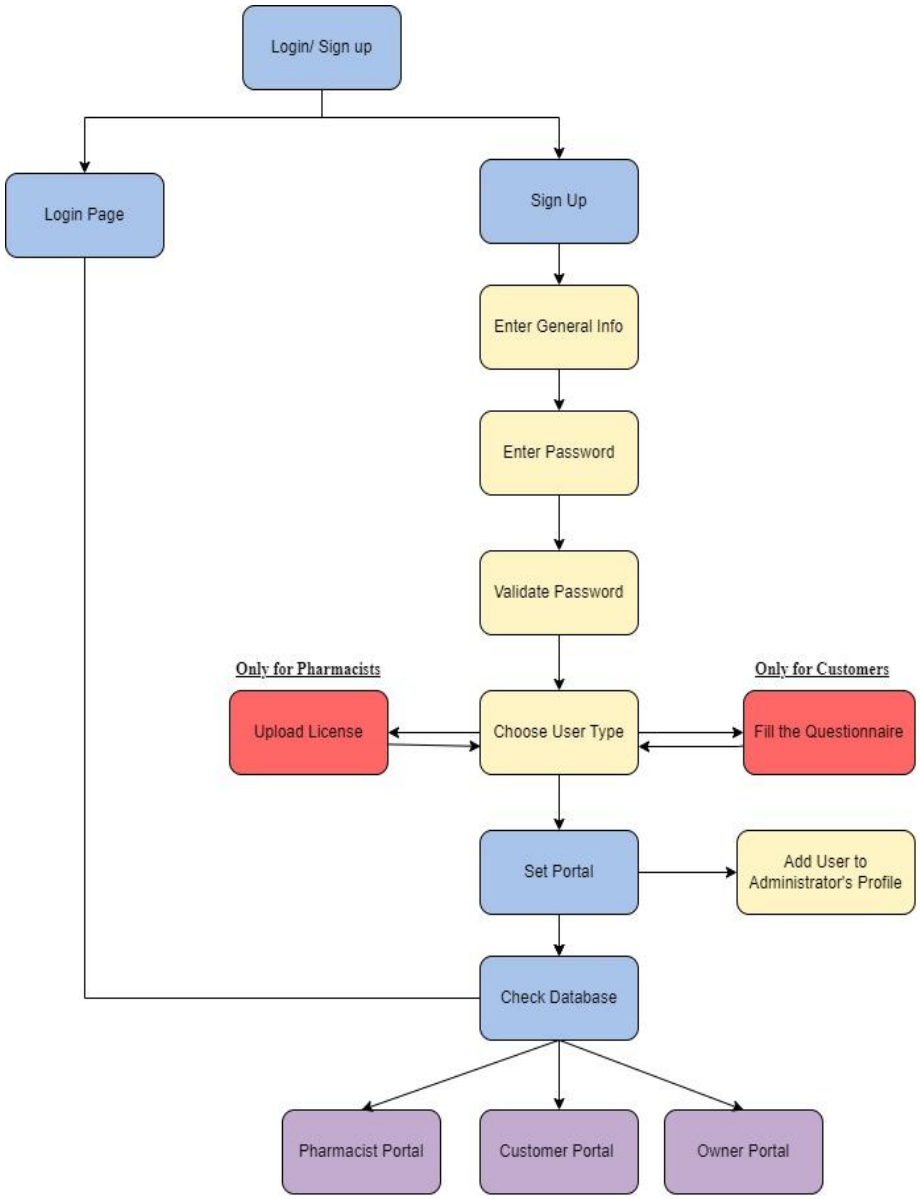
C. Use Case Diagram Owner

The Owner interacts with the system to oversee and manage various core functionalities critical to maintaining and optimizing business operations. On the products page, the owner can manage product listings and delete or edit product/medicine details. Sales management capabilities allow the owner to generate and view comprehensive sales reports, filter sales data by date, and employ analysis tools to assess business performance. Within the administration section, the owner can assign tasks to personnel, block users, and verify pharmacist registrations, ensuring adherence to standards. The owner also has the ability to review and modify stock records, add new entries, and filter records based on specific criteria. Lastly, the owner is equipped to respond to email inquiries, enhancing communication with stakeholders and customers. Robust access controls secure these operations, ensuring the integrity and privacy of the system.



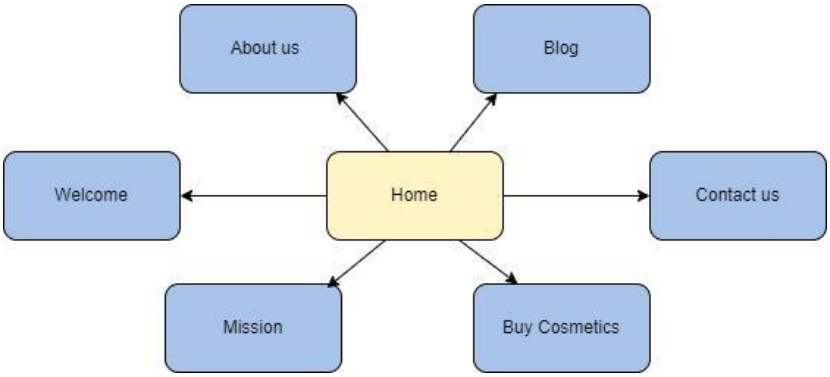
D. Login and Sign up Activity

To access the website, users are prompted to log in with their credentials if they are already registered. New users, whether customers or pharmacists, are required to sign up. The sign-up process for both groups involves entering general information, creating a password, and confirming it. Customers have an additional step, which involves filling out a questionnaire to establish their electronic medical record. Pharmacists, on the other hand, must upload a copy of their license and provide required work information, after which they await verification from the owner. To identify the user as either a customer or a pharmacist, they must select one of two available checkboxes. Once all necessary information is provided, the portal is set up. Login succeeds once the entered credentials are verified in the database, granting each user access to their respective portal.



E. Website Home Activity

The homepage of the website features a welcoming title: "Welcome to ARZ Pharmacy." It includes sections such as "About," "Mission," and "Buy Cosmetics," along with a "Blog" button that leads to a page with engaging blog posts for customers. Additionally, there is a "Contact Us" button that enables users to send emails directly to the pharmacists and the pharmacy owner(s).



F. Activity Diagram of Customer

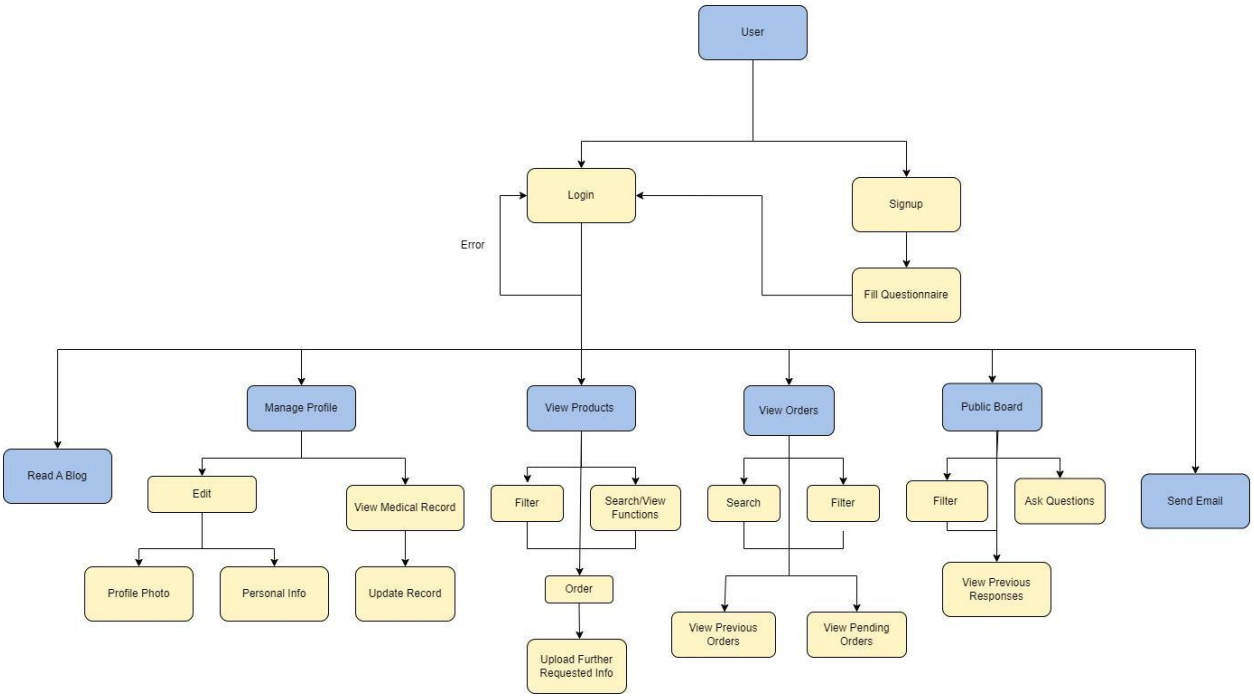
When customers access the website, they are prompted to log in using their credentials. New customers are required to sign up, provide the necessary details for registration, complete a questionnaire to build their electronic personal medical record, and choose “customer” as their intended user role. After registration, they are redirected to the login page to proceed to the website with their new account details automatically saved in the owner’s administrative dashboard. The home page serves as an introduction to the system, displaying our pharmacy’s details and contact information. It also includes a small cosmetics section offering simple medical products for sale. The primary features of the system can be accessed through the portal button. Here, customers can view the listed medicines and products, along with essential information such as price, expiry date, and type of approval required. A search bar allows users to quickly find products or medicines by name, while a filtering option helps customers find medicines based on symptoms or required approval type.

Once an order is placed, and if the order requires any form of approval, a request is sent to a specialized pharmacist who reviews the case. The pharmacist responds with either an approval, a rejection or further documentation, ensuring that all medicines are distributed responsibly and with the customer’s health as a priority. This will be key for individualized and tailored treatment.

Customers are also provided with a record of all their orders. Previous orders can be accessed, and pending orders will display their status (approved or rejected) once updated by the pharmacists. If an order is approved, delivery details will also be shown.

Additionally, customers have access to a public board where they can submit their concerns anonymously via a dropbox. A registered pharmacist reviews these concerns and posts suitable answers, which are made available for all users to benefit from.

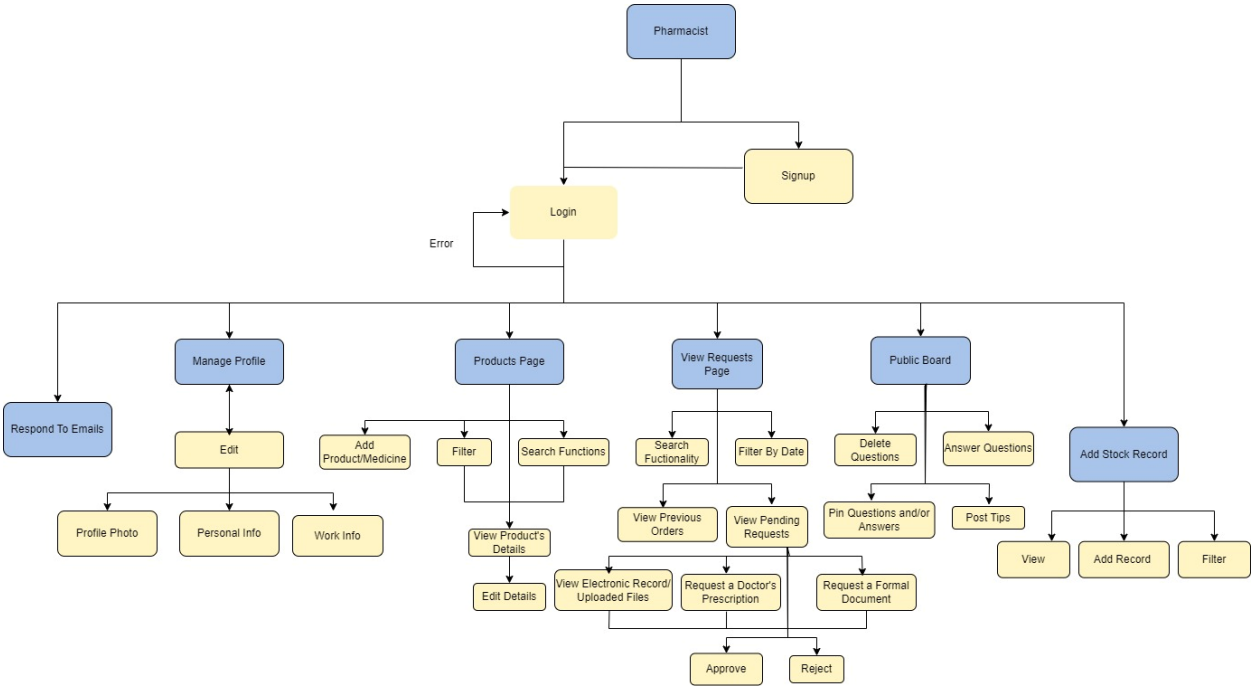
Customers can edit their profiles and update their electronic medical records as needed. Finally, the website provides the option to send emails to pharmacists and read selected blogs for additional information.



G. Activity Diagram of Pharmacist

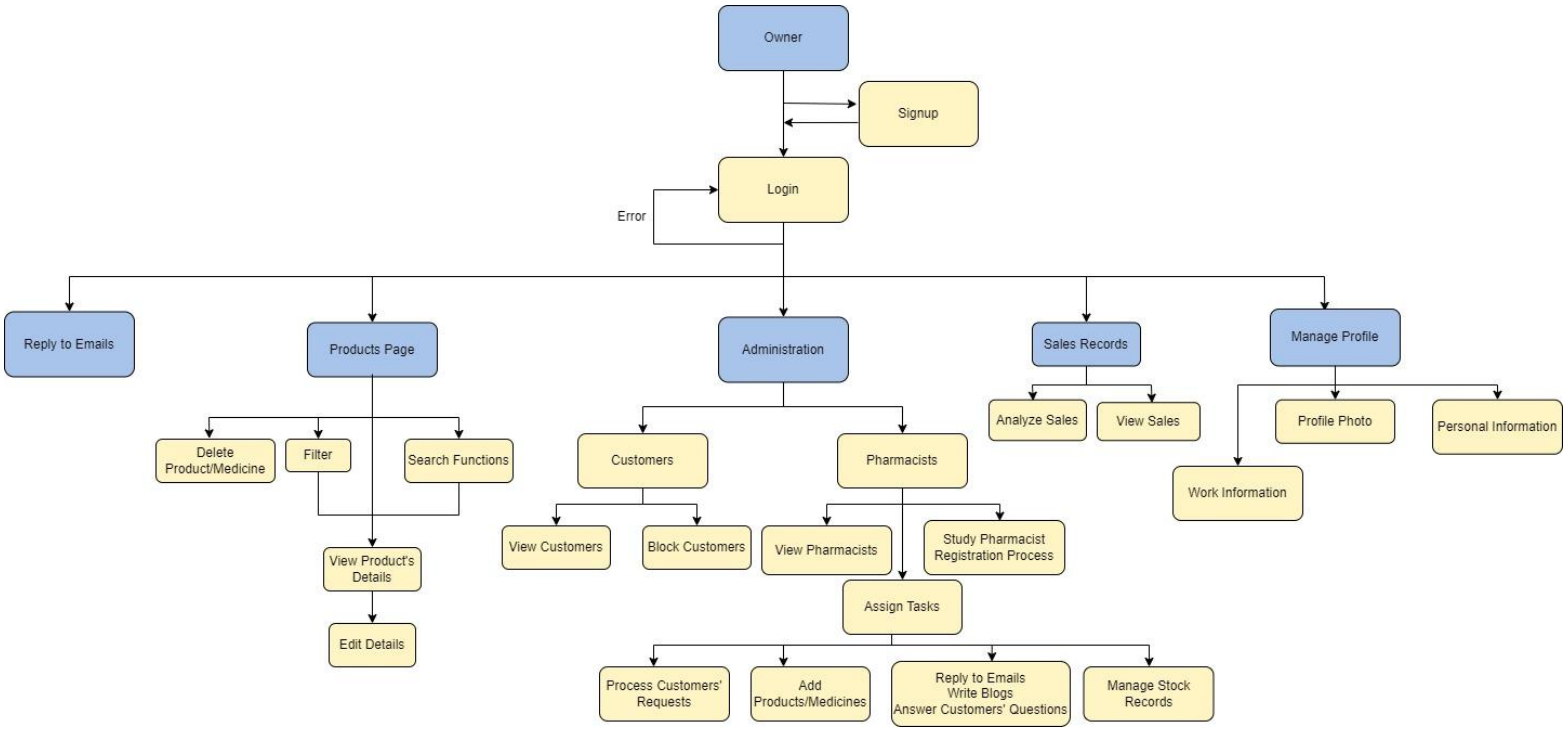
At first, pharmacists are required to use their credentials to log in. New pharmacists must sign up, provide the necessary details for registration, choose “pharmacist” as their intended user role, and upload their license as an identifier to be approved by the owner. After logging in, both new and existing pharmacists can access the home page and proceed to their designated tasks made available for them at their profiles by the owner. The first task involves managing stock records. Pharmacists use the "Add Stock Record" page to view and filter previously added records of purchased stocks, including essential details such as arrival date, quantity, and overall price to track inventory effectively. They are also responsible for adding new records as stock arrives. Second, pharmacists ensure that bought items are made available for customers by adding them to the page where they appear on the customers' portal. New products or medicines are added as new items to the list, while previously added items are updated as needed. For convenience, pharmacists can search and filter products to enable faster access when handling large inventories. The third and most crucial task for a pharmacist is the sale of appropriate medicines. On the "View Requests" page, pharmacists can access customer requests to evaluate them for approval or rejection. The medication approval process depends on the complexity of the drug and the patient’s needs. Over-the-counter medications, such as painkillers, receive direct approval. For more complex drugs, pharmacists review the patient’s electronic medical record to identify potential contraindications. High-risk medications, such as cancer treatments, require additional documentation, including a doctor’s prescription or formal authorization from the Ministry of Health. Based on these factors, requests are either approved or denied. The fourth task pertains to the "Public Board," where pharmacists interact with customers by answering questions, deleting inappropriate messages, pinning

high-priority and frequently asked questions, and offering additional tips. Pharmacists also have access to their profiles, allowing them to update components such as their profile photo, personal information, and work information. Lastly, pharmacists are responsible for responding to emails sent to them.



H. Activity Diagram of the Owner

The owner is the person who buys the software to manage his pharmacy effectively. For the first time he/she must sign up to access the system and control its activities. After that, he/she will use the credentials to login regularly. The owner plays the role of the manager, where he is granted access to every part of the system. First, the owner can view the page where items are listed for sale, filter and search its content, view and edit any product's details, and delete any instance from the found ones. Second, he can access the stock records, where the system integrates the sales records daily into this page giving an overview of sold items as well as remaining ones. With the association of data analysis tools, the owner then can analyze sales and take the appropriate measures accordingly. Third, the owner of the pharmacy can manage the activity of the users of the website whether they are customers or pharmacists. For customers, the owner will have an overview of all the registered customers accounts in the website in addition to blocking scammers whenever they are found. During the pharmacists registration process, the owner is responsible for reviewing their uploaded license and granting them the access to their portals. For already registered pharmacists, the owner will have an overview of their accounts and he is responsible for assigning each pharmacist his task on a regular basis. As we mentioned before, the tasks that might be assigned to a pharmacist include processing customers' requests, adding products and medicines as items for sale, managing stock records, and handling communication with the customers including replying to emails, writing blogs, and answering customers' questions on the public board. Finally, the owner can also reply to customers' emails and edit his profile containing his profile photo, work information, and work information.


Owner
Signup
Login
Error
Reply to Emails
Products Page
Administration
Sales Records
Manage Profile
Delete Product/Medicine
Filter
Search Functions
Customers
Pharmacists
Analyze Sales
View Sales
Profile Photo
Personal Information
Work Information
View Product's Details
Edit Details
View Customers
Block Customers
View Pharmacists
Study Pharmacist Registration Process
Assign Tasks
Process Customers' Requests
Add Products/Medicines
Reply to Emails
Write Blogs
Answer Customers' Questions
Manage Stock Records

VIII. System Evolution

The ARZ Devs Pharmacy System is designed with scalability and future growth in mind, with our goal always being to give pharmacy managers and customers a stable, flexible, and user-friendly platform. As healthcare continues to evolve, we envision an incremental approach to upgrade our system, focusing on improving patient care, enhancing pharmacy management, and expanding services. In order to provide long-term value for our users, we concentrate on developing the following areas that outline our plans for the system's evolution:

1. **Integration with National Health Systems and expansion into other pharmacies:** The ARZ Devs Pharmacy System aims to integrate with other Lebanese Pharmacies and with Lebanon's national healthcare databases in order to aid in the Ministry of Health's digital transformation efforts. This integration will allow access to centralized patient medical records and will ensure better coordination across different healthcare providers. Each pharmacy surely keeps its records separately.
2. **Telemedicine integration:** We plan to introduce direct video consultations with pharmacists.
3. **Support for wearable health devices:** Our system can later integrate with wearable devices such as smartwatches and fitness trackers. This will enable real-time monitoring of patient's health metrics. This can be later stored in a similar fashion to the electronic health record, allowing pharmacists to provide more accurate and proactive care.
4. **E-prescription expansion and doctor collaboration:** Establish partnerships with doctors and healthcare providers. This will allow doctors to directly send prescriptions and ease the approval and treatment process.
5. **Mobile application:** In the future, integrating a mobile application could greatly benefit both customers and pharmacists. Customers could read medication information and access pharmacy services straight from their devices with a mobile app. Furthermore, push notifications for special offers or reminders may increase consumer satisfaction and engagement. A mobile software could help pharmacists provide more efficient services by streamlining inventory checks and patient data access.
6. **Advanced AI features:** Plans may include drug interaction alerts and systems, personalized medication suggestions based on patient history, and predictive restocking based on seasonal demands and patient trends.
7. **Enhanced data analytics and reporting:** More tools for sales analysis and inventory optimization.

In summary, we are dedicated to ongoing development, ensuring that our system remains flexible, user-focused, and ready for expansion in the future.

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