Project Based Evaluation

Project Report

Semester-IV (Batch-2023)

Pharmacy Management System

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Abstract

The Pharmacy Management System is a comprehensive Java application developed as a final project for the Data Structures and Algorithms (DSA) and Java course. The project embodies the principles of modular programming and object-oriented design through the implementation of a robust pharmacy automation system. With features ranging from medicine inventory management to customer handling and billing, the application provides a full stack solution using Java's core features and custom-built data structures.

This console-based system ensures streamlined pharmacy operations by introducing key modules such as Medicine Management, Customer Profile Handling, Billing System, and Transaction History. The system enables pharmacy staff to manage medicine stocks, receive alerts on low inventory, and track purchase histories. Customers can register, browse medicines, and checkout with a seamless cart experience.

Implemented with a custom Model-View-Controller (MVC) architecture, the code separates logic, data models, and UI control, making the application scalable and maintainable. The use of custom data structures such as MyLinkedList and MyQueue, along with the MergeSort algorithm for sorting, demonstrates strong conceptual understanding and practical usage of DSA.

Moreover, data persistence using CSV files ensures that medicine and customer records are retained across sessions, allowing easy testing and deployment without requiring database integration. Overall, this project is a practical implementation of core Java and DSA concepts in a real-world application scenario.

INDEX

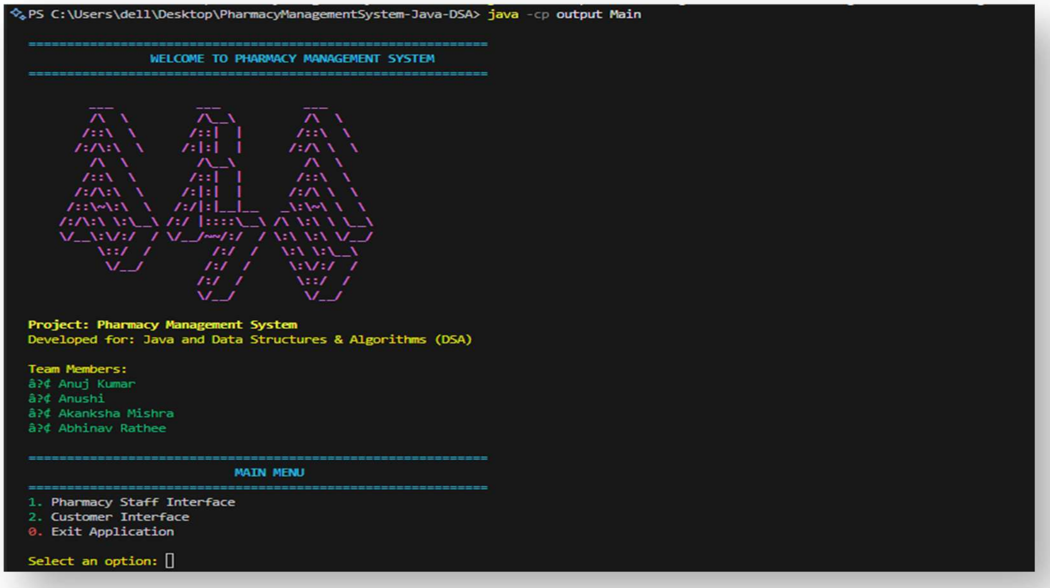
1. Introduction:

1.1 Background:

Pharmacies play a critical role in healthcare by ensuring the availability of medicines and providing essential services to customers. However, traditional pharmacy operations often involve manual processes, which can lead to inefficiencies, errors, and delays. With the increasing demand for faster and more accurate services, there is a need for a robust system that can automate and optimize pharmacy operations. The Pharmacy Management System addresses these challenges by leveraging modern programming techniques and data structures to create a reliable and efficient solution. The system is designed to handle key operations such as inventory management, customer interactions, and transaction processing, ensuring that pharmacies can meet the needs of their customers effectively.

The Pharmacy Management System is a comprehensive Java application developed as a final project for the Data Structures and Algorithms (DSA) and Java course. This system provides a complete solution for pharmacy management, including inventory control, customer management, medicine tracking, and sales processing.

This is how the terminal looks like at first step:



```
PS C:\Users\dell\Desktop\PharmacyManagementSystem-Java-DSA> java -cp output Main

  ==============================================================
                 WELCOME TO PHARMACY MANAGEMENT SYSTEM
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  Project: Pharmacy Management System
  Developed for: Java and Data Structures & Algorithms (DSA)

  Team Members:
  â?¢ Anuj Kumar
  â?¢ Anushi
  â?¢ Akanksha Mishra
  â?¢ Abhinav Rathee

  ==============================================================
                            MAIN MENU
  ==============================================================
  1. Pharmacy Staff Interface
  2. Customer Interface
  0. Exit Application

  Select an option: 
```

1.2 Objectives:

- Streamline Pharmacy Operations: Automate routine tasks such as inventory updates, customer management, and billing to reduce manual effort and errors.
- Efficient Data Management: Utilize custom data structures like linked lists and queues to handle dynamic data efficiently and ensure scalability.
- User-Friendly Interface: Provide an intuitive interface for both pharmacy staff and customers to enhance usability and accessibility.
- Data Persistence: Implement CSV-based data storage to ensure that all records are securely saved and can be retrieved as needed.
- Enhanced Customer Experience: Offer features like medicine search, cart management, and transaction history to improve customer satisfaction.

1.3 Features:

- Medicine Management: Add, search, update, and remove medicines from inventory
- Customer Management: Register customers, manage profiles, and track purchase history. During registration, the system checks for existing contact numbers to avoid duplicate entries.
- Shopping Cart: Easy-to-use interface for adding medicines to cart and checkout
- Inventory Management: Track stock levels and receive low stock alerts
- Transaction Processing: Process sales and maintain transaction history
- Billing System: Generate detailed bills for customers
- Data Persistence: Save and load data using CSV files
- Secure Login System: Implements password-protected access for both users and admins. Password input is hidden (masked) in the terminal for enhanced security.

1.4 Significance:

- The Pharmacy Management System is significant for several reasons:
- Operational Efficiency: By automating key processes, the system reduces the workload on pharmacy staff, allowing them to focus on customer service and other critical tasks.
- Error Reduction: Automation minimizes human errors in inventory management, billing, and transaction processing, ensuring accuracy and reliability.
- Scalability: The use of custom data structures ensures that the system can handle increasing amounts of data as the pharmacy grows.
- Cost-Effectiveness: By reducing manual labor and improving efficiency, the system helps pharmacies save time and resources.
- Improved Customer Satisfaction: Features like quick medicine search and seamless billing enhance the overall customer experience, fostering loyalty and trust.
- Adaptability: The system's modular design allows for easy integration of additional features, making it adaptable to the evolving needs of pharmacies.

In conclusion, the Pharmacy Management System is a vital tool for modern pharmacies, addressing the challenges of traditional operations and paving the way for a more efficient and customer-centric approach.

2. Problem Definition and Requirements:

2.1 Problem Statement:

- The goal is to design and implement a Pharmacy Management System that can efficiently manage customers, medicines, inventory, and transactions using core Java data structures and object-oriented concepts.

2.2 Software/Hardware Requirements:

- Java JDK 17 or later
- IntelliJ IDEA / VS Code / Command Line
- Basic terminal to execute the application
- Windows/Linux OS
- Minimum 4 GB RAM and 500 MB storage

3. Proposed Design / Methodology:

3.1 Architecture & File Structure:

The Pharmacy Management System is developed using a modular architecture inspired by the Model-View-Controller (MVC) design pattern. This architecture ensures a clear separation of concerns between user interface control, business logic, and data representation.

- Model: This layer includes classes such as Medicine, Customer, Cart, CartItem, Transaction, and Bill. These represent real-world entities and hold the data associated with them.
- Controller: Controllers like PharmacyManager and CustomerManager handle the logic and bridge communication between the user interface and models. They encapsulate core functionality such as inventory updates, customer validation, and transaction processing.

- View (Console UI): While a dedicated view class isn't used, the console-based interface in Main.java acts as the view and controller combined, handling all user inputs and outputs interactively.
- Utilities & Storage: Utilities like CSVUtility and BillUtility handle operations such as bill formatting and CSV file I/O. The DataStore class maintains persistent data storage, enabling session continuity without databases. Additionally, a configuration file is used to securely store the admin password. This file is hidden from direct access, ensuring protection against unauthorized use.

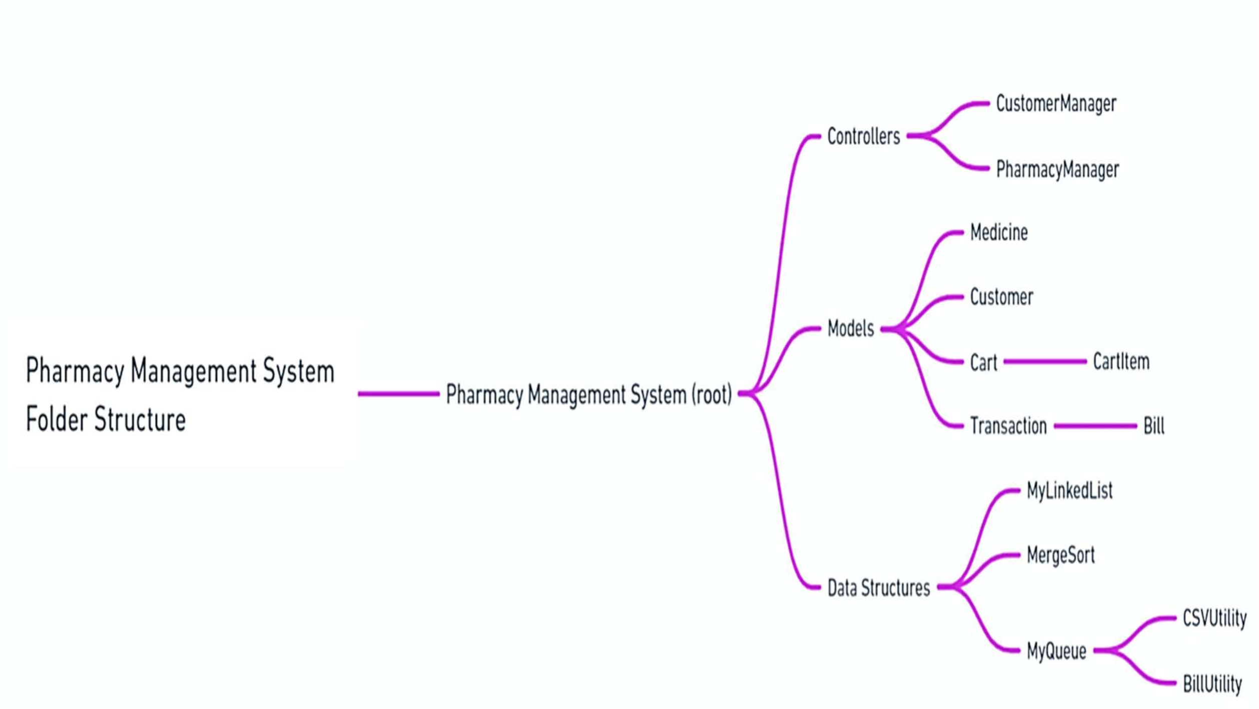


Figure 3.1.1 Folder Structure of Project

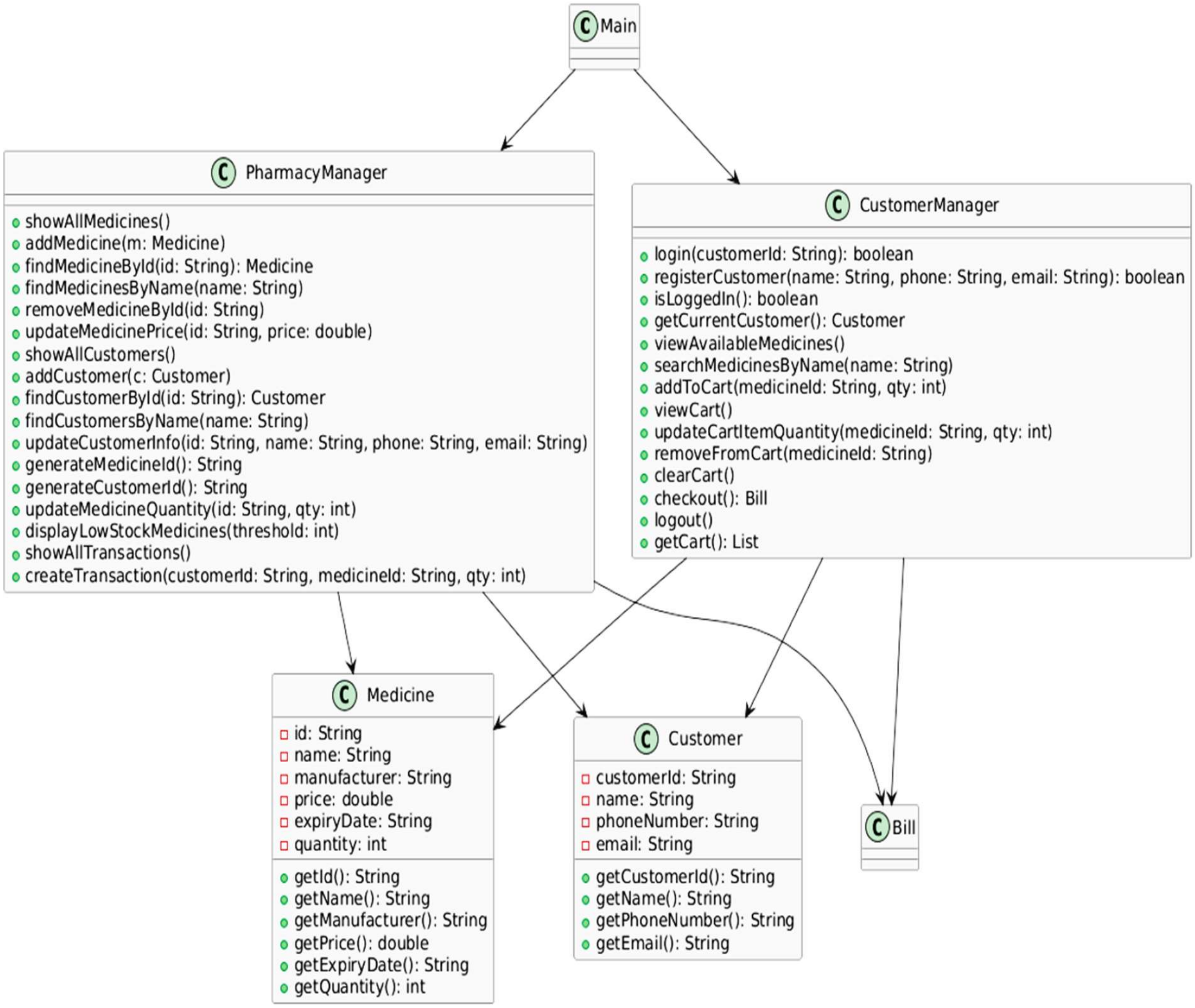

Main
PharmacyManager
showAllMedicines()
addMedicine(m: Medicine)
findMedicineById(id: String): Medicine
findMedicinesByName(name: String)
removeMedicineById(id: String)
updateMedicinePrice(id: String, price: double)
showAllCustomers()
addCustomer(c: Customer)
findCustomerById(id: String): Customer
findCustomersByName(name: String)
updateCustomerInfo(id: String, name: String, phone: String, email: String)
generateMedicineId(): String
generateCustomerId(): String
updateMedicineQuantity(id: String, qty: int)
displayLowStockMedicines(threshold: int)
showAllTransactions()
createTransaction(customerId: String, medicineId: String, qty: int)
CustomerManager
login(customerId: String): boolean
registerCustomer(name: String, phone: String, email: String): boolean
isLoggedIn(): boolean
getCurrentCustomer(): Customer
viewAvailableMedicines()
searchMedicinesByName(name: String)
addToCart(medicineId: String, qty: int)
viewCart()
updateCartItemQuantity(medicineId: String, qty: int)
removeFromCart(medicineId: String)
clearCart()
checkout(): Bill
logout()
getCart(): List
Medicine
id: String
name: String
manufacturer: String
price: double
expiryDate: String
quantity: int
getId(): String
getName(): String
getManufacturer(): String
getPrice(): double
getExpiryDate(): String
getQuantity(): int
Customer
customerId: String
name: String
phoneNumber: String
email: String
getCustomerId(): String
getName(): String
getPhoneNumber(): String
getEmail(): String
Bill

Figure 3.1.2 Class Diagram of Project

3.2 DSA Concepts Used:

The system effectively demonstrates the implementation and application of key Data Structures and Algorithms (DSA), which are fundamental to optimizing performance and data organization.

- Linked List (MyLinkedList):
  - Used to dynamically store collections such as customer records or transaction history.
  - A generic linked list implementation used throughout the system for dynamic data storage.
  - Allows efficient insertion and deletion operations without resizing overhead.

- Queue (MyQueue):
  - Applied for managing first-come-first-serve scenarios, such as processing customer checkout queues or transaction logs.
  - A queue implementation used for processing orders.

- Merge Sort:
  - A recursive divide-and-conquer algorithm implemented to sort data such as medicines based on price, name, or expiry date.
  - Ensures stability and efficiency (O(n log n)) for large datasets.
  - An efficient sorting algorithm used for sorting medicines and transactions.

- Custom Iterators and Utility Functions:
  - Provide traversal and manipulation of internal data structures, showcasing practical use of pointers and loops in data navigation.

These DSA elements not only support internal logic but also make the system scalable and responsive for increasing data loads.

3.3 CRUD Operations:

The application provides robust CRUD (Create, Read, Update, Delete) functionality across its core modules, ensuring comprehensive data manipulation and management.

- Medicine Management:
    - Create: Add new medicines with generated unique IDs, storing name, price, manufacturer, quantity, and expiry.
    - Read: List all medicines or search by name/ID.
    - Update: Modify medicine price and quantity as needed.
    - Delete: Remove expired or obsolete medicines from the system.

- Customer Management:
    - Create: Register new customers with ID, name, contact details. The system restricts multiple registrations using the same contact number, ensuring data integrity and avoiding duplication.
    - Read: View customer database or search by name/ID.
    - Update: Edit customer contact details.
    - Delete: Not implemented to retain customer history for billing.

- Transaction/Billing Management:
    - Create: Generate bills upon checkout using selected medicines from cart.
    - Read: Display transaction history for review and audit.
    - Update/Delete: Transactions are final to ensure billing integrity.

Together, these CRUD operations empower both pharmacy staff and customers to interact with the system dynamically, ensuring a seamless experience and solid data control throughout the software lifecycle.

3.4 Usage:

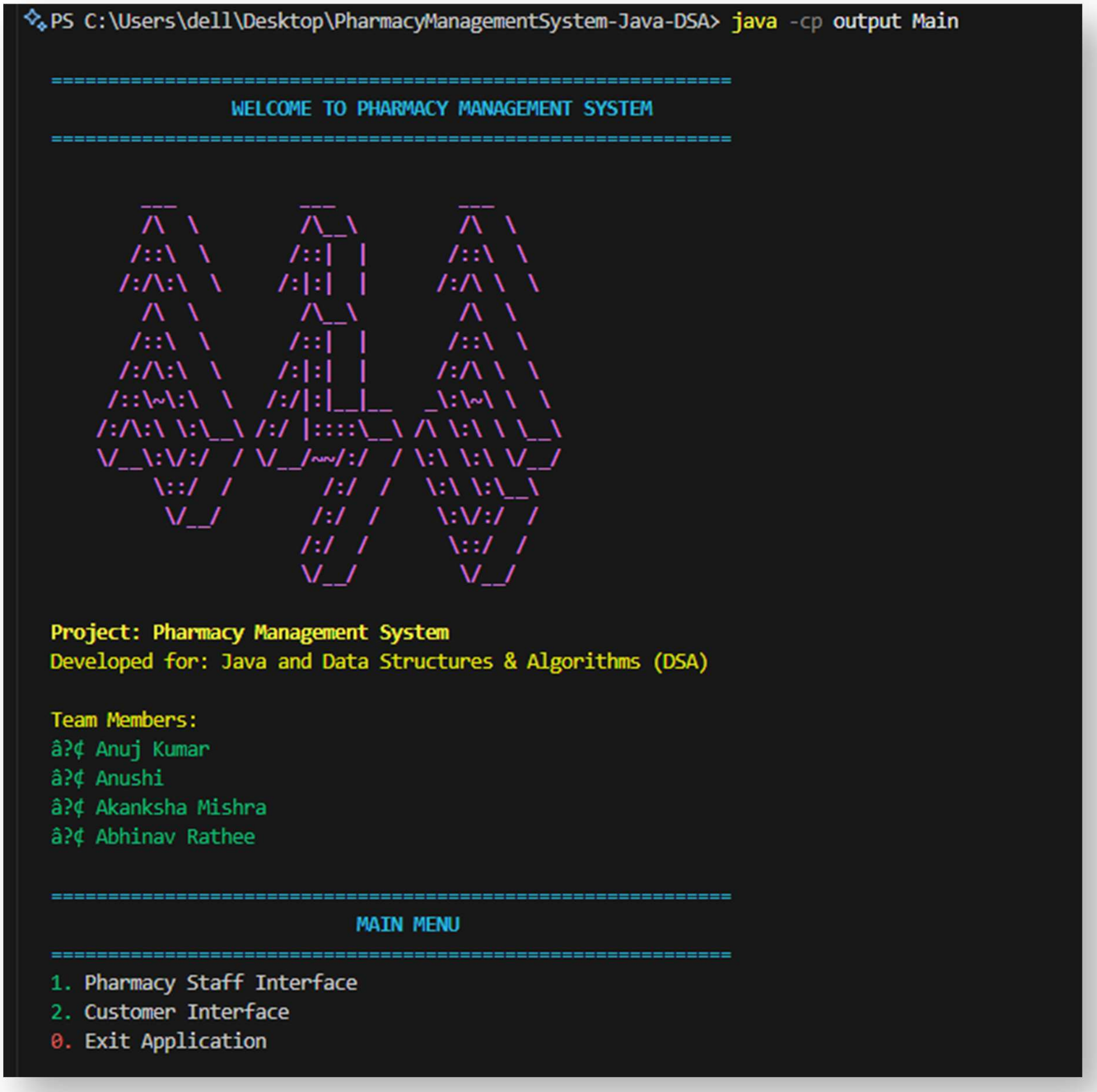
After launching the application, you'll be presented with the main menu:

- For Pharmacy Staff:
  - Medicine Management: Add, update, and remove medicines
  - Customer Management: Manage customer profiles
  - Inventory Management: Update quantities and check low stock
  - Transaction History: View past transactions

- For Customers:
  - Browse available medicines
  - Search for specific medicines
  - Add medicines to cart
  - View and manage cart
  - Checkout and receive bills
  - During registration, the system checks for existing contact numbers to avoid duplicate entries.

4. Results:

Below are the screenshots of the application showing major functionalities like:



```
PS C:\Users\dell\Desktop\PharmacyManagementSystem-Java-DSA> java -cp output Main

============================================================
                WELCOME TO PHARMACY MANAGEMENT SYSTEM
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============================================================
                           MAIN MENU
============================================================
1. Pharmacy Staff Interface
2. Customer Interface
0. Exit Application
```
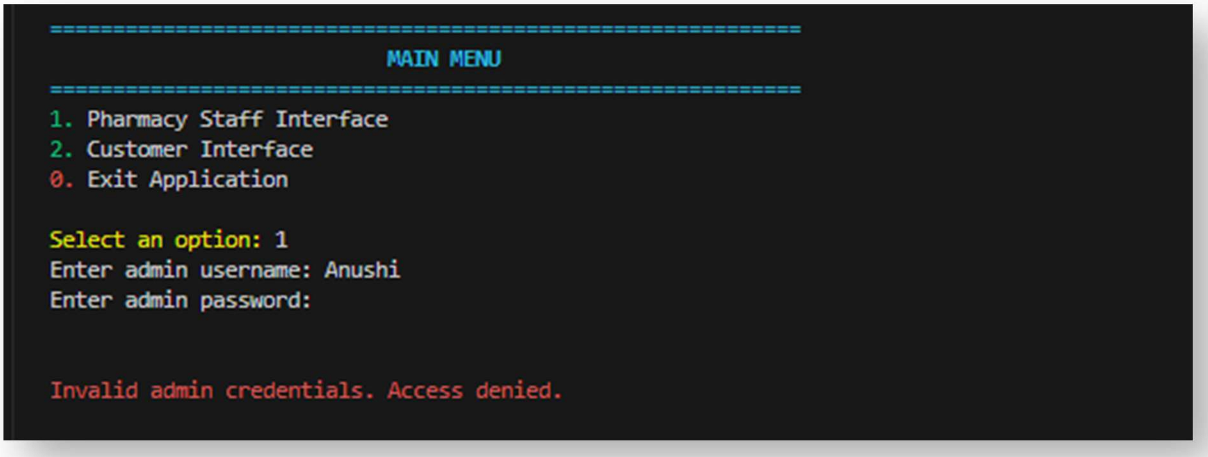
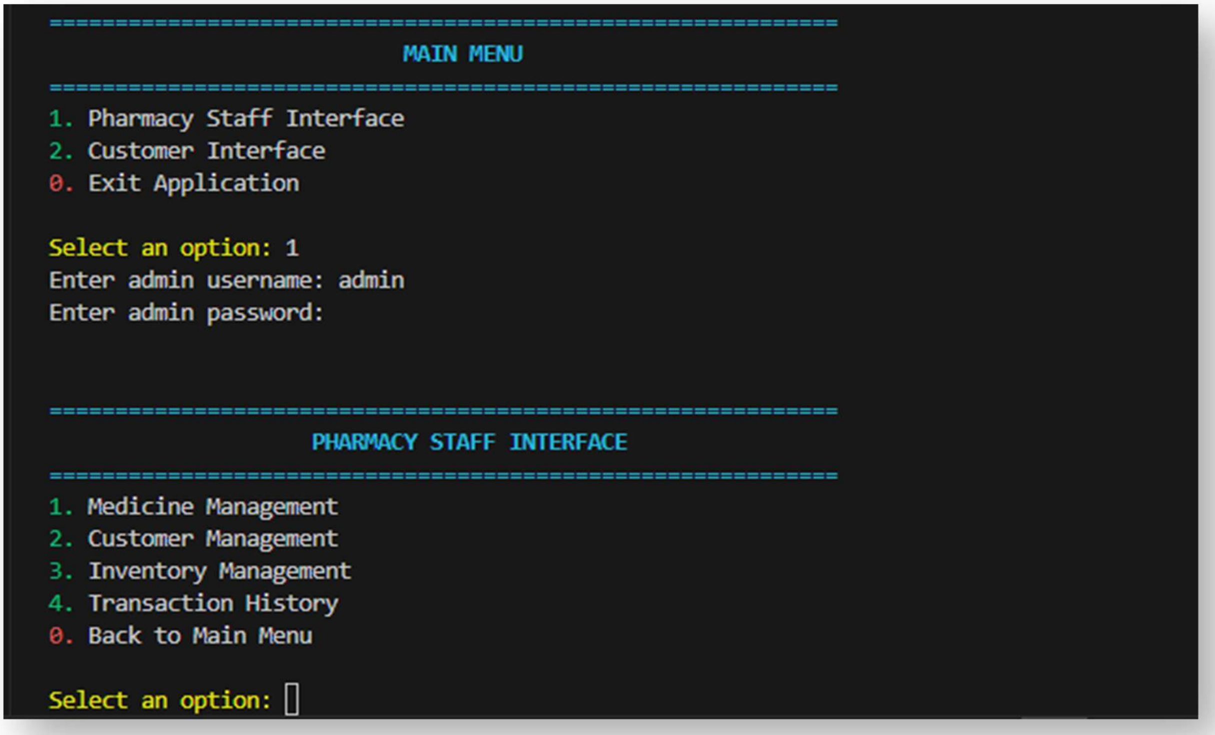

Fig 4.1 Pharmacy Management System with Main Menu Options



```
============================================================
                          MAIN MENU
============================================================
1. Pharmacy Staff Interface
2. Customer Interface
0. Exit Application

Select an option: 1
Enter admin username: Anushi
Enter admin password:


Invalid admin credentials. Access denied.
```

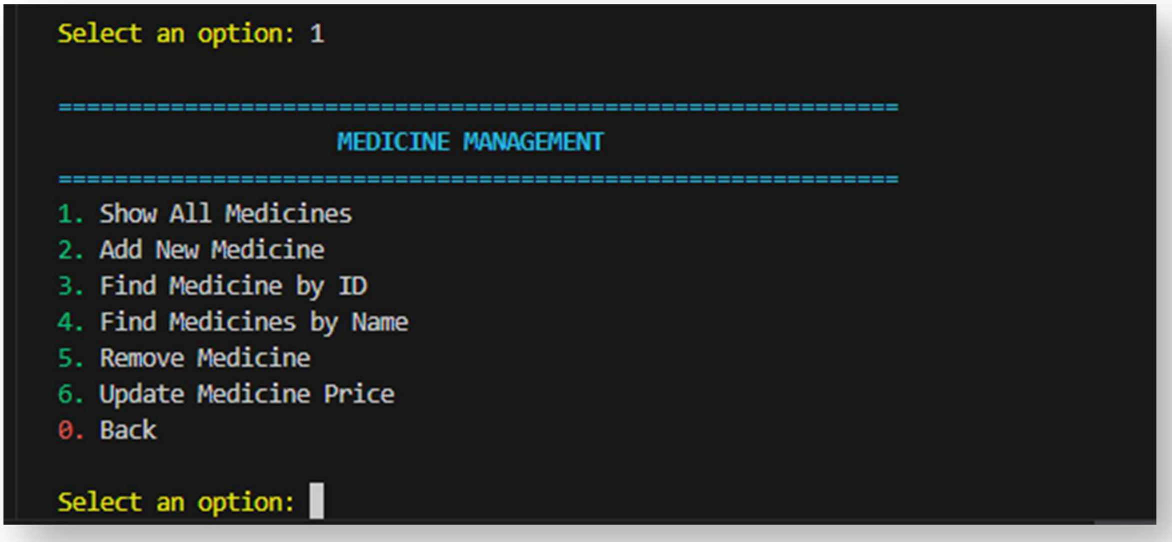
Fig 4.2 Since Wrong Credentials Given as Input, So Access Denied.

Also, Password Masked in the Terminal



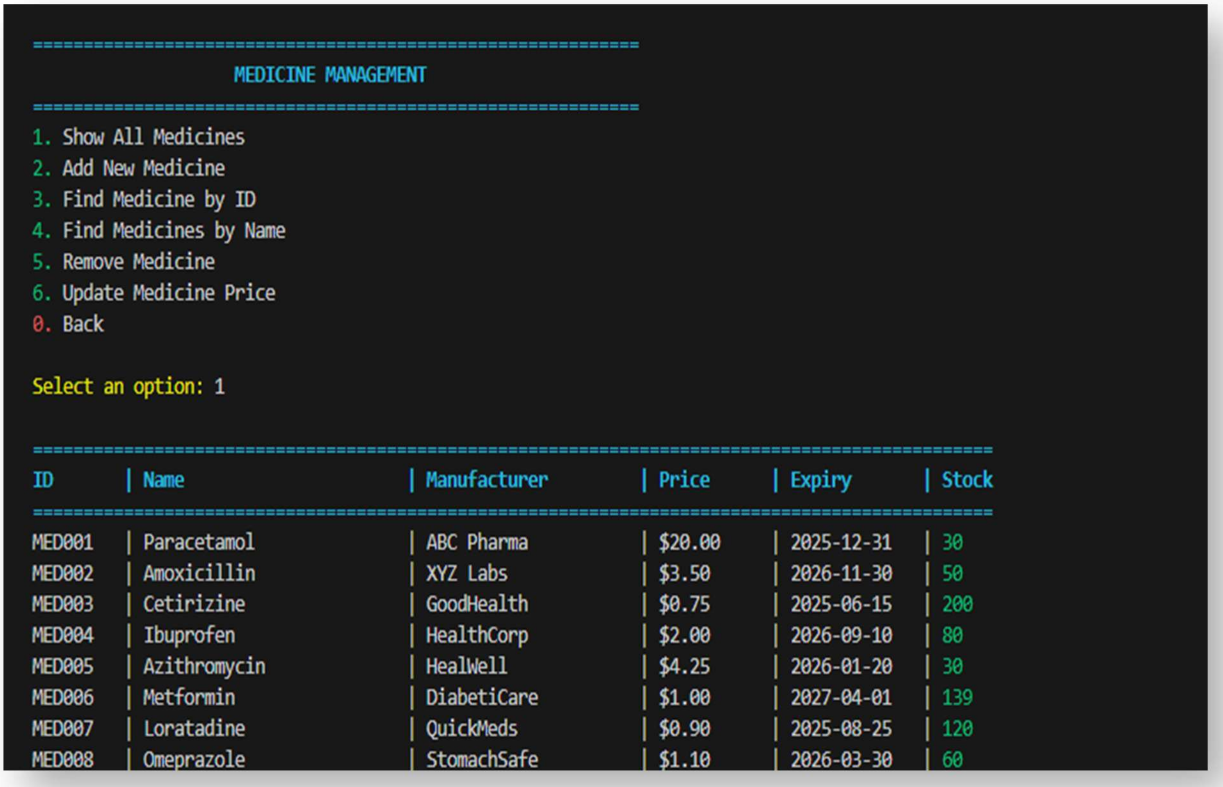
```
============================================================
                          MAIN MENU
============================================================
1. Pharmacy Staff Interface
2. Customer Interface
0. Exit Application

Select an option: 1
Enter admin username: admin
Enter admin password:


============================================================
                  PHARMACY STAFF INTERFACE
============================================================
1. Medicine Management
2. Customer Management
3. Inventory Management
4. Transaction History
0. Back to Main Menu

Select an option: 
```

Fig 4.3 On Selecting Option 1 and Using Right Credentials, Opens the Pharmacy Staff Interface

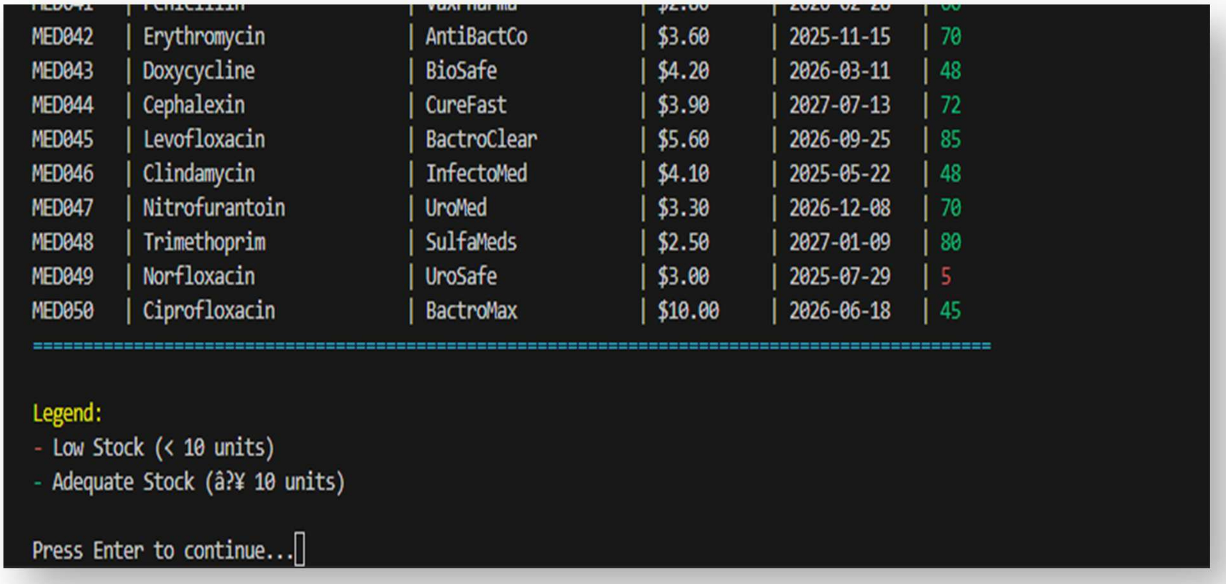


```
Select an option: 1

============================================================
                    MEDICINE MANAGEMENT
============================================================
1. Show All Medicines
2. Add New Medicine
3. Find Medicine by ID
4. Find Medicines by Name
5. Remove Medicine
6. Update Medicine Price
0. Back

Select an option: 
```

Fig 4.4 Further Selecting Option 1, Opens Details Under Medicine Management

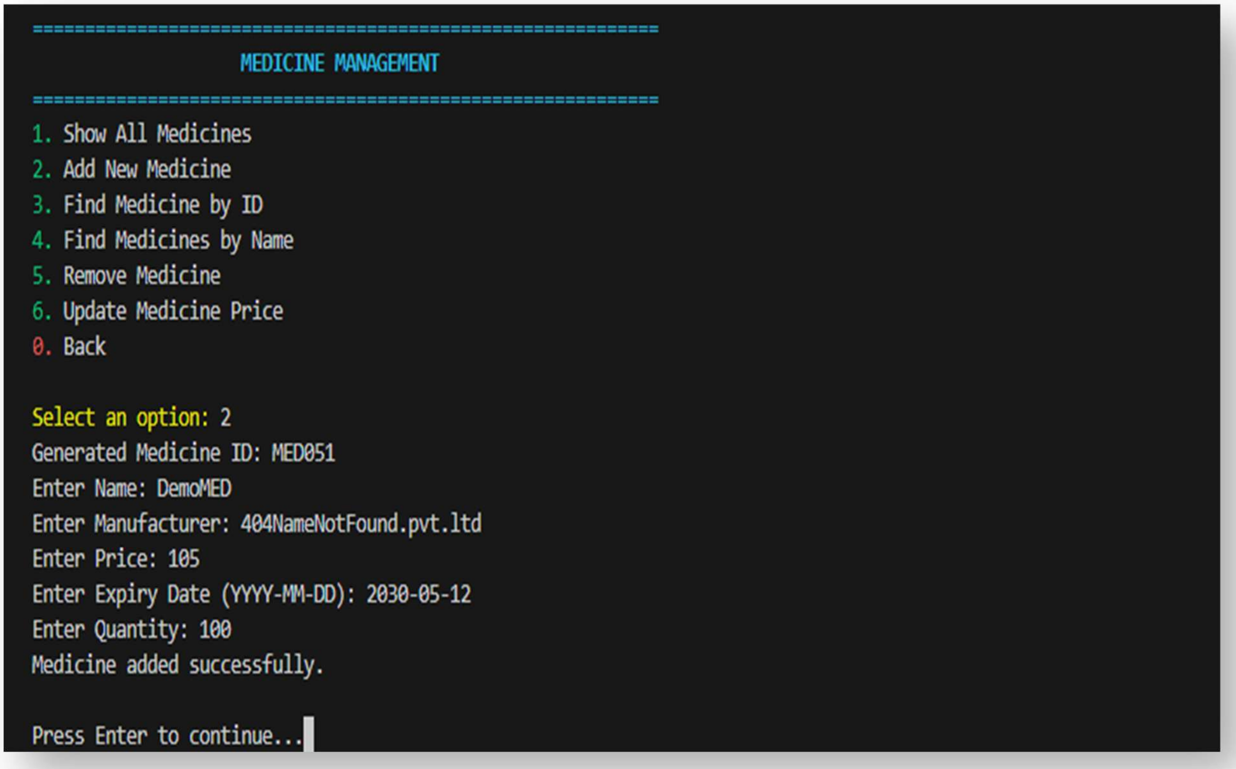


```
============================================================
                    MEDICINE MANAGEMENT
============================================================
1. Show All Medicines
2. Add New Medicine
3. Find Medicine by ID
4. Find Medicines by Name
5. Remove Medicine
6. Update Medicine Price
0. Back

Select an option: 1

===============================================================================================
ID        | Name                        | Manufacturer          | Price        | Expiry        | Stock
===============================================================================================
MED001    | Paracetamol                 | ABC Pharma            | $20.00       | 2025-12-31    | 30
MED002    | Amoxicillin                 | XYZ Labs              | $3.50        | 2026-11-30    | 50
MED003    | Cetirizine                  | GoodHealth            | $0.75        | 2025-06-15    | 200
MED004    | Ibuprofen                   | HealthCorp            | $2.00        | 2026-09-10    | 80
MED005    | Azithromycin                | HealWell              | $4.25        | 2026-01-20    | 30
MED006    | Metformin                   | DiabetiCare           | $1.00        | 2027-04-01    | 139
MED007    | Loratadine                  | QuickMeds             | $0.90        | 2025-08-25    | 120
MED008    | Omeprazole                  | StomachSafe           | $1.10        | 2026-03-30    | 60
```

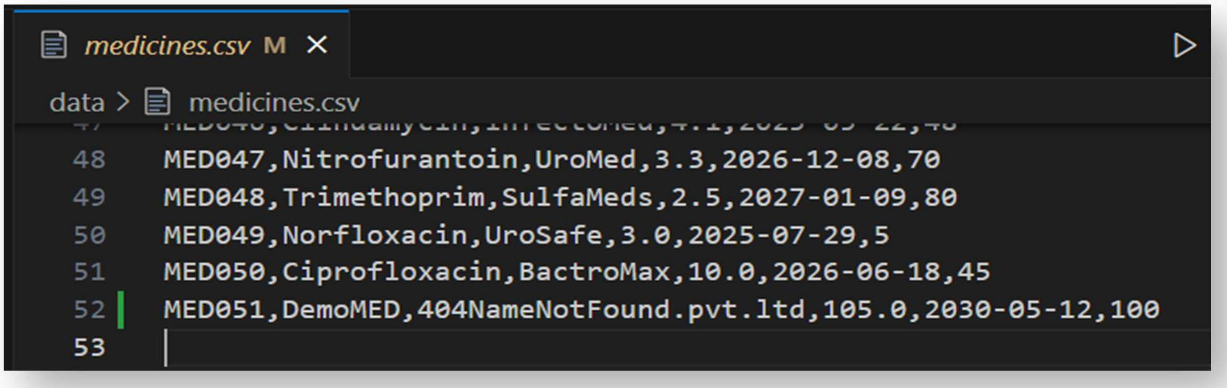


```
MED042    | Erythromycin                | AntiBactCo            | $3.60        | 2025-11-15    | 70
MED043    | Doxycycline                 | BioSafe               | $4.20        | 2026-03-11    | 48
MED044    | Cephalexin                  | CureFast              | $3.90        | 2027-07-13    | 72
MED045    | Levofloxacin                | BactroClear           | $5.60        | 2026-09-25    | 85
MED046    | Clindamycin                 | InfectoMed            | $4.10        | 2025-05-22    | 48
MED047    | Nitrofurantoin              | UroMed                | $3.30        | 2026-12-08    | 70
MED048    | Trimethoprim                | SulfaMeds             | $2.50        | 2027-01-09    | 80
MED049    | Norfloxacin                 | UroSafe               | $3.00        | 2025-07-29    | 5
MED050    | Ciprofloxacin               | BactroMax             | $10.00       | 2026-06-18    | 45
===============================================================================================

Legend:
- Low Stock (< 10 units)
- Adequate Stock (â?¥ 10 units)

Press Enter to continue...
```

Fig 4.5 Further Selecting Option 1, shows all the medicines

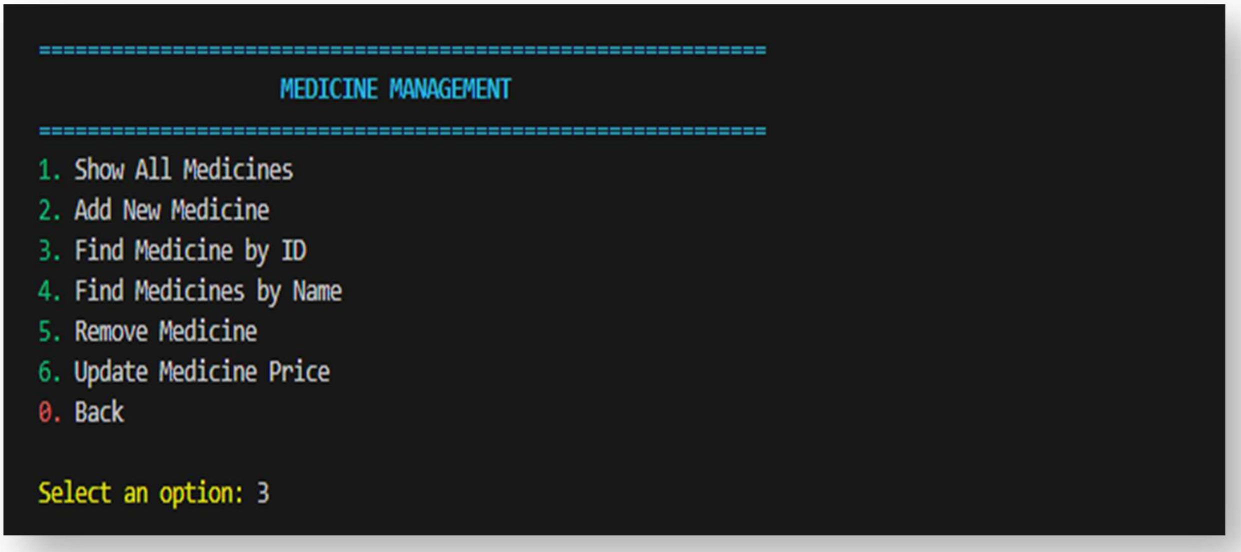


```
============================================================
                    MEDICINE MANAGEMENT
============================================================
1. Show All Medicines
2. Add New Medicine
3. Find Medicine by ID
4. Find Medicines by Name
5. Remove Medicine
6. Update Medicine Price
0. Back

Select an option: 2
Generated Medicine ID: MED051
Enter Name: DemoMED
Enter Manufacturer: 404NameNotFound.pvt.ltd
Enter Price: 105
Enter Expiry Date (YYYY-MM-DD): 2030-05-12
Enter Quantity: 100
Medicine added successfully.

Press Enter to continue...
```

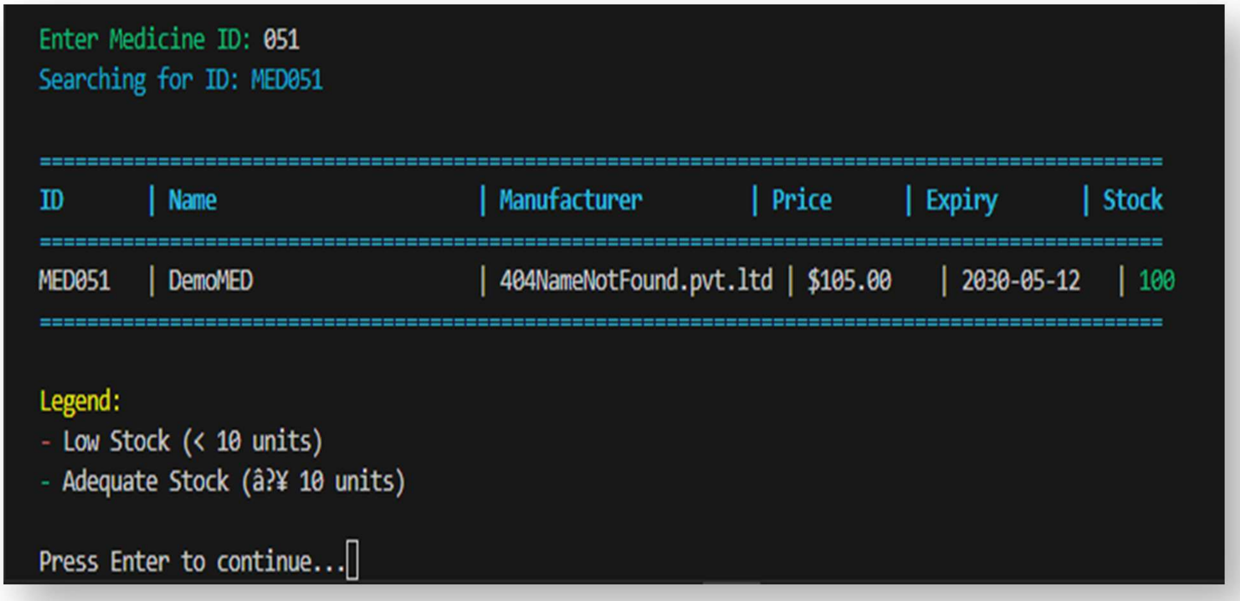


```
MED047,Nitrofurantoin,UroMed,3.3,2026-12-08,70
MED048,Trimethoprim,SulfaMeds,2.5,2027-01-09,80
MED049,Norfloxacin,UroSafe,3.0,2025-07-29,5
MED050,Ciprofloxacin,BactroMax,10.0,2026-06-18,45
MED051,DemoMED,404NameNotFound.pvt.ltd,105.0,2030-05-12,100
```

Fig 4.6 On Selecting Option 2, Can Add Med. & the Record Gets Updated

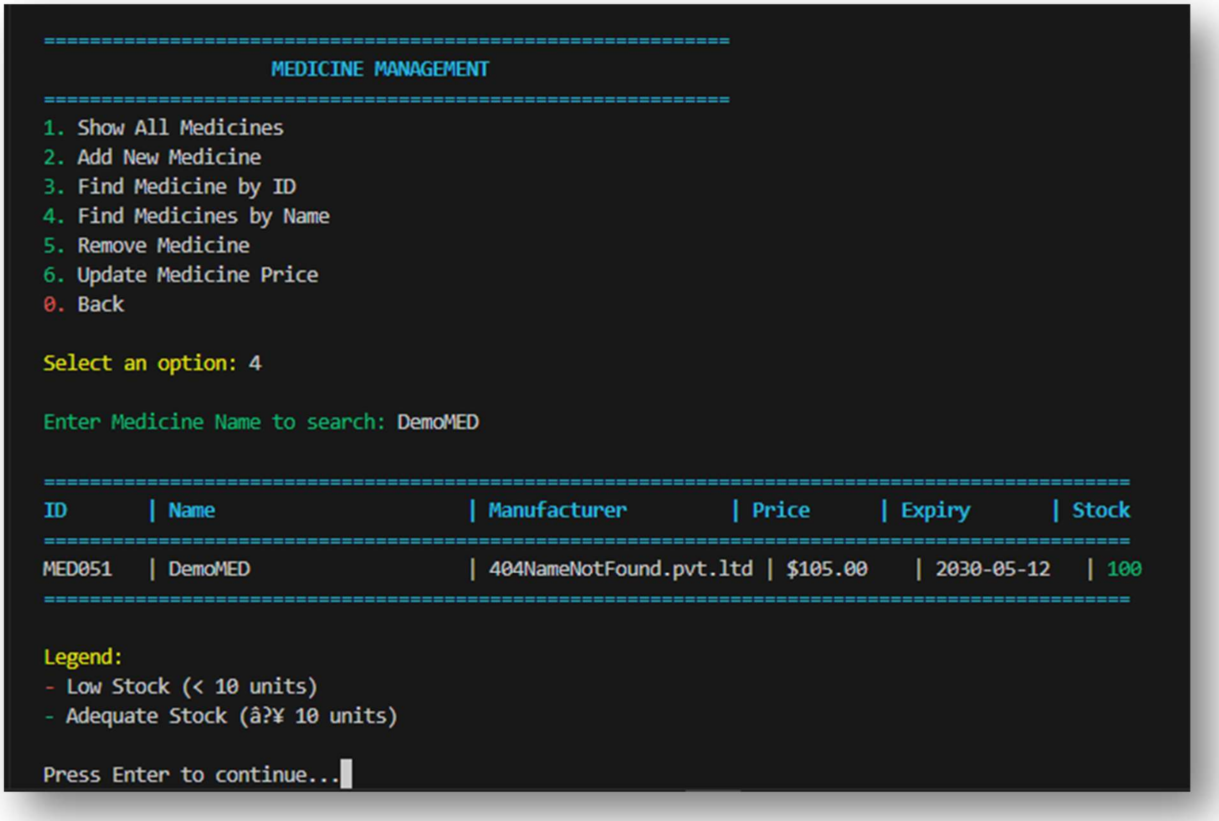


```
============================================================
                   MEDICINE MANAGEMENT
============================================================
1. Show All Medicines
2. Add New Medicine
3. Find Medicine by ID
4. Find Medicines by Name
5. Remove Medicine
6. Update Medicine Price
0. Back

Select an option: 3
```



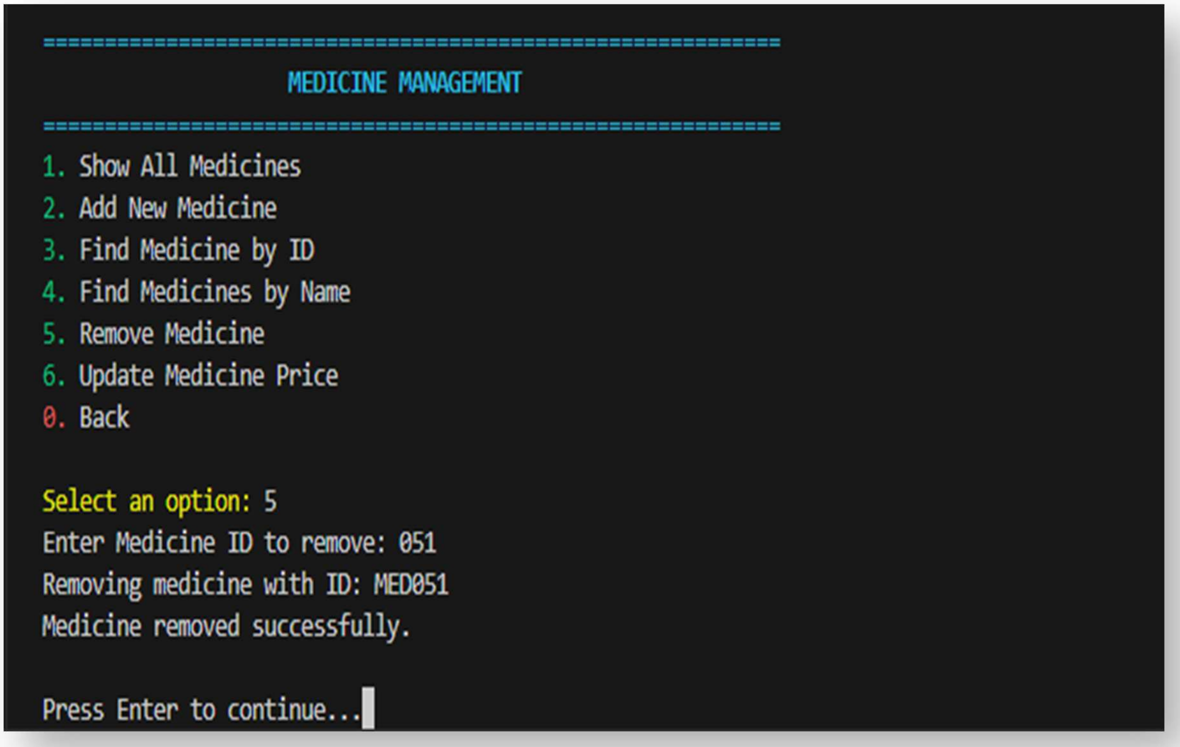
```
Enter Medicine ID: 051
Searching for ID: MED051


============================================================================================
ID        | Name                         | Manufacturer          | Price        | Expiry         | Stock
============================================================================================
MED051    | DemoMED                      | 404NameNotFound.pvt.ltd | $105.00    | 2030-05-12   | 100
============================================================================================


Legend:
- Low Stock (< 10 units)
- Adequate Stock (â?¥ 10 units)

Press Enter to continue...
```

Fig 4.7 On Selecting Option 3, Finds Medicine by Med ID

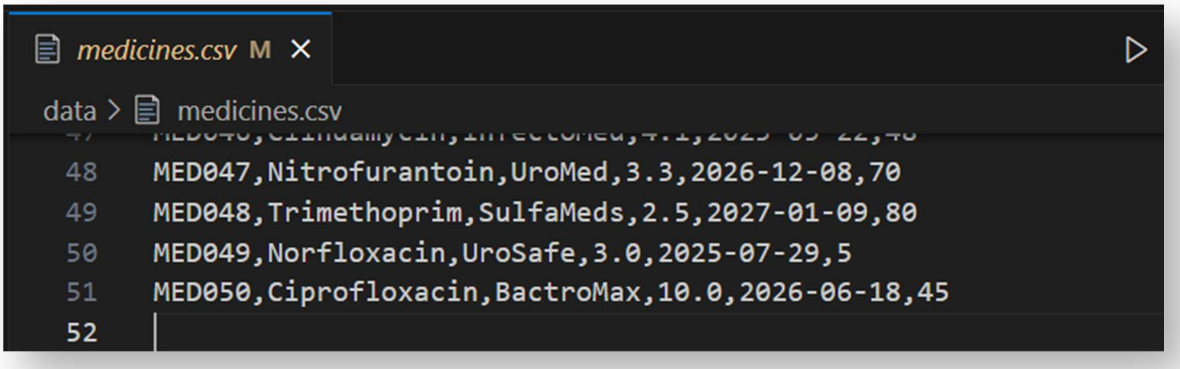


```
============================================================
                    MEDICINE MANAGEMENT
============================================================
1. Show All Medicines
2. Add New Medicine
3. Find Medicine by ID
4. Find Medicines by Name
5. Remove Medicine
6. Update Medicine Price
0. Back

Select an option: 4

Enter Medicine Name to search: DemoMED

===============================================================================================
ID        | Name                          | Manufacturer          | Price        | Expiry        | Stock
===============================================================================================
MED051    | DemoMED                       | 404NameNotFound.pvt.ltd | $105.00    | 2030-05-12    | 100
===============================================================================================

Legend:
- Low Stock (< 10 units)
- Adequate Stock (â?¥ 10 units)

Press Enter to continue...
```

Fig 4.8 On Selecting Option 3, Finds Med by Med Name

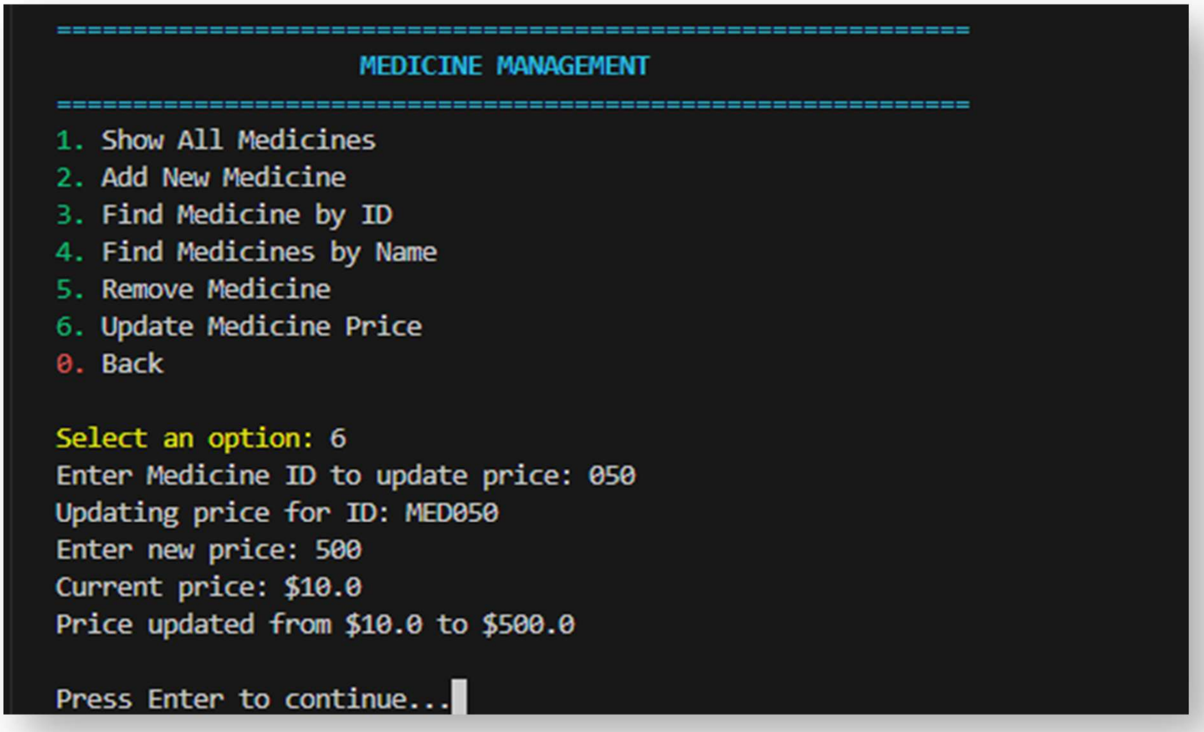


```
==============================================================
                   MEDICINE MANAGEMENT
==============================================================
1. Show All Medicines
2. Add New Medicine
3. Find Medicine by ID
4. Find Medicines by Name
5. Remove Medicine
6. Update Medicine Price
0. Back

Select an option: 5
Enter Medicine ID to remove: 051
Removing medicine with ID: MED051
Medicine removed successfully.

Press Enter to continue...
```

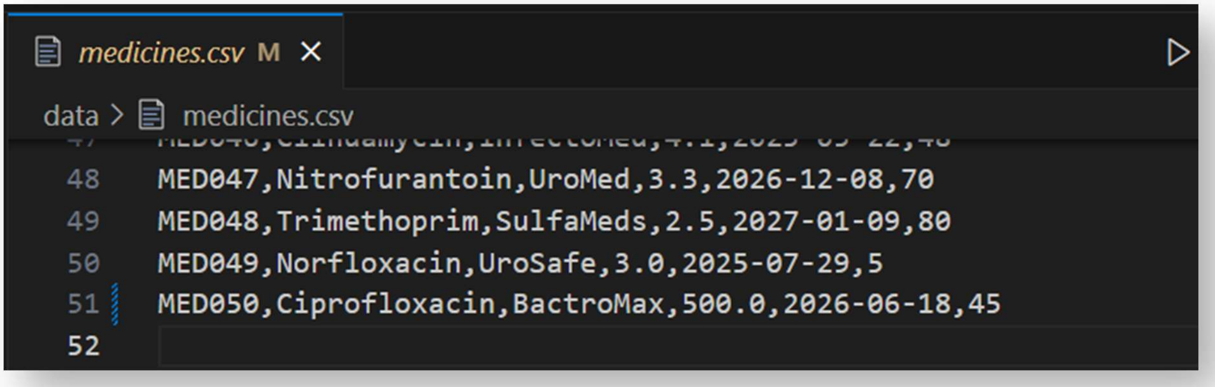


```
MED046,Clindamycin,InfectoMed,4.1,2025-05-22,48
MED047,Nitrofurantoin,UroMed,3.3,2026-12-08,70
MED048,Trimethoprim,SulfaMeds,2.5,2027-01-09,80
MED049,Norfloxacin,UroSafe,3.0,2025-07-29,5
MED050,Ciprofloxacin,BactroMax,10.0,2026-06-18,45

```

Fig 4.9 On Selecting Option 5, Removes the Medicine From the Record



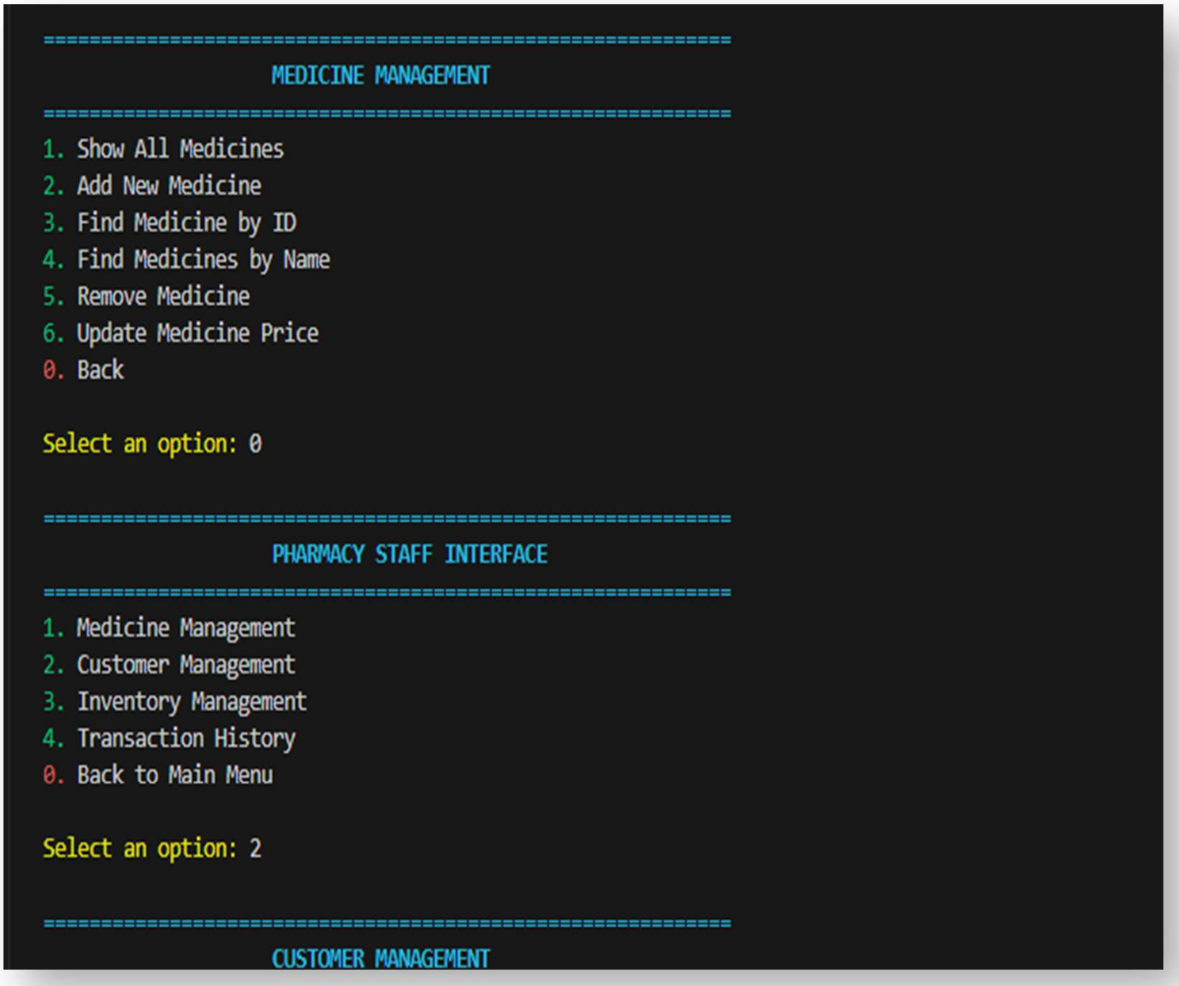
```
============================================================
                    MEDICINE MANAGEMENT
============================================================
1. Show All Medicines
2. Add New Medicine
3. Find Medicine by ID
4. Find Medicines by Name
5. Remove Medicine
6. Update Medicine Price
0. Back

Select an option: 6
Enter Medicine ID to update price: 050
Updating price for ID: MED050
Enter new price: 500
Current price: $10.0
Price updated from $10.0 to $500.0

Press Enter to continue...
```



```
MED046,Clindamycin,InfectoMed,4.1,2025-05-22,48
MED047,Nitrofurantoin,UroMed,3.3,2026-12-08,70
MED048,Trimethoprim,SulfaMeds,2.5,2027-01-09,80
MED049,Norfloxacin,UroSafe,3.0,2025-07-29,5
MED050,Ciprofloxacin,BactroMax,500.0,2026-06-18,45

```

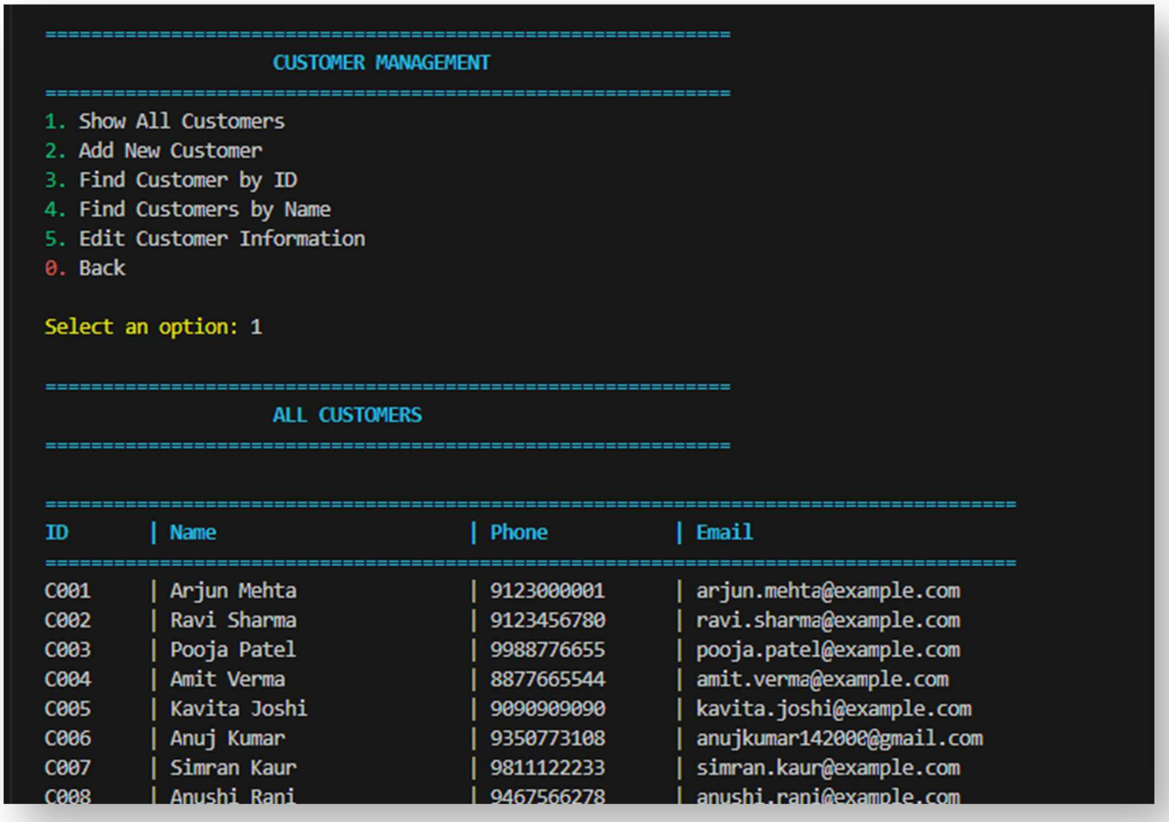
Fig 4.10 On Selecting Option 6, Changes Price of Medicine in the Record

Now, choosing ‘0’ to land at starting of ‘Pharmacy Staff Interface’:

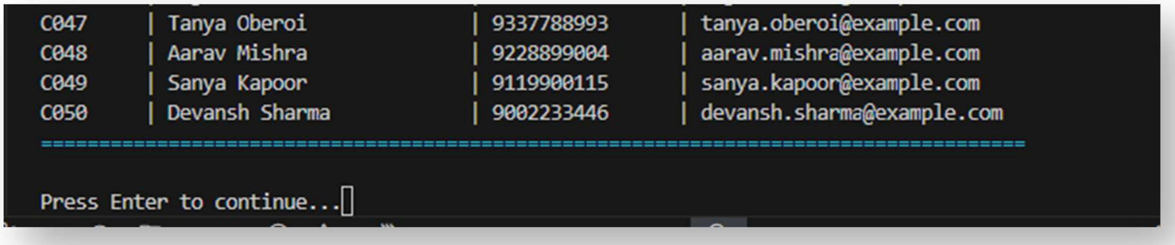


```
============================================================
                    MEDICINE MANAGEMENT
============================================================
1. Show All Medicines
2. Add New Medicine
3. Find Medicine by ID
4. Find Medicines by Name
5. Remove Medicine
6. Update Medicine Price
0. Back

Select an option: 0

============================================================
                    PHARMACY STAFF INTERFACE
============================================================
1. Medicine Management
2. Customer Management
3. Inventory Management
4. Transaction History
0. Back to Main Menu

Select an option: 2

============================================================
                    CUSTOMER MANAGEMENT
```

Fig 4.11 In Pharmacy Staff Interface, Selecting Option 2, Opens Customer Management

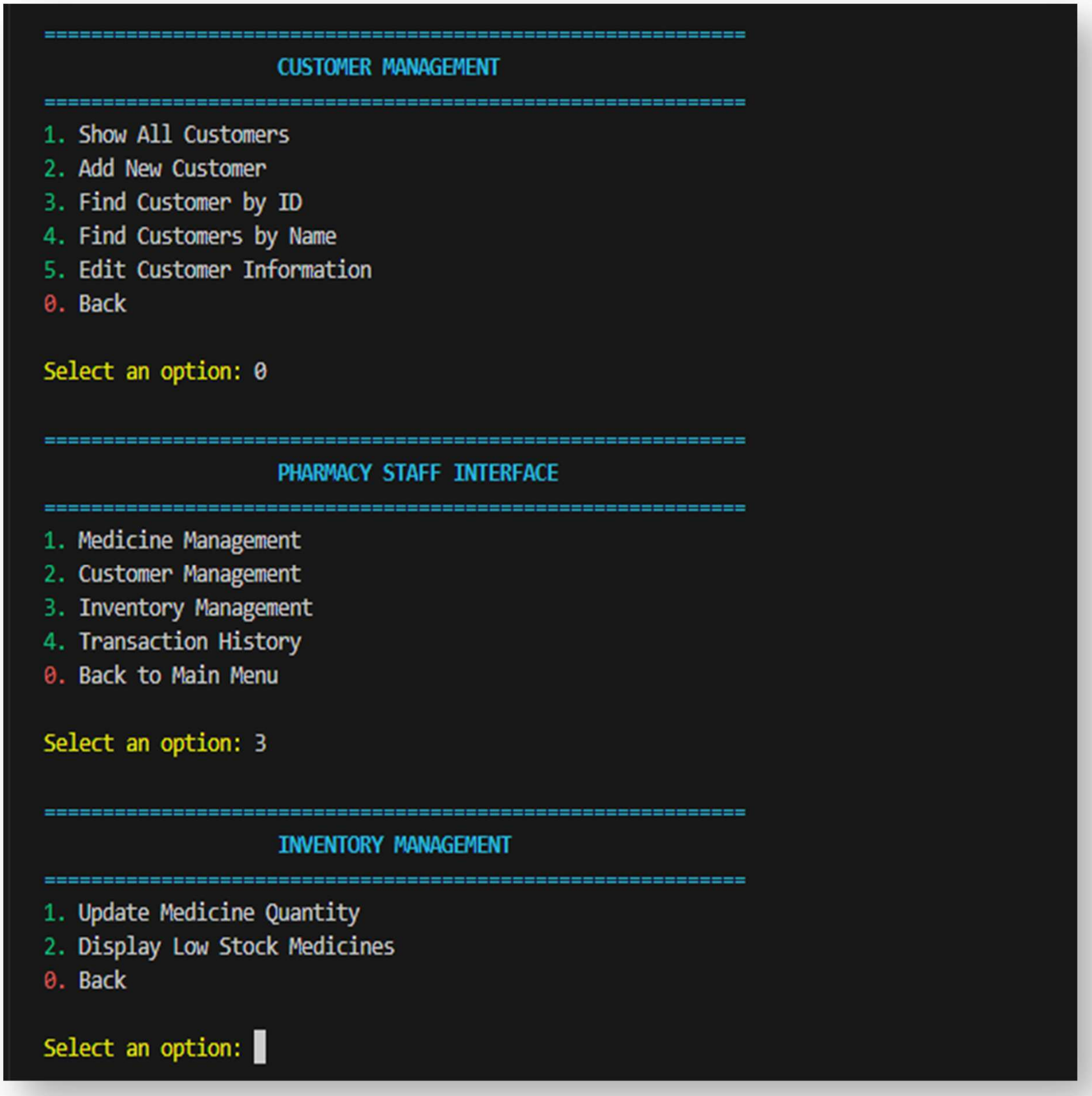


```
============================================================
                    CUSTOMER MANAGEMENT
============================================================
1. Show All Customers
2. Add New Customer
3. Find Customer by ID
4. Find Customers by Name
5. Edit Customer Information
0. Back

Select an option: 1

============================================================
                    ALL CUSTOMERS
============================================================


=====================================================================================
ID        | Name                       | Phone            | Email
=====================================================================================
C001      | Arjun Mehta                | 9123000001       | arjun.mehta@example.com
C002      | Ravi Sharma                | 9123456780       | ravi.sharma@example.com
C003      | Pooja Patel                | 9988776655       | pooja.patel@example.com
C004      | Amit Verma                 | 8877665544       | amit.verma@example.com
C005      | Kavita Joshi               | 9090909090       | kavita.joshi@example.com
C006      | Anuj Kumar                 | 9350773108       | anujkumar142000@gmail.com
C007      | Simran Kaur                | 9811122233       | simran.kaur@example.com
C008      | Anushi Rani                | 9467566278       | anushi.rani@example.com
```



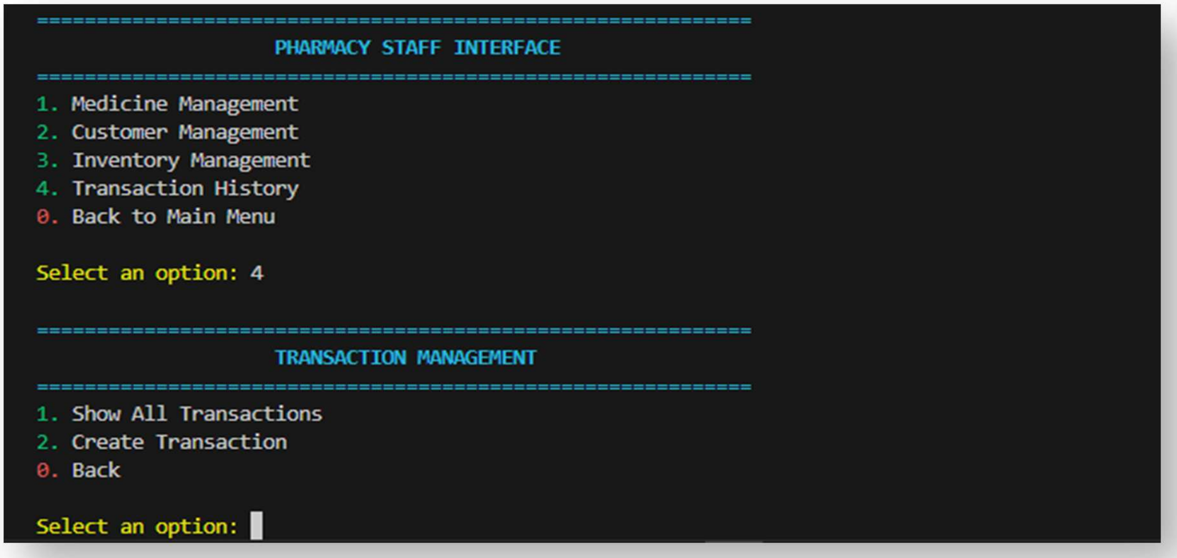
```
C047      | Tanya Oberoi               | 9337788993       | tanya.oberoi@example.com
C048      | Aarav Mishra               | 9228899004       | aarav.mishra@example.com
C049      | Sanya Kapoor               | 9119900115       | sanya.kapoor@example.com
C050      | Devansh Sharma             | 9002233446       | devansh.sharma@example.com
=====================================================================================

Press Enter to continue...
```

Fig 4.12 Under Customer Management, Choosing Option 1, Opens List of All the Customers & so on Can Proceed With All the Options as Done in Medicine Management.



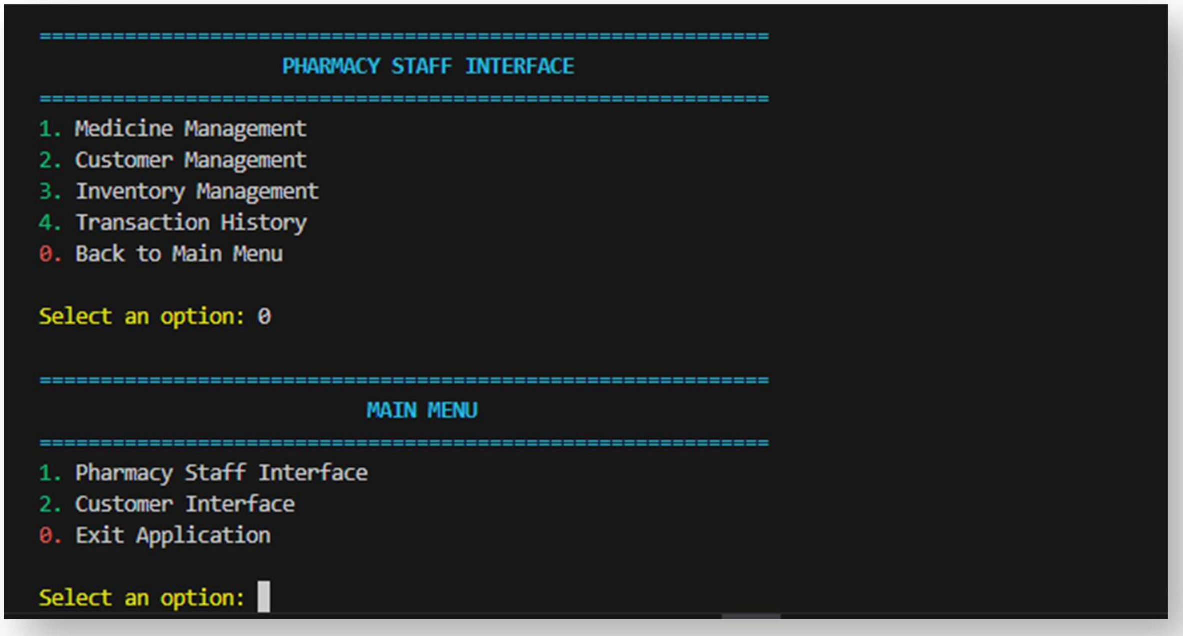
```
============================================================
                    CUSTOMER MANAGEMENT
============================================================
1. Show All Customers
2. Add New Customer
3. Find Customer by ID
4. Find Customers by Name
5. Edit Customer Information
0. Back

Select an option: 0

============================================================
                    PHARMACY STAFF INTERFACE
============================================================
1. Medicine Management
2. Customer Management
3. Inventory Management
4. Transaction History
0. Back to Main Menu

Select an option: 3

============================================================
                    INVENTORY MANAGEMENT
============================================================
1. Update Medicine Quantity
2. Display Low Stock Medicines
0. Back

Select an option: 
```

Fig 4.13 In Pharmacy Staff Interface, Selecting Option 3, Opens Inventory Management



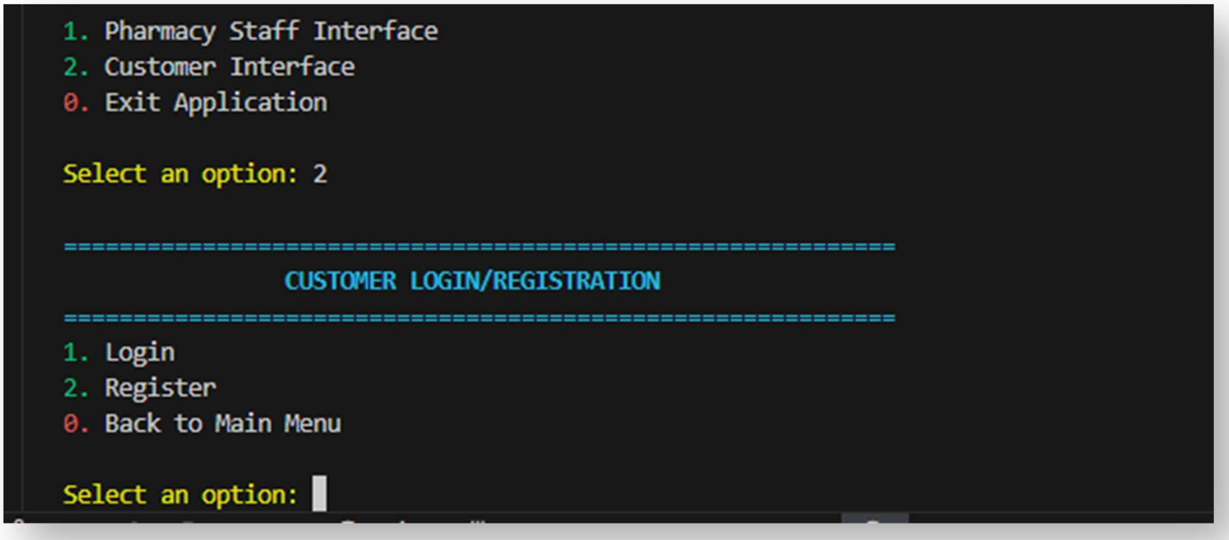
```
============================================================
                    PHARMACY STAFF INTERFACE
============================================================
1. Medicine Management
2. Customer Management
3. Inventory Management
4. Transaction History
0. Back to Main Menu

Select an option: 4

============================================================
                    TRANSACTION MANAGEMENT
============================================================
1. Show All Transactions
2. Create Transaction
0. Back

Select an option: 
```

Fig 4.14 In Pharmacy Staff Interface, selecting option-4, opens Transaction History



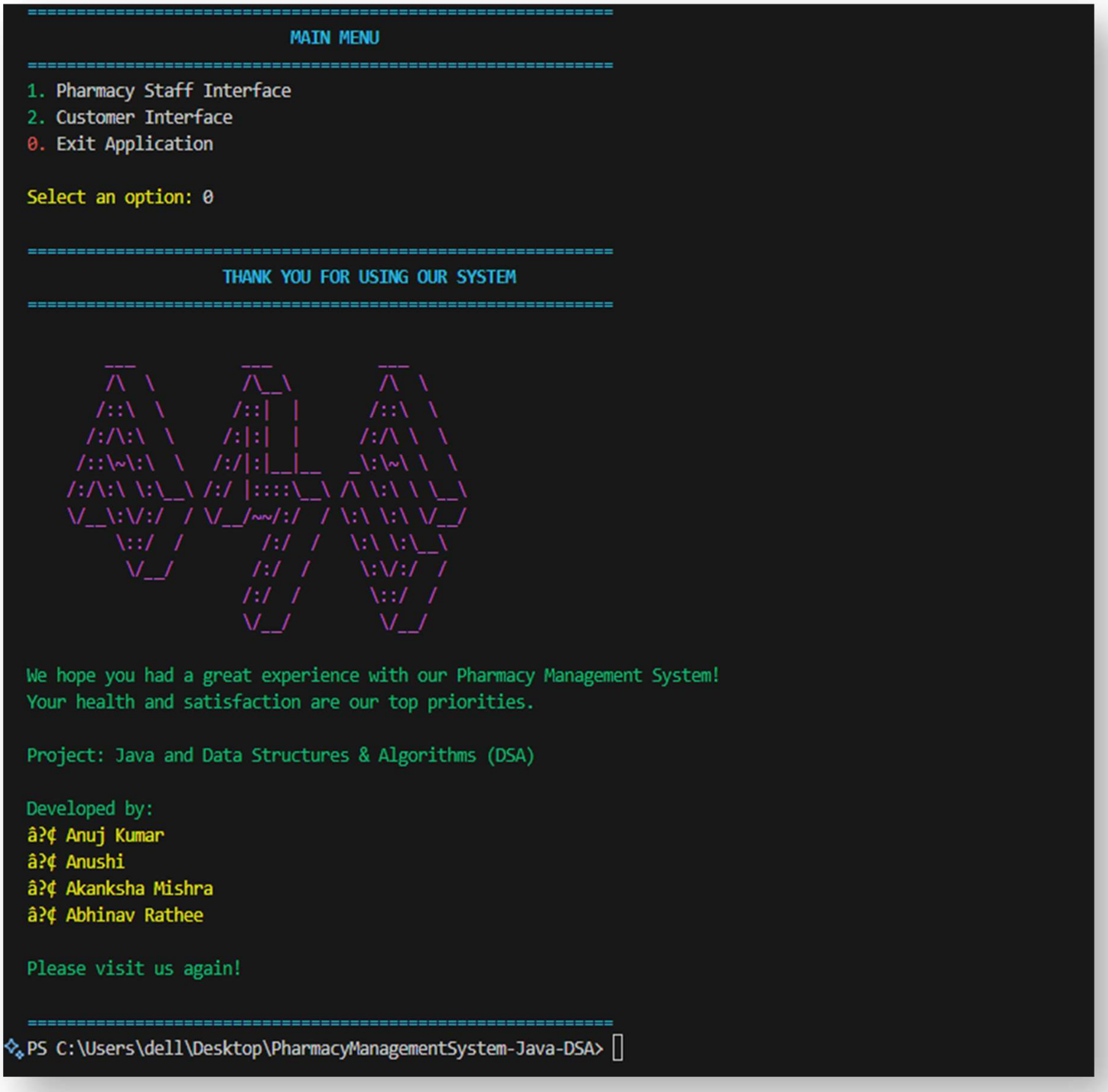
```
============================================================
                    PHARMACY STAFF INTERFACE
============================================================
1. Medicine Management
2. Customer Management
3. Inventory Management
4. Transaction History
0. Back to Main Menu

Select an option: 0

============================================================
                          MAIN MENU
============================================================
1. Pharmacy Staff Interface
2. Customer Interface
0. Exit Application

Select an option: 
```

Fig 4.15 In Pharmacy Staff Interface, selecting option-0, opens Main-Menu where user one shift to Customer Interface by choosing '2' as the option



```
1. Pharmacy Staff Interface
2. Customer Interface
0. Exit Application

Select an option: 2

============================================================
                CUSTOMER LOGIN/REGISTRATION
============================================================
1. Login
2. Register
0. Back to Main Menu

Select an option:
```

Fig 4.16 Further Customer Interface Also has 2 Options to Choose From, else Choose Again '0' to Land Back to Main-Menu



```
============================================================
                           MAIN MENU
============================================================
1. Pharmacy Staff Interface
2. Customer Interface
0. Exit Application

Select an option: 0

============================================================
                    THANK YOU FOR USING OUR SYSTEM
============================================================


         ___           ___           ___
        /\  \         /\__\         /\  \
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We hope you had a great experience with our Pharmacy Management System!
Your health and satisfaction are our top priorities.

Project: Java and Data Structures & Algorithms (DSA)

Developed by:
â?¢ Anuj Kumar
â?¢ Anushi
â?¢ Akanksha Mishra
â?¢ Abhinav Rathee

Please visit us again!

============================================================
PS C:\Users\dell\Desktop\PharmacyManagementSystem-Java-DSA> 
```

Fig 4.17 Further Customer Interface also has 2 options to choose from, else choose again '0' to land to back to Main-Menu

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