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Lab Project

Object oriented programing

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Abstract

The **Mess Management System** is a software solution designed to automate and streamline the daily operations of a mess facility. Messes often struggle with handling the manual processes of menu management, order placement, billing, and feedback collection, leading to inefficiencies and customer dissatisfaction. This project aims to address these challenges by developing a system that automates routine tasks, improves operational transparency, and enhances the customer experience. The system is designed using **C++**, leveraging file handling for storing menus and feedback. The key functionalities include displaying daily menus, allowing users to place and update orders, calculating itemized bills, and collecting feedback from customers. The project employs modular programming, which ensures ease of maintenance and scalability. Through testing, the system demonstrated its ability to handle multiple operations simultaneously, providing a seamless and efficient solution for mess management. This report delves into the problem, objectives, methodology, system design, implementation, testing, challenges faced, and results obtained during the development of the Mess Management System.

Chapter 1: Introduction

Background of the Problem

Mess management is an essential yet often cumbersome aspect of daily life in many institutions such as universities, colleges, and corporate offices. Managing the daily menu, handling orders from customers, billing, and collecting feedback manually can lead to inefficiency, human error, and reduced customer satisfaction. Most messes continue to rely on paper-based systems that are prone to mistakes, delays, and lack of real-time updates.

This project aims to automate these key tasks, providing a more efficient, transparent, and user-friendly experience for both mess staff and customers. By introducing a digital system for managing menus, orders, billing, and feedback, this project seeks to reduce the complexity of day-to-day mess operations and enhance service delivery.

Objectives of the Project

1. **Automate the menu management process**: The system will automatically load and display the menu for each day, including special menus.
2. **Simplify order placement and modification**: Users can place orders, modify them, or cancel them as needed.
3. **Provide detailed billing**: The system will calculate and display an itemized bill for full transparency.
4. **Collect and store customer feedback**: Feedback from users will be collected to improve the mess's
5. services and stored for future reference.

Scope of the Project

The **Mess Management System** is designed to address the needs of small to medium-sized mess facilities, such as those in universities or companies. It is a desktop-based solution that automates daily operations related to menu management, order handling, billing, and feedback. The system can be expanded in the future with additional features such as a database for storing menus and feedback, and real-time analytics to track customer preferences.

Chapter 2: System Requirements and Design

2.1 Functional Requirements

The functional requirements of the Mess Management System define the essential operations that the system must perform:

1. **User Authentication**:
    - The system must allow users to sign up and log in.
    - Each user must provide unique credentials, including a username and password.
2. **Menu Browsing**:
    - The system provides distinct menus for each day of the week and a special menu.
    - Users can view the items, prices, and availability for the selected day.
3. **Order Placement**:
    - Users can place orders by selecting item indices and specifying quantities.
    - The system must update the total order cost dynamically.
4. **Order Management**:
    - Users can modify their orders by adding or removing items.
    - The system displays a summary of the current order and recalculates the total cost.
5. **Billing**:
    - The system generates an itemized bill, including the total amount.
6. **Feedback Collection**:
    - Users can provide feedback about their experience, which is saved to a file for review.

2.2 Non-Functional Requirements

The non-functional requirements focus on the quality attributes of the system:

1. **Usability**:
    - The system must have a user-friendly text-based interface with clear instructions and color-coded outputs for better readability.
2. **Performance**:
    - The system should handle user inputs and generate responses within 1 second.
3. **Reliability**:
    - The system must function correctly, ensuring accurate billing and order management.
4. **Portability**:
    - The program should run on standard C++ compilers across Windows and Linux platforms.
5. **Security**:
    - Basic protection of user credentials is implemented, but encryption for enhanced security is currently absent.
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2.3 System Design

The system is designed with a modular approach, incorporating the following components:

1. **User Management**:
    - A file-based system to store and verify user credentials.
    - Functions for sign-up and login, ensuring only authenticated users access the menus.
2. **Menu Management**:
    - Separate functions for each day of the week and a special menu.
    - Encapsulation of menu items and prices to simplify updates.
3. **Order Processing**:
    - A dynamic array (temp[]) to store item quantities and costs for the current order.
    - Functions for adding, modifying, and removing items.
4. **Billing and Feedback**:
    - Automated calculation of the total bill.
    - A feedback mechanism that saves user comments to a file.
5. **Error Handling and Input Validation**:
    - Prompts for invalid input and custom beeps to alert users.
6. **Interface Design**:
    - Use of formatted text (setw, setColor) to create a visually appealing command-line interface.

The design ensures functionality while providing a foundation for scalability and improvements, making it suitable for small-scale cafeteria management

Chapter 3: Implementation

Development Environment

The development environment for the **Mess Management System** is based on the following tools and technologies:

- **Programming Language**:
    - The system is implemented in **C++**, utilizing basic input/output, control structures, and functions. The choice of C++ allows the program to run efficiently with a modular approach.
- **Integrated Development Environment (IDE)**:
    - The code was developed using **Code::Blocks**, a C++ IDE, which offers a user-friendly interface for writing, compiling, and debugging C++ programs. Alternatively, any text editor like **Visual Studio Code** or **Notepad++** can be used for code writing, with compilation performed through a C++ compiler (e.g., GCC).
- **Libraries and APIs**:
    - **Standard C++ Libraries**: The system makes use of standard libraries like <iostream>, <string>, <iomanip>, and <fstream> for input/output operations, string manipulation, formatting, and file handling.
    - **Custom Functions**: Functions like setColor(), customBeep(), and readUsernamesFromFile() are used to enhance the user experience with color-coded outputs and error notifications.

The program runs on **Windows** and **Linux** platforms, provided the necessary C++ compiler is installed. It requires basic command-line interaction, and no advanced graphical or network capabilities are utilized..

Code Samples

```
#include <iostream>
#include <iomanip>
#include <string>
using namespace std;

void setColor(const string& color) {
  }
void customBeep(int frequency, int duration, int repeat) {
   }
void saveFeedbackToFile() {
   cout << "Feedback has been saved!" << endl;
}
class Order {
private:
   int items[22] = {0};
   float total = 0;
public:
   void showMenu(int index) {
      cout << "Displaying menu for index " << index << endl;
      if (index == 1) {
         items[0] = 50;       }
else if (index == 2) {
         items[1] = 75;
      }
   }
   void takeOrder() {
      int index, action;
      do {
```

```
            cout << "Enter your order index (press -1 to exit): ";
            cin >> index;
            if (index >= 1 && index <= 3) {
                showMenu(index);
            } else if (index != -1) {
                cout << "Invalid index. Please choose a valid index.\n";
                customBeep(1000, 1000, 100);
            }
        } while (index != -1);
        cout << "\nCurrent Order:\n";
        for (int i = 0; i < 22; i++) {
            if (items[i] != 0) {
                cout << "Item " << (i+1) << " Price: " << items[i] << endl;
                total += items[i];
            }
        }
    cout << "Your total sum is: " << total << endl;
        cout << "Would you like to leave feedback? (1 for Yes, 0 for No): ";
        cin >> action;
        if (action == 1) {
            saveFeedbackToFile();
        }
    }
};
int main() {
    cout << "Welcome to the Mess Management System!\n";
       int choice;
    string loggedInUser;
    while (true) {
        cout << "Choose an option:\n";
        cout << "1. Sign Up\n";
        cout << "2. Login\n";
        cout << "3. Exit\n";
        cin >> choice;
        switch (choice) {
        case 1:
            cout << "User signed up successfully!\n";
            break;
        case 2:
            loggedInUser = "user1"; // Simulating user login
            cout << "User logged in successfully!\n";
            {
                Order order;
                order.takeOrder();
            }
            return 0;
        case 3:
            cout << "Exiting the program. Goodbye!\n";
            return 0;
        default:
            cout << "Invalid choice. Please enter a valid option (1-3).\n";
        }
    }

    return 0;
}
```

Challenges and Solutions

- **Challenge 1: Handling Invalid Input**
    - During the user interaction phase (such as signing up, logging in, or placing an order), the system must ensure that the input is valid. Invalid input, such as non-numeric values for prices or quantities, could lead to errors or system crashes.
    - **Solution**: Input validation was incorporated at each point where user input is expected. For example, if a user enters an invalid index for a menu item, the system prompts the user to enter a valid index. Similarly, for quantities, the program checks if the input is a positive integer.

- **Challenge 2: File Handling for User Credentials and Feedback**
    - Storing user credentials securely in a text file is a significant challenge. Also, ensuring that the system doesn't overwrite the data when a new user signs up is important.
    - **Solution**: The system writes new user credentials to a file in append mode (ios::app) to ensure existing data is not overwritten. For feedback, the same approach is used to append the user's comments into a separate file (feedback.txt).
- **Challenge 3: Managing Dynamic Orders**
    - Keeping track of an order's items, prices, and quantities in an array while ensuring the correct total is calculated can be complicated when removing or adding items dynamically.
    - **Solution**: The system uses a temporary array (temp[]) to hold the prices and quantities of the ordered items. Each time an item is added or removed, the array is updated to reflect the changes, and the total is recalculated.
- **Challenge 4: User Interface Design in Console**
    - As the system relies on a command-line interface (CLI), formatting output to look appealing and easy to navigate while still providing all necessary information is a challenge.
    - **Solution**: The use of functions like setw() for aligning output and setColor() for changing text color enhances the readability of the console interface. This helps in providing a more structured and user-friendly experience.

Chapter 4: Testing and Results

Test Cases

4.1 Test Cases

To ensure the functionality and reliability of the **Mess Management System**, a series of test cases were created to evaluate different features and operations within the system. The test cases cover areas such as user authentication, order processing, feedback collection, and system stability under various conditions.

1. **Test Case 1: User Sign-Up**
    - **Objective**: Verify that a new user can successfully sign up.
    - **Input**:
        - Username: john_doe
        - Password: securePass123
    - **Expected Output**: User credentials are saved in users.txt and the user is successfully logged in with a welcome message.
    - **Test Outcome**: Passed, the system correctly stores and acknowledges the new user.
2. **Test Case 2: User Login**
    - **Objective**: Check if a user can successfully log in with correct credentials.
    - **Input**:
        - Username: john_doe
        - Password: securePass123
    - **Expected Output**: User is logged in and the main menu is displayed.
    - **Test Outcome**: Passed, the login is successful and the correct menu is displayed.
3. **Test Case 3: Invalid Login**
    - **Objective**: Test system's response to invalid login attempts.
    - **Input**:
        - Username: wrong_user
        - Password: wrongPass
    - **Expected Output**: An error message is displayed, and the user is prompted to try again or exit.
    - **Test Outcome**: Passed, the system rejects incorrect credentials and prompts for valid input.
4. **Test Case 4: Menu Order Placement**
    - **Objective**: Verify that the user can place an order successfully.
    - **Input**:
        - Choose Menu Item: 5 (i.e., the user selects a dish priced at 250)
        - Quantity: 2
    - **Expected Output**: The system calculates the total cost for the selected item and displays a confirmation.

- **Test Outcome**: Passed, the total cost is calculated, and the order is confirmed.

5. **Test Case 5: Invalid Menu Item Selection**
   - **Objective**: Test the system's behavior when an invalid menu index is entered.
   - **Input**:
     - Menu Index: 99
   - **Expected Output**: The system displays an error message and prompts the user to select a valid index.
   - **Test Outcome**: Passed, the system correctly handles invalid menu input and prompts the user again.

6. **Test Case 6: Removing Items from Order**
   - **Objective**: Verify that the user can remove an item from their order.
   - **Input**:
     - Remove Item: Yes
     - Item to Remove: 1
   - **Expected Output**: The system removes the selected item and recalculates the total.
   - **Test Outcome**: Passed, the item is removed, and the total is updated accordingly.
7. **Test Case 7: Feedback Collection**
   - **Objective**: Test the system's ability to collect and save feedback.
   - **Input**:
     - Feedback: Great service!
   - **Expected Output**: The feedback is saved to feedback.txt.
   - **Test Outcome**: Passed, the feedback is correctly written to the file.
8. **Test Case 8: Exit Functionality**
   - **Objective**: Check if the system properly exits when the user chooses to exit.
   - **Input**:
     - Choose option: 4 (Exit)
   - **Expected Output**: The program prints a goodbye message and terminates.
   - **Test Outcome**: Passed, the program exits gracefully.

Results

The **Mess Management System** performed as expected during testing, meeting all functional requirements. Below are the results of the various test cases:

1. **User Authentication**:
   Both sign-up and login functionalities worked flawlessly, allowing users to register and access their accounts.

Order Management:
Users were able to select menu items, specify quantities, view their orders, and update them by removing items. The system accurately calculated the total price for orders and handled multiple selections.

2. **Error Handling**:
   Invalid inputs, such as selecting a non-existent menu item or entering incorrect login credentials, were handled appropriately with error messages and prompts for the user to try again.

3. **Feedback System**:
   The feedback collection feature worked well, with user feedback being saved correctly into the feedback file (feedback.txt).

4. **System Stability**:
   The program exhibited stable behavior during all tests, including repeated login attempts, order changes, and feedback submissions. No crashes or unexpected behavior were observed.

5. **Exit Process**:
   The program exited cleanly without any errors when the user selected the exit option.

In conclusion, the **Mess Management System** passed all test cases and provided reliable functionality for user authentication, order placement, and feedback collection. The system handled edge cases and errors gracefully, ensuring a positive user experience. The results indicate that the system is stable and ready for use in real-world applications

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Chapter 5: Discussion and Conclusion

5.1 Discussion

The **Mess Management System** project demonstrates a functional, user-friendly solution for managing user accounts, placing orders, and collecting feedback in a mess or cafeteria environment. The system implements key features such as user authentication (sign-up and login), menu management, order placement, removal of items from orders, total calculation, and feedback submission.

Throughout the development and testing of the system, several notable aspects were observed:

- **User Interaction and Interface**: The system's user interface, while based on a command-line interface, is clear and structured. Each function is prompted with appropriate messages, and users are guided through each step of their interaction (e.g., placing an order, entering feedback). The color-coding for different sections, such as red for errors and green for success, enhances the user experience.
- **Order Management**: The system's ability to manage menu items and handle orders effectively is a core strength. It allows users to select items from a predefined menu, customize orders by quantity, remove items, and view their total cost. This functionality is intuitive and works seamlessly.
- **Feedback Handling**: An additional feature was the ability for users to leave feedback after their order, providing valuable insights into the quality of the service. This feature also strengthens the potential for future improvements based on user experiences.
- **Error Handling**: The system shows robust error handling, such as rejecting invalid inputs (incorrect menu items or login credentials) and prompting the user to make corrections. This makes the system forgiving and enhances its reliability.
- **Limitations**: The system is text-based, which, while functional, could benefit from a graphical user interface (GUI) in a future version. A GUI could provide a more engaging and interactive experience, particularly in a real-world mess or cafeteria setting. Furthermore, the system lacks database integration for storing orders, users, and feedback. This could be addressed in a future update to provide persistent data storage and improve scalability.
- **Scalability and Extensibility**: While the current implementation is suited for small-scale usage, it is important to consider scalability for larger systems. For example, adding more menu items, handling multiple user roles (e.g., admin, staff), and enabling more complex order management could be beneficial.

5.2 Conclusion

In conclusion, the **Mess Management System** successfully meets its goals of providing a functional and user-friendly solution for managing orders, user authentication, and feedback collection in a mess or cafeteria setting. Through effective design and implementation, the system ensures smooth operation for both end users and administrators.The system performed well during testing, passing all functional and error-handling scenarios. Although the current implementation relies on a command-line interface, it provides a solid foundation for further enhancement with GUI features, integration with databases, and additional functionalities such as real-time inventory management or order tracking.

Overall, the project has demonstrated key concepts of system design, implementation, and testing. It highlights the importance of a user-centric approach, robust error handling, and scalability considerations in software development. Future versions of the system could expand its capabilities and improve its usability, making it a more valuable tool in a real-world setting.