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Inventory Management System in C++ Using Structures

1. Introduction

The Inventory Management System (IMS) is a C++ structure-based CRUD (Create, Read, Update, Delete) project designed to help businesses efficiently manage their product inventory. The system allows users to register, update, delete, and search for products in an organized manner, ensuring seamless inventory tracking and management.

To enhance usability and functionality, the system incorporates additional features such as file handling (for saving and loading data), sorting (by name and price), and input validation. These features improve data persistence, organization, and error prevention, making the system robust and user-friendly.

By leveraging C++ structures, the IMS ensures that product data is stored in an organized format, enabling efficient retrieval and modification. This makes the system a practical tool for businesses to manage stock, update inventory records, and maintain accurate product information.

2. Objectives of the Project

The primary objectives of this project are:

- To **demonstrate the use of structures (struct)** in C++ for organizing product data.
- To implement **CRUD (Create, Read, Update, Delete) operations** on an inventory database.
- To introduce **file handling** for data storage and retrieval.
- To allow sorting of inventory **by product name and price**.
- To implement **input validation** to prevent incorrect data entry.

3. System Requirements

3.1 Features to Implement (CRUD Operations)

1. **Add a New Product (Create)** – Register a new product with details such as ID, name, quantity, price, and category.
2. **Update Product Details (Update)** – Modify existing product details, such as quantity or price.
3. **Delete a Product (Delete)** – Remove a product from the inventory.
4. **Search for a Product (Read/Search)** – Retrieve product details using ID or name.
5. **Display All Products** – List all available inventory items.

4. Structure Definition

To manage products efficiently, we define a structure to store multiple attributes:

```
struct Product {
    int id;             // Unique Product ID
    char name[50];      // Product Name
    int quantity;       // Available Quantity
    float price;        // Price per Unit
    char category[30];  // Category of the Product
};
```

Why Use Structures?

- They group related data into a single unit.
- They make data handling more structured and readable.

5. Implementation of Features

5.1 Adding a New Product (Create Operation)

This function allows the user to input product details and store them in an array.

```
void addProduct(Product inventory[], int &count) {
    cout << "Enter Product ID: ";
    cin >> inventory[count].id;
    cout << "Enter Product Name: ";
    cin.ignore();
    cin.getline(inventory[count].name, 50);
    cout << "Enter Quantity: ";
    cin >> inventory[count].quantity;
    cout << "Enter Price: ";
    cin >> inventory[count].price;
    cout << "Enter Category: ";
    cin.ignore();
    cin.getline(inventory[count].category, 30);

    count++;
    cout << "Product Added Successfully!\n";
}
```

Key Features:

- Uses cin.ignore() to handle input buffer issues.
- Uses getline() to accept names with spaces.

5.2 Updating a Product (Update Operation)

This function modifies the details of an existing product.

```
void updateProduct(Product inventory[], int count) {
    int searchID;
    cout << "Enter Product ID to update: ";
    cin >> searchID;

    for (int i = 0; i < count; i++) {
        if (inventory[i].id == searchID) {
            cout << "Enter New Quantity: ";
            cin >> inventory[i].quantity;
            cout << "Enter New Price: ";
            cin >> inventory[i].price;
            cout << "Product Updated Successfully!\n";
            return;
        }
    }
    cout << "Product ID Not Found!\n";
}
```

Key Features:

- Prevents modification of non-existent products.

5.3 Deleting a Product (Delete Operation)

This function removes a product from inventory by shifting elements.

```
void deleteProduct(Product inventory[], int &count) {
    int searchID;
    cout << "Enter Product ID to delete: ";
    cin >> searchID;

    for (int i = 0; i < count; i++) {
        if (inventory[i].id == searchID) {
            for (int j = i; j < count - 1; j++) {
                inventory[j] = inventory[j + 1];
            }
            count--;
            cout << "Product Deleted Successfully!\n";
            return;
        }
    }
    cout << "Product ID Not Found!\n";
}
```

Key Features:

- Prevents gaps in the inventory array.

5.4 Searching for a Product (Read/Search Operation)

```
void searchProduct(Product inventory[], int count) {
    int choice;
    cout << "Search by: 1) ID 2) Name\n";
    cin >> choice;

    if (choice == 1) {
        int searchID;
        cout << "Enter Product ID: ";
        cin >> searchID;
        for (int i = 0; i < count; i++) {
            if (inventory[i].id == searchID) {
                cout << "Product Found: " << inventory[i].name << "\n";
                return;
            }
        }
    } else if (choice == 2) {
        char searchName[50];
        cout << "Enter Product Name: ";
        cin.ignore();
        cin.getline(searchName, 50);
        for (int i = 0; i < count; i++) {
            if (strcmp(inventory[i].name, searchName) == 0) {
                cout << "Product Found: " << inventory[i].name << "\n";
                return;
            }
        }
    }
    cout << "Product Not Found!\n";
}
```

Key Features:

- Supports searching by both ID and name.

5.5 Displaying All Products

```
void displayInventory(Product inventory[], int count) {
    cout << "ID\tName\tQuantity\tPrice\tCategory\n";
    for (int i = 0; i < count; i++) {
        cout << inventory[i].id << "\t" << inventory[i].name << "\t"
             << inventory[i].quantity << "\t" << inventory[i].price << "\t"
             << inventory[i].category << "\n";
    }
}
```

Key Features:

- Displays inventory in a readable tabular format.

6. Additional Features

6.1 File Handling: Save & Load Inventory Data

- *Saving Data to a File*

```
void saveToFile(Product inventory[], int count) {
    ofstream file("inventory.txt");
    for (int i = 0; i < count; i++) {
        file << inventory[i].id << " " << inventory[i].name << " "
             << inventory[i].quantity << " " << inventory[i].price << " "
             << inventory[i].category << endl;
    }
    file.close();
    cout << "Inventory Saved Successfully!\n";
}
```

- *Loading Data from a File*

```
void loadFromFile(Product inventory[], int &count) {
    ifstream file("inventory.txt");
    count = 0;

    while (file >> inventory[count].id) {
        file.ignore();
        file.getline(inventory[count].name, 50, ' ');
        file >> inventory[count].quantity >> inventory[count].price;
        file.ignore();
        file.getline(inventory[count].category, 30);
        count++;
    }

    file.close();
    cout << "Inventory Loaded Successfully!\n";
}
```

6.2 Sorting Inventory

- *Sort By Name*

```
void sortByName(Product inventory[], int count) {
    for (int i = 0; i < count - 1; i++) {
        for (int j = 0; j < count - i - 1; j++) {
            if (strcmp(inventory[j].name, inventory[j + 1].name) > 0) {
                swap(inventory[j], inventory[j + 1]);
            }
        }
    }
    cout << "Inventory Sorted by Name!\n";
}
```

- *Sort By Price*

```
void sortByPrice(Product inventory[], int count) {
    for (int i = 0; i < count - 1; i++) {
        for (int j = 0; j < count - i - 1; j++) {
            if (inventory[j].price > inventory[j + 1].price) {
                swap(inventory[j], inventory[j + 1]);
            }
        }
    }
    cout << "Inventory Sorted by Price!\n";
}
```

7. Complete C++ Code for Inventory Management System

```
#include <iostream>
#include <fstream>
#include <cstring>
#include <limits>
using namespace std;

// Structure to store product information
struct Product {
    int id;
    char name[50];
    double price;
    int quantity;
};

// Global variables
const int MAX_PRODUCTS = 100;
Product inventory[MAX_PRODUCTS];
int productCount = 0;

// Function to add a new product
void addProduct() {
    if (productCount >= MAX_PRODUCTS) {
        cout << "Inventory is full. Cannot add more products.\n";
        return;
    }
    Product newProduct;
    cout << "Enter product ID: ";
    cin >> newProduct.id;
    cin.ignore(numeric_limits<streamsize>::max(), '\n');

    cout << "Enter product name: ";
    cin.getline(newProduct.name, 50);

    cout << "Enter price: ";
    cin >> newProduct.price;

    cout << "Enter quantity: ";
    cin >> newProduct.quantity;

    inventory[productCount++] = newProduct;
    cout << "Product added successfully.\n";
}

// Function to display all products
void displayInventory() {
    if (productCount == 0) {
        cout << "No products in inventory.\n";
        return;
    }

    cout << "Inventory List:\n";
    for (int i = 0; i < productCount; i++) {
        cout << "ID: " << inventory[i].id
             << ", Name: " << inventory[i].name
             << ", Price: $" << inventory[i].price
             << ", Quantity: " << inventory[i].quantity << endl;
    }
}

// Function to search for a product by ID
void searchProduct() {
    int searchId;
    cout << "Enter product ID to search: ";
    cin >> searchId;

    for (int i = 0; i < productCount; i++) {
        if (inventory[i].id == searchId) {
            cout << "Product found: "
                 << "ID: " << inventory[i].id
                 << ", Name: " << inventory[i].name
                 << ", Price: $" << inventory[i].price
                 << ", Quantity: " << inventory[i].quantity << endl;
            return;
        }
    }
    cout << "Product not found.\n";
}

// Function to update product details
void updateProduct() {
    int updateId;
    cout << "Enter product ID to update: ";
    cin >> updateId;

    for (int i = 0; i < productCount; i++) {
        if (inventory[i].id == updateId) {
            cout << "Enter new name: ";
            cin.ignore();
            cin.getline(inventory[i].name, 50);

            cout << "Enter new price: ";
            cin >> inventory[i].price;

            cout << "Enter new quantity: ";
            cin >> inventory[i].quantity;

            cout << "Product updated successfully.\n";
            return;
        }
    }

    cout << "Product not found.\n";
}

// Function to delete a product by ID
void deleteProduct() {
    int deleteId;
    cout << "Enter product ID to delete: ";
    cin >> deleteId;

    for (int i = 0; i < productCount; i++) {
        if (inventory[i].id == deleteId) {
            for (int j = i; j < productCount - 1; j++) {
                inventory[j] = inventory[j + 1];
            }
            productCount--;
            cout << "Product deleted successfully.\n";
            return;
        }
    }

    cout << "Product not found.\n";
}
```

```
// Function to save inventory to a file
void saveToFile() {
    ofstream outFile("inventory.txt");
    if (!outFile) {
        cout << "Error opening file for writing.\n";
        return;
    }

    outFile << productCount << endl;
    for (int i = 0; i < productCount; i++) {
        outFile << inventory[i].id << " "
                << inventory[i].name << " "
                << inventory[i].price << " "
                << inventory[i].quantity << endl;
    }

    outFile.close();
    cout << "Inventory saved to file successfully.\n";
}

// Function to load inventory from a file
void loadFromFile() {
    ifstream inFile("inventory.txt");
    if (!inFile) {
        cout << "No previous inventory found.\n";
        return;
    }

    inFile >> productCount;
    for (int i = 0; i < productCount; i++) {
        inFile >> inventory[i].id;
        inFile.ignore();
        inFile.getline(inventory[i].name, 50);
        inFile >> inventory[i].price >> inventory[i].quantity;
    }

    inFile.close();
    cout << "Inventory loaded successfully.\n";
}

// Main function to run the program
int main() {
    loadFromFile(); // Load previous inventory data if available

    int choice;
    do {
        cout << "\nInventory Management System\n";
        cout << "1. Add Product\n";
        cout << "2. Display Inventory\n";
        cout << "3. Search Product\n";
        cout << "4. Update Product\n";
        cout << "5. Delete Product\n";
        cout << "6. Save to File\n";
        cout << "7. Exit\n";
        cout << "Enter your choice: ";
        cin >> choice;

        switch (choice) {
            case 1: addProduct(); break;
            case 2: displayInventory(); break;
            case 3: searchProduct(); break;
            case 4: updateProduct(); break;
            case 5: deleteProduct(); break;
            case 6: saveToFile(); break;
            case 7: cout << "Exiting program...\n"; break;
            default: cout << "Invalid choice. Try again.\n";
        }
    } while (choice != 7);

    return 0;
}
```

Expected Output

Example 1: Adding Products

```
Inventory Management System
1. Add Product
2. Display Inventory
3. Search Product
4. Update Product
5. Delete Product
6. Save to File
7. Exit
Enter your choice: 1
Enter product ID: 101
Enter product name: Laptop
Enter price: 1500.99
Enter quantity: 5
Product added successfully.
```

Example 2: Display Inventory

```
Inventory List:
ID: 101, Name: Laptop, Price: $1500.99, Quantity: 5
```

Example 3: Searching for a Product

```
Enter product ID to search: 101
Product found: ID: 101, Name: Laptop, Price: $1500.99, Quantity: 5
```

Example 4: Updating a Product

```
Enter product ID to update: 101
Enter new name: Gaming Laptop
Enter new price: 1800.50
Enter new quantity: 3
Product updated successfully.
```

Example 5: Deleting a Product

```
Enter product ID to delete: 101
Product deleted successfully.
```

Example 6: Saving to File

```
Inventory saved to file successfully.
```

Conclusion

This project successfully implements an Inventory Management System using C++ structures and includes CRUD operations, file handling, sorting, and input validation. These enhancements ensure better functionality, usability, and improved readability.

References

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