

The background features a light grey gradient. In the top-left and bottom-right corners, there are clusters of thin, curved grey lines that create a sense of motion or depth. Additionally, there are two solid grey triangles: one in the top-right corner pointing downwards and one in the bottom-left corner pointing upwards.

# **PRESENTATION**



# PROJECT OVERVIEW

This is a comprehensive C++ console application designed for personal financial management. The Enhanced Expense Tracker v2.0 provides users with a robust system to track, manage, analyze, and report on their personal expenses with advanced features like undo/redo functionality, detailed analytics, and multiple search options.

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# ARCHITECTURE AND DESIGN PATTERN

The application follows **Object-Oriented Programming** (OOP) principles with a well-structured class hierarchy:

## Core Classes

1. **Validator Class** - Utility class for input validation and formatting
  2. **Expense Class** - Represents individual expense records
  3. **ExpenseManager Class** - Handles all expense operations and data management
  4. **ExpenseTrackerApp Class** - Main application interface and menu system
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# VALIDATOR CLASS (UTILITY HELPER)

**Purpose:** Provides static utility methods for data validation, formatting, and conversion.

Key Features:

- **Input Validation:** Validates monetary amounts, dates, and formats
  - **Date Operations:** Checks date validity, leap years, and calculates date differences
  - **String Utilities:** Trimming, case conversion, and formatting
  - **Currency Formatting:** Consistent money display with \$ symbol and 2 decimal places
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# EXPENSE CLASS (DATA MODEL)

**Purpose:** Represents a single expense record with comprehensive attributes.

## **Core Attributes:**

- **id** - Unique auto-incrementing identifier
  - **description** - Expense description
  - **amount** - Monetary value
  - **category** - Classification (Food, Transport, etc.)
  - **date** - Date in YYYY-MM-DD format
  - **notes** - Additional notes (optional)
  - **isRecurring** - Recurring expense flag
  - **paymentMethod** - Cash, Card, Online, etc.
  - **location** - Where expense occurred
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# EXPENSE CLASS (DATA MODEL)

**Purpose:** Provides static utility methods for data validation, formatting, and conversion.

Key Features:

- **Auto-ID Generation:** Static nextId ensures unique identifiers
- **Data Validation:** Setters include validation logic
- **Serialization:** toString() and fromString() for file persistence
- **Display Methods:** Both tabular and detailed view formats
- **Copy Functionality:** Creates duplicates with modified descriptions

**Data Persistence Format:**

ID|Description|Amount|Category|Date|Notes|IsRecurring|PaymentMethod|Location

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# EXPENSEMANAGER CLASS

## (CORE BUSINESS LOGIC)

**Purpose:** Manages all expense operations, file I/O, search functionality, and analytics.

### Data Management Features

Storage Mechanisms:

- **vector<Expense> expenses** - Primary data storage
  - **stack<vector<Expense>> undoStack** - Undo functionality (up to 20 operations)
  - **stack<vector<Expense>> redoStack** - Redo functionality
  - **set<string> categories** - Unique category tracking
  - **map<string, int> categoryCount** - Category usage statistics
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# EXPENSEMANAGER CLASS

## Core Functionalities

### 1. Expense Operations:

- **Add Expense:** Full featured form with all fields
- **Quick Add:** Streamlined entry with smart defaults
- **Update Expense:** Selective field modification
- **Delete Expense:** Confirmation-based deletion
- **Duplicate Expense:** Creates copies with "(Copy)" suffix

### 2. View and Display Options:

- **View All:** Sortable by date, amount, category, or ID
  - **View by Category:** Grouped display with percentages
  - **View Recurring:** Shows monthly recurring expenses
  - **Detailed View:** Complete information for single expense
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# EXPENSEMANAGER CLASS

## Core Functionalities

### Advanced Search System:

- **By Description:** Partial string matching (case-insensitive)
  - **By Category:** Exact category matching
  - **By Date Range:** Between start and end dates
  - **By Amount Range:** Between minimum and maximum amounts
  - **By Payment Method:** Exact payment method matching
  - **Advanced Search:** Multiple criteria combination
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# EXPENSEMANAGER CLASS

## Core Functionalities

### Analytics and Reporting:

- **Summary Generation:** Comprehensive expense analytics including:
    - Total expenses and amounts
    - Average expense calculation
    - Highest/lowest expense identification
    - Category breakdown with percentages
    - Payment method distribution
    - Monthly trends analysis
    - Recurring expense projections
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# EXPENSEMANAGER CLASS

## Core Functionalities

### Data Operations:

- **File Persistence:** Automatic save/load with error handling
- **CSV Export:** Professional format for external analysis
- **Backup Creation:** Timestamped backup files
- **Data Clearing:** Secure deletion with confirmation

### Undo/Redo System:

- **State Management:** Saves state before modifications
  - **Memory Management:** Limits undo stack to 20 operations
  - **Operation Tracking:** Separate undo and redo stacks
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# EXPENSETRACKERAPP CLASS (USER INTERFACE)

**Purpose: Provides the main application interface and user experience.**

Features:

- **Comprehensive Menu:** 16 different operations organized by category
- **Input Validation:** Robust menu choice handling
- **Screen Management:** Clear screen and pause functionality
- **User Experience: Professional formatting and feedback**
- **Error Handling:** Graceful error recovery

# EXPENSETRACKERAPP CLASS

Menu Structure:

## **EXPENSE MANAGEMENT (1-6)**

- |—— Add/Quick Add Expenses
- |—— View Options (All, Details, Category, Recurring)

## **SEARCH & FILTER (7)**

- |—— Multiple search criteria

## **EDIT & MANAGE (8-10)**

- |—— Update, Delete, Duplicate

## **UNDO/REDO (11-12)**

- |—— Operation history management

## **REPORTS & ANALYTICS (13-14)**

- |—— Summary generation and CSV export

## **UTILITIES (15-16)**

- |—— Backup and data management
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# Welcome to Enhanced Expense Tracker v2.0!

Your comprehensive solution for  
managing personal finances

## ENHANCED EXPENSE TRACKER

### EXPENSE MANAGEMENT

1. Add Expense
2. Quick Add Expense
3. View All Expenses
4. View Expense Details
5. View Expenses by Category
6. View Recurring Expenses

### SEARCH & FILTER

7. Search Expenses

### EDIT & MANAGE

8. Update Expense
9. Delete Expense
10. Duplicate Expense

### UNDO/REDO

11. Undo Last Operation
12. Redo Last Operation

### REPORTS & ANALYTICS

13. Generate Summary & Analytics
14. Export to CSV

### UTILITIES

15. Backup Data
16. Clear All Data

0. Exit Application



# TECHNICAL IMPLEMENTATION

## File I/O System

**Storage Format:** Pipe-delimited text file for human readability and parsing efficiency.

### Error Handling:

- Graceful handling of missing files
- Corruption detection and skipping
- Automatic recovery mechanisms

## Memory Management

### Efficient Data Structures:

- **vector** for primary storage (dynamic sizing)
  - **stack** for undo/redo (LIFO operations)
  - **set** for unique categories (sorted, no duplicates)
  - **map** for statistics (key-value relationships)
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# TECHNICAL IMPLEMENTATION

## Input Validation System

### Multi-layered Validation:

1. **Format Validation:** Regex patterns for amounts and dates
2. **Range Validation:** Logical bounds checking
3. **Business Logic Validation:** Domain-specific rules
4. **User Experience:** Clear error messages and retry prompts

## Search Algorithm Implementation

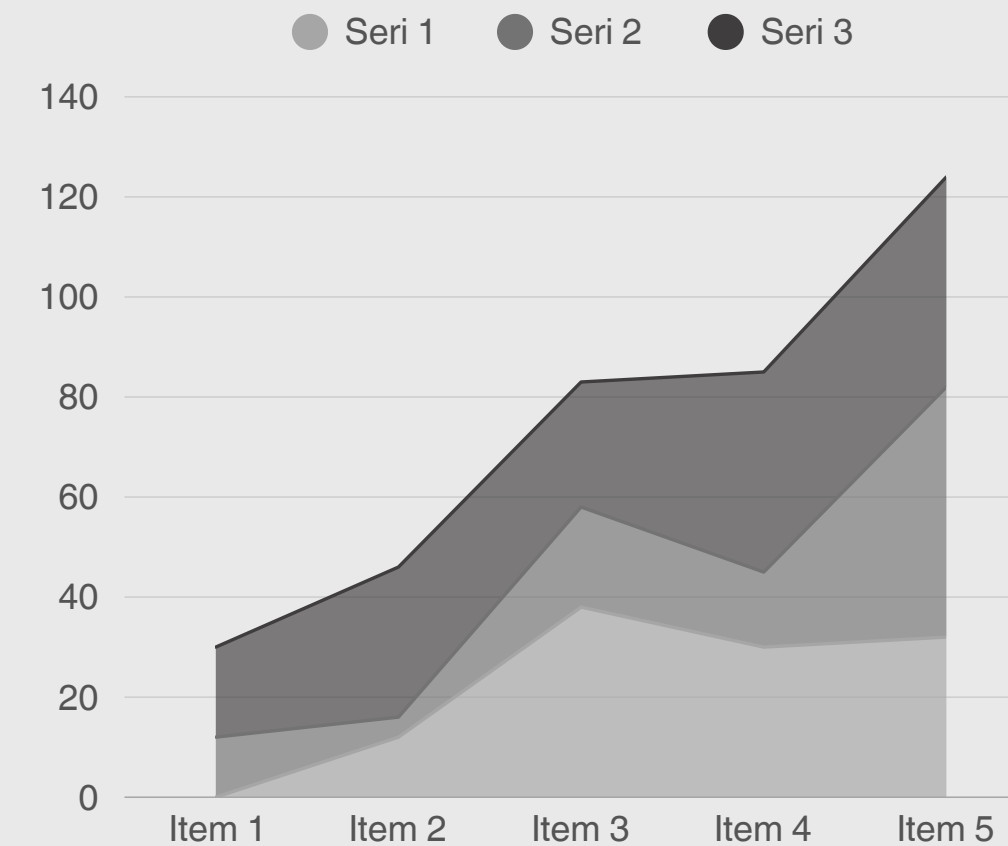
### Search Efficiency:

- **Linear Search:**  $O(n)$  complexity for all search operations
  - **Case-insensitive Matching:** Consistent user experience
  - **Partial Matching:** Flexible description searches
  - **Multi-criteria Filtering:** Boolean logic combination
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# ADVANCED FEATURES

## Statistical Analytics

- **Category Analysis:** Spending patterns by category with percentages
- **Payment Method Tracking:** Distribution across payment types
- **Monthly Trends:** Time-based expense analysis
- **Recurring Projections:** Annual spending forecasts



# ADVANCED FEATURES

## User Experience Enhancements

- **Smart Suggestions:** Category recommendations based on usage
- **Quick Operations:** Streamlined data entry
- **Comprehensive Feedback:** Success/error messages
- **Professional Display:** Formatted tables and reports\

## Data Integrity

- **Backup System:** Timestamped backup creation
  - **Undo Protection:** Safe operation reversal
  - **Validation Layers:** Multiple validation checkpoints
  - **Error Recovery:** Graceful degradation
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# CONCLUSION

This Enhanced Personal Expense Tracker represents a well-engineered C++ application that demonstrates advanced programming concepts including object-oriented design, file I/O, data structures, algorithms, and user interface design. The comprehensive feature set makes it suitable for both personal and small business financial management while maintaining code quality and user experience standards.

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# THANK YOU