

# FinBro Developer Guide

## Introduction

FinBro is a personal finance management application that operates through a Command Line Interface (CLI). This developer guide provides comprehensive information about the architecture, implementation, and design decisions behind FinBro to help developers understand the codebase and contribute effectively.

## Setting Up the Development Environment

### Prerequisites

- JDK 17
- Gradle 7.6.2 or higher
- IntelliJ IDEA (recommended)

### Getting Started

1. Clone the repository:

```
git clone https://github.com/AY2425S2-CS2113-W13-3/tp.git
```

2. Import the project as a Gradle project in IntelliJ IDEA:

- Open IntelliJ IDEA
- Select "Import Project"
- Navigate to the project directory and select the `build.gradle` file
- Follow the prompts to complete the import

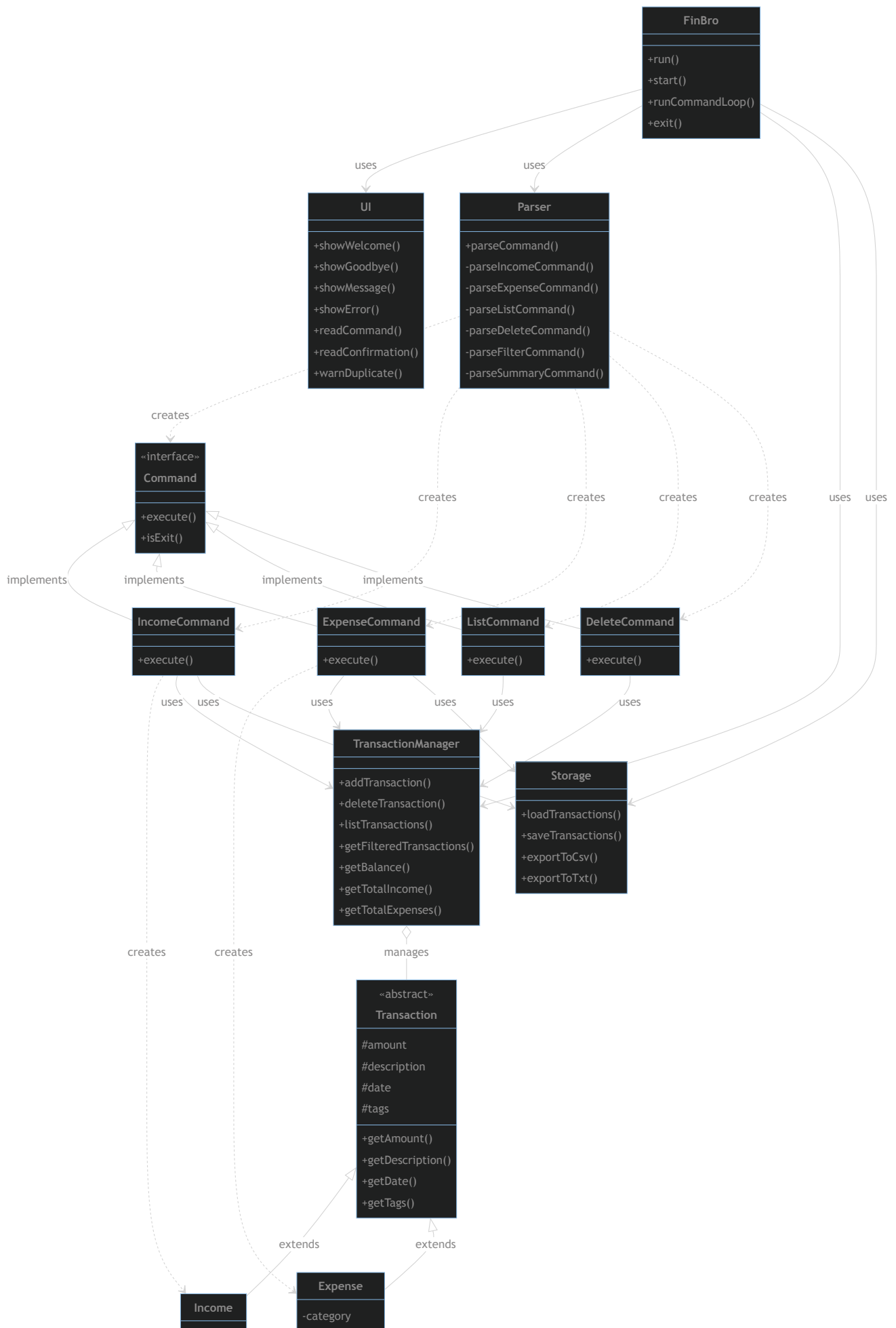
3. Verify the setup:

- Run the tests:  `./gradlew test`
- Run the application:  `./gradlew run`

## Architecture

FinBro follows a layered architecture pattern with clear separation of concerns:





```
+toString()
```

```
+getCategory()  
+toString()
```

## Sequence Diagram

## Component Overview

### 1. Main Component ( `FinBro.java` )

- Serves as the entry point of the application
- Coordinates interactions between other components
- Manages the main execution flow

### 2. UI Component ( `Ui.java` )

- Handles all user interaction through the command line
- Displays messages, prompts, and results to the user
- Captures and forwards user input to the parser

### 3. Logic Component

- **Parser** ( `Parser.java` ): Converts user input into command objects
- **Command Classes**: Implement specific functionalities using the Command pattern

### 4. Model Component

- **Transaction Classes**: Define the core data structures
- **TransactionManager**: Manages the collection of transactions
- Implements business logic and operations on the data model

### 5. Storage Component ( `Storage.java` )

- Handles persistence of data
- Manages saving and loading of transaction data
- Supports data export in various formats

## Class Structure

```
seedu.finbro/  
├── FinBro.java           # Main class  
├── logic/  
│   ├── command/  
│   │   ├── Command.java       # Command interface  
│   │   ├── IncomeCommand.java  
│   │   ├── ExpenseCommand.java  
│   │   └── ...                # Other command implementations  
│   └── parser/  
│       └── Parser.java         # Input parser  
├── model/  
│   ├── Transaction.java       # Abstract base class  
│   └── Income.java
```

```

|   | Expense.java
|   | TransactionManager.java # Business logic
|   |
| storage/
|   | Storage.java           # Data persistence
|   |
| ui/
|   | Ui.java                 # User interface

```

## Sequence Diagrams

### Adding a Transaction

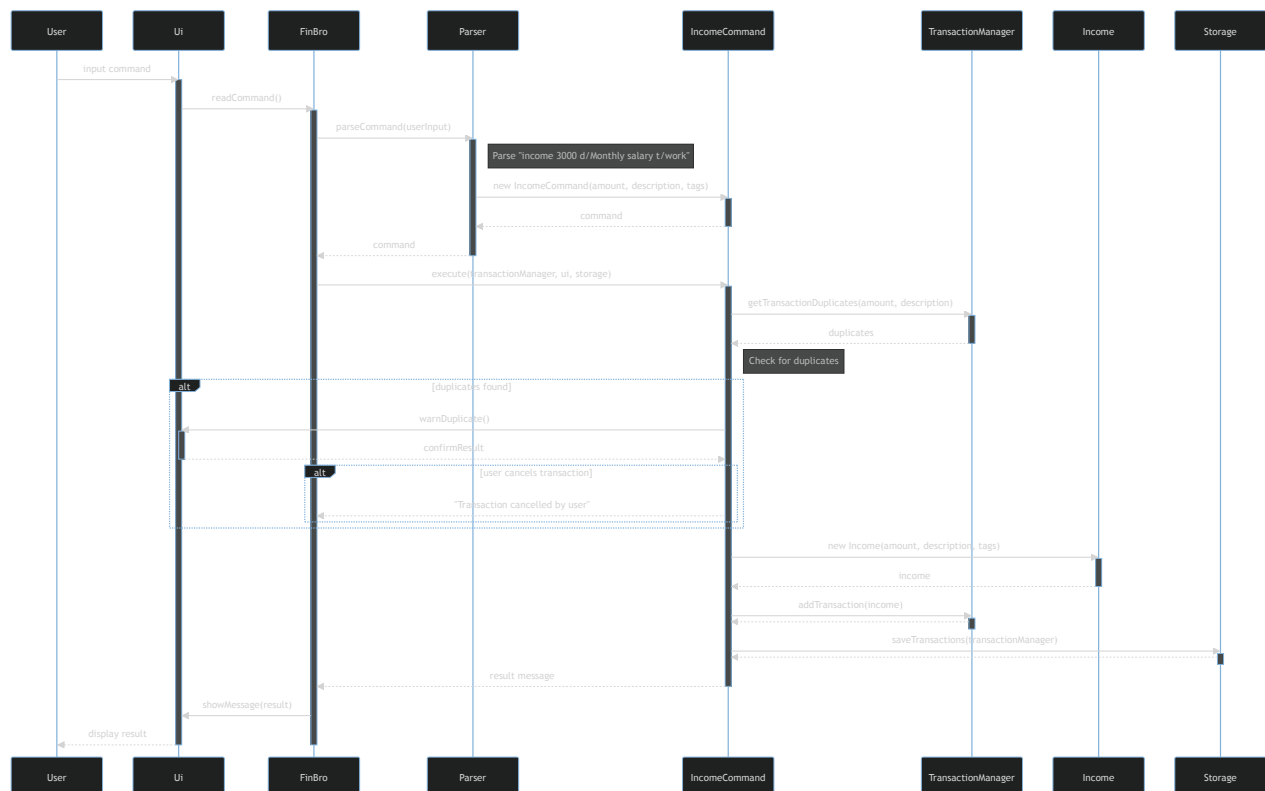
The following sequence diagram illustrates the basic process when a user adds a new transaction:

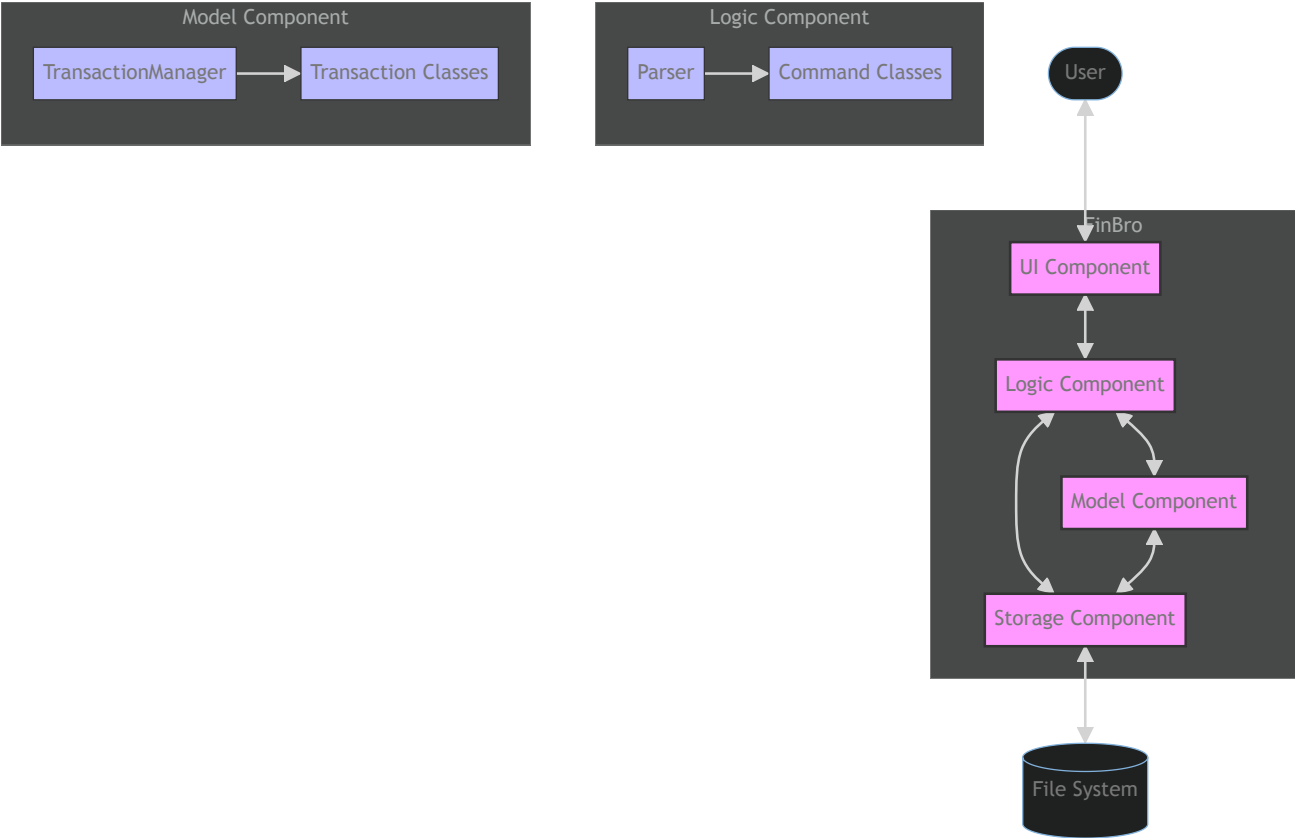
```

User -> FinBro: input command
FinBro -> Parser: parseCommand(userInput)
Parser -> IncomeCommand: new IncomeCommand(...)
Parser --> FinBro: command
FinBro -> IncomeCommand: execute()
IncomeCommand -> TransactionManager: addTransaction(income)
IncomeCommand -> Storage: saveTransactions()
IncomeCommand --> FinBro: result message
FinBro -> Ui: showMessage(result)
Ui --> User: display result

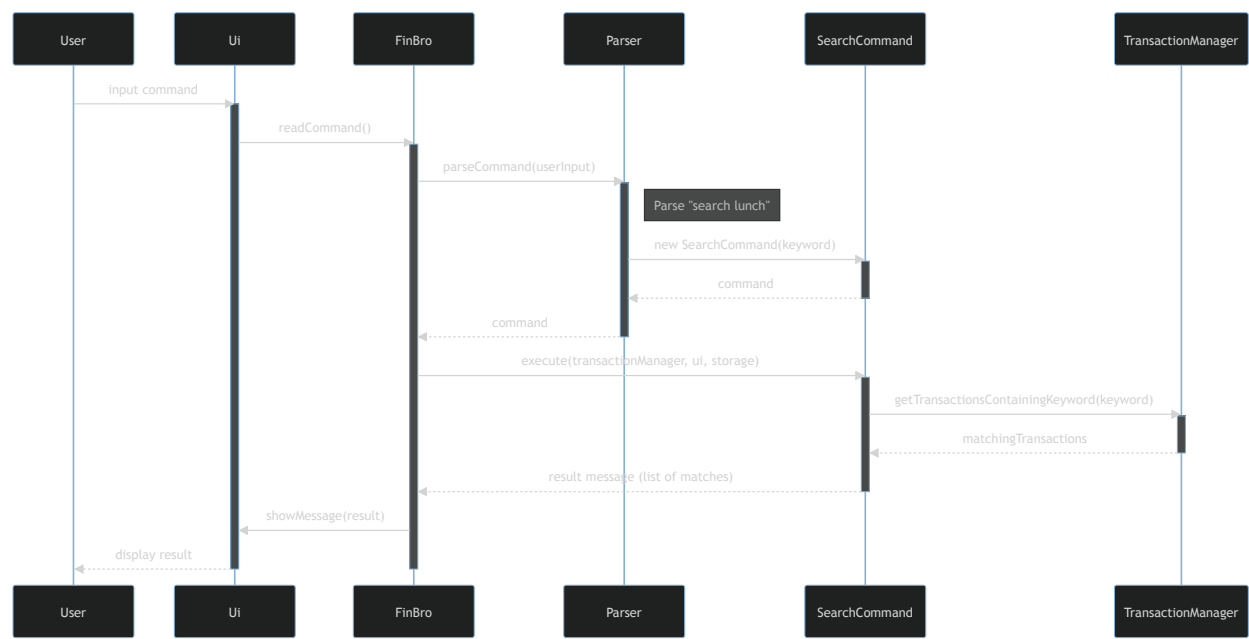
```

Here's a more detailed sequence diagram showing the flow for adding an income transaction, including duplicate transaction checking:



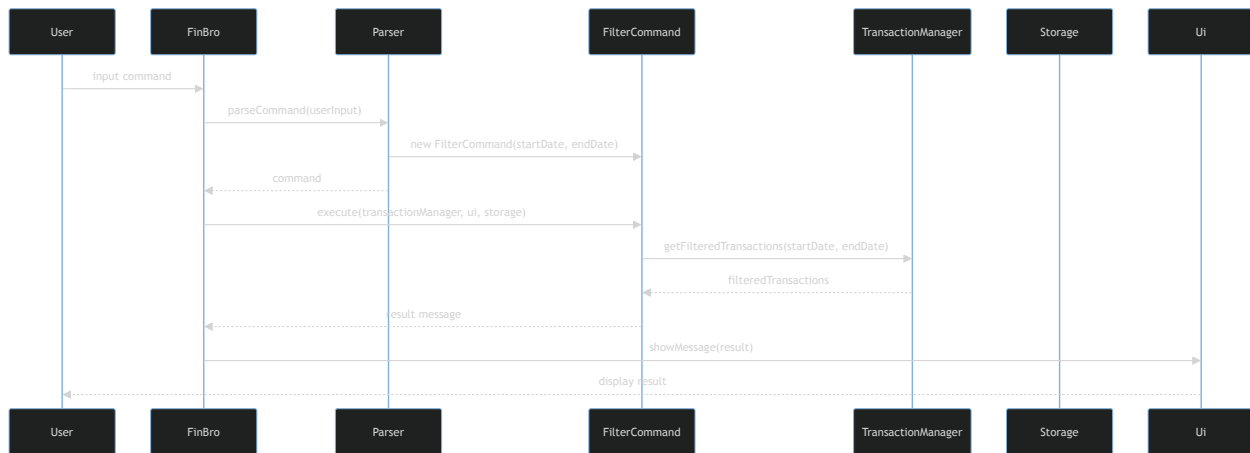


Searching for a transaction



Filtering transactions

The follow sequence diagram illustrates the process of filtering transactions based on a date range:

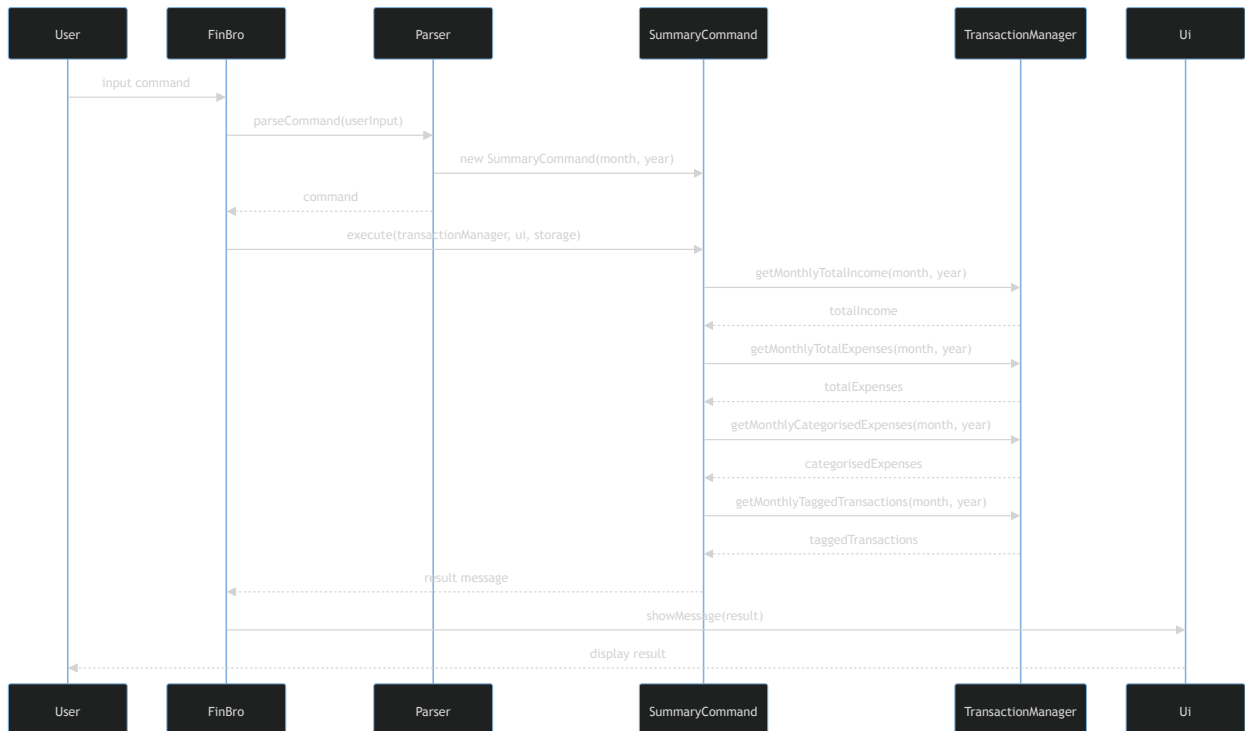


Here's a more detailed sequence diagram showing the flow for filtering transactions based on a date range:

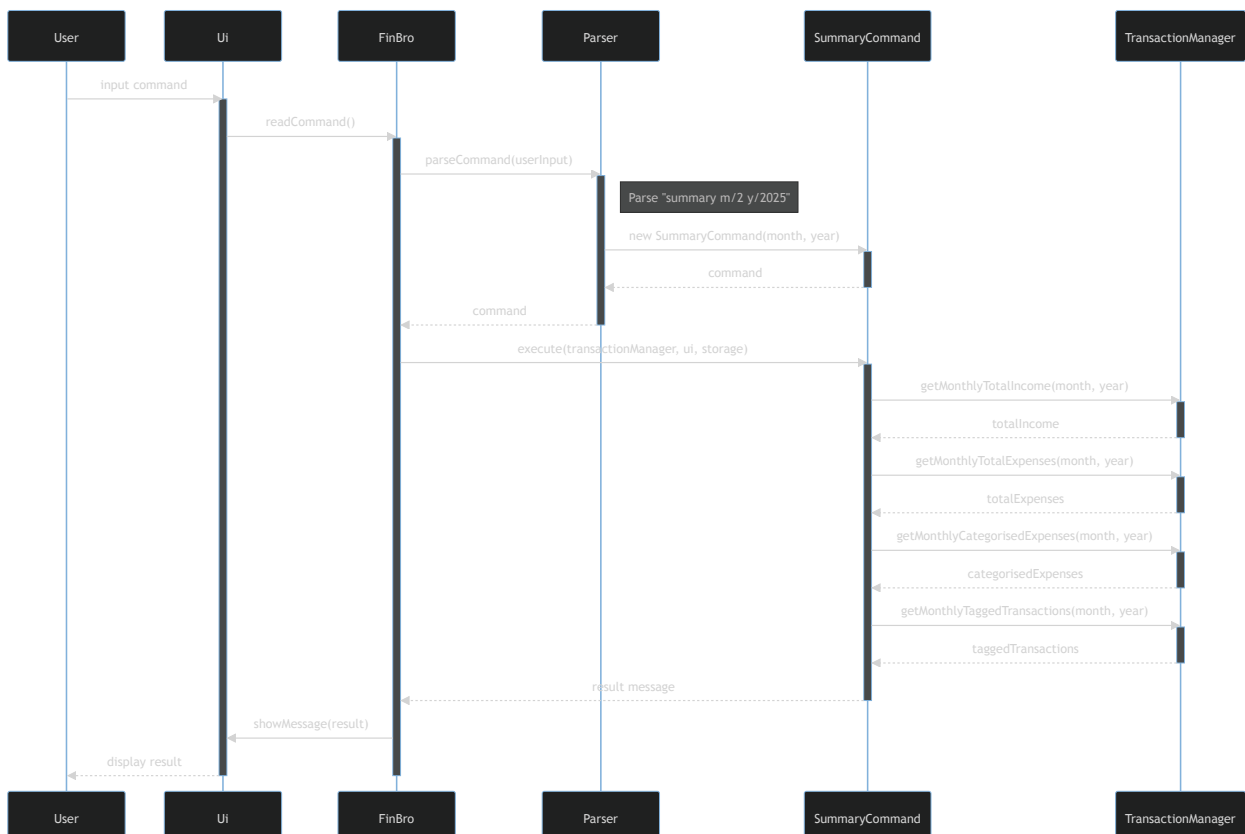


## Obtaining a monthly financial summary

The follow sequence diagram illustrates the process of obtaining a monthly financial summary based on a given month and year:



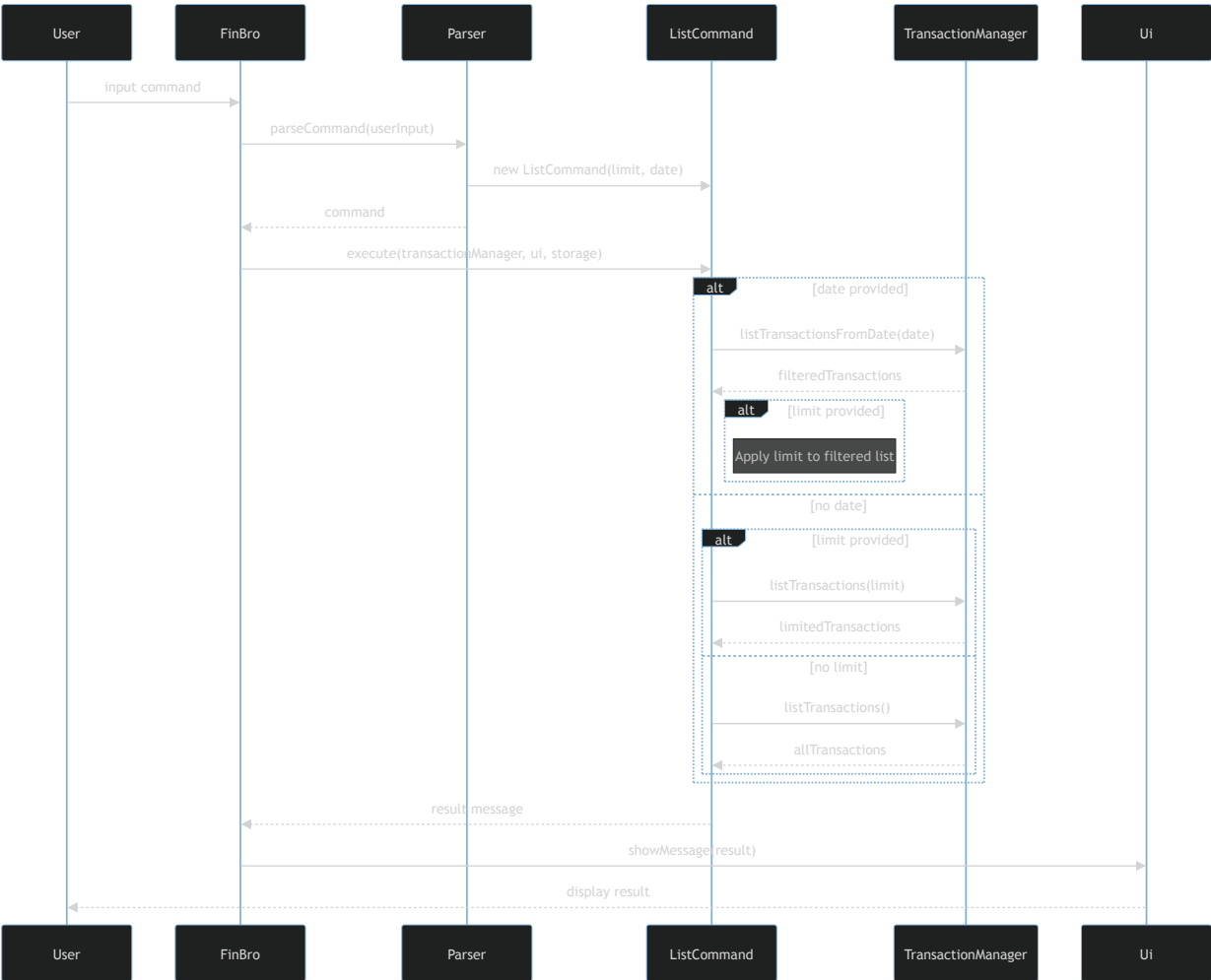
Here's a more detailed sequence diagram showing the flow for obtaining a monthly financial summary based on a given month and year:



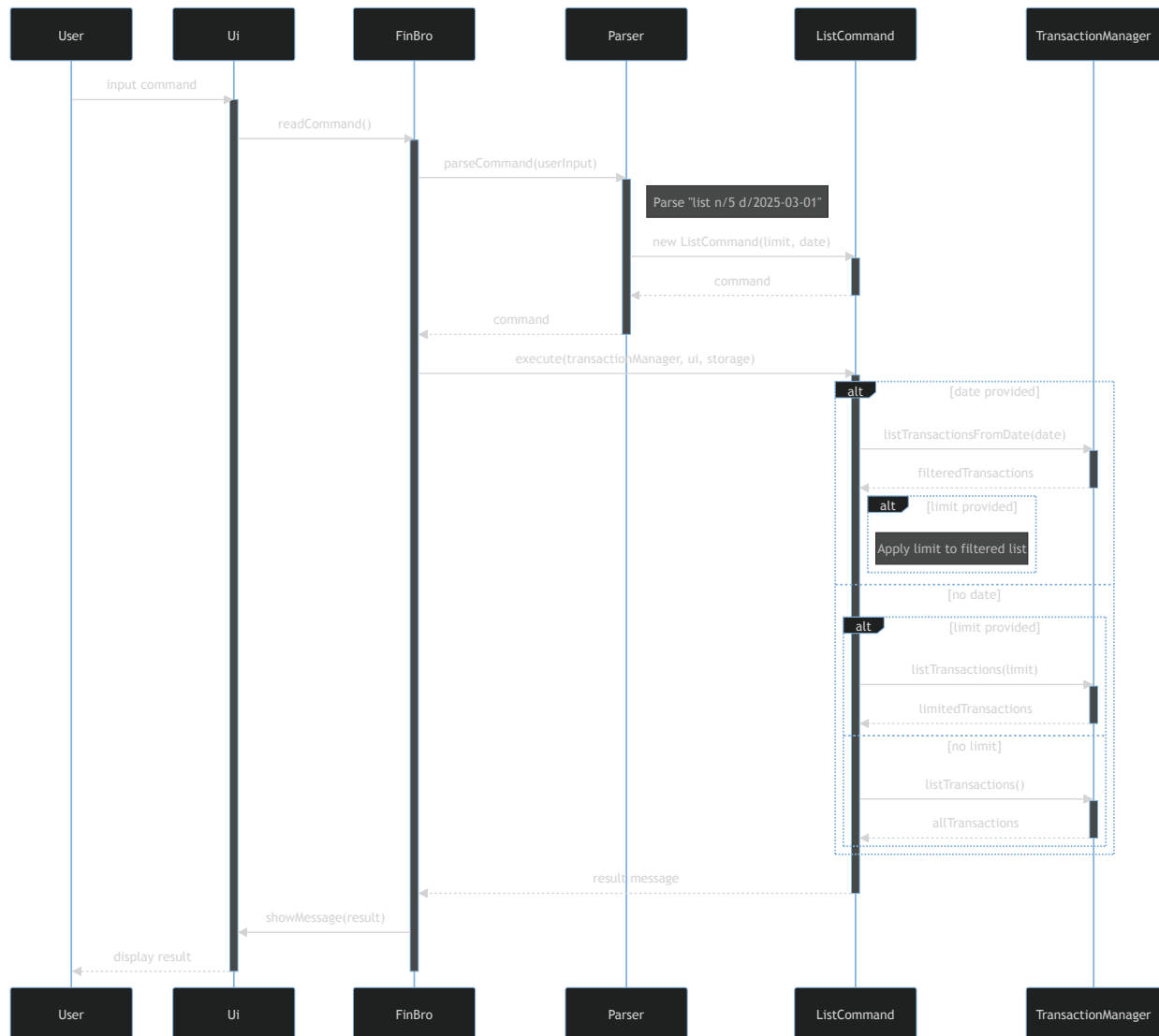
## Obtaining the current list of transactions



The follow sequence diagram illustrates the process of obtaining the current list of transactions:



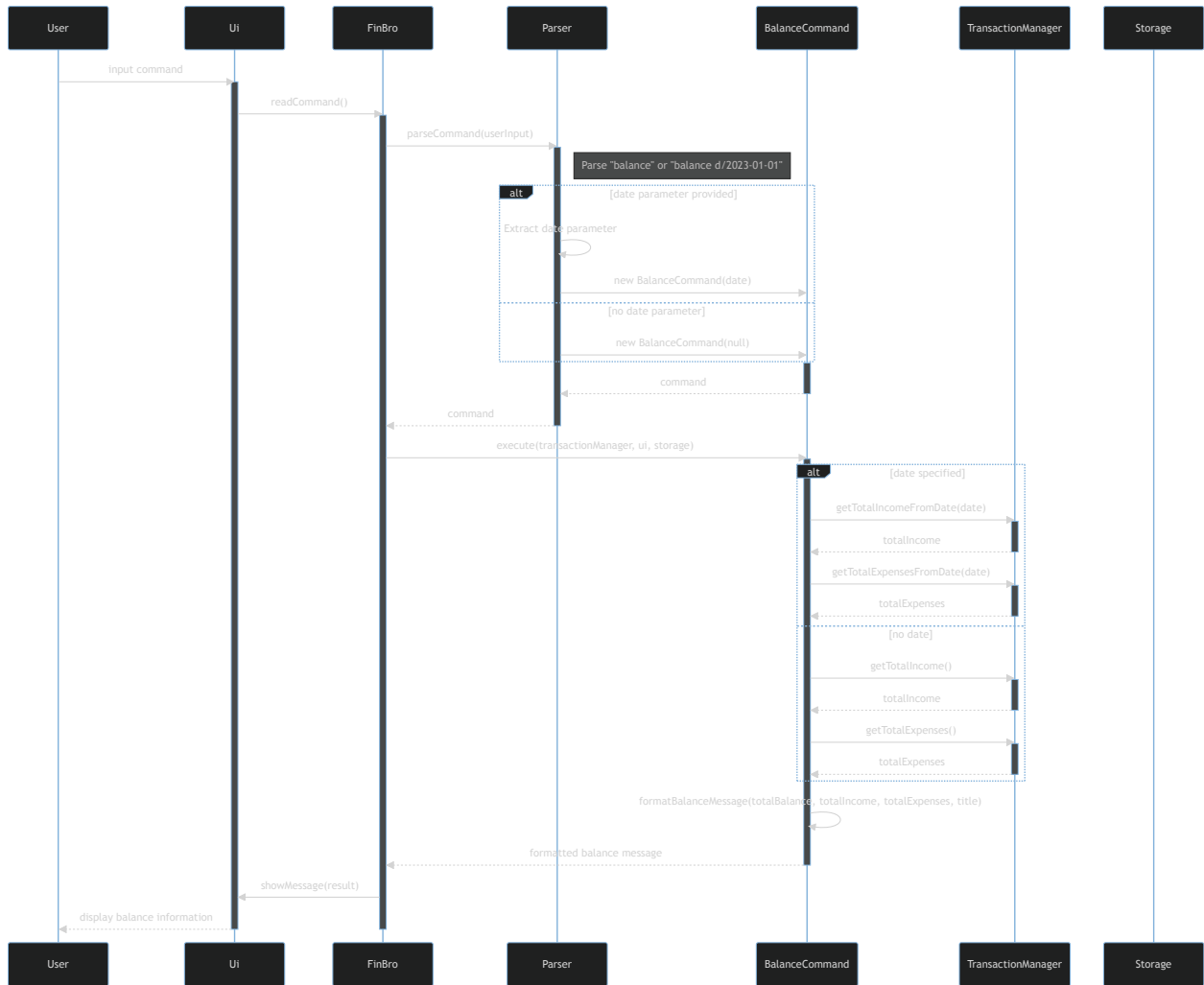
Here's a more detailed sequence diagram showing the flow for obtaining the current list of transactions:



## Viewing Balance

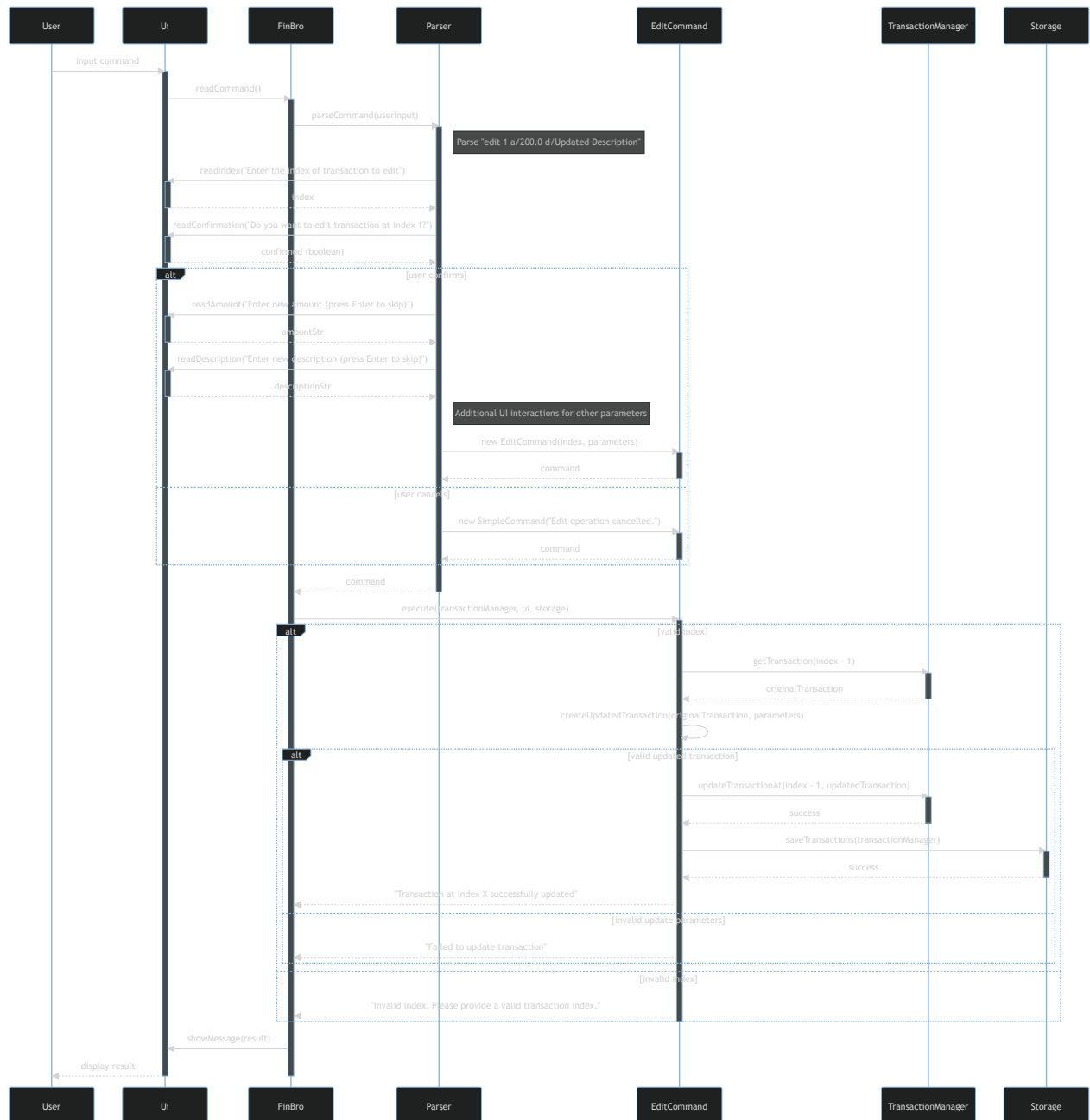
This sequence diagram shows:

1. User initiates the balance command (with or without date parameter)
2. Parser creates the appropriate BalanceCommand
3. BalanceCommand requests financial data from TransactionManager:
4. Either filtered by date or overall totals
5. BalanceCommand formats the balance information
6. Results are displayed to the user



## Editing a transaction

The follow sequence diagram illustrates the process of editing a transaction:



# Design Patterns

FinBro implements several design patterns to enhance maintainability and extensibility:

## 1. Command Pattern

All user actions are encapsulated as command objects implementing the `Command` interface. This allows for:

- Uniform handling of different commands
- Easy addition of new commands
- Support for operations like undo/redo (future enhancement)

## 2. Singleton Pattern

The `TransactionManager` is implemented as a singleton to ensure:

- Only one instance manages the transactions
- Consistent state across the application
- Centralized access to transaction data

## 3. Factory Method Pattern

The `Parser` class serves as a factory, creating appropriate command objects based on user input. Benefits include:

- Encapsulation of command creation logic
- Separation of command execution from creation
- Enhanced extensibility when adding new commands

## 4. Model-View-Controller (MVC)

The application follows an MVC-like structure:

- **Model:** `Transaction` classes and `TransactionManager`
- **View:** `Ui` class
- **Controller:** `Command` classes and `FinBro` class

# Implementation Details

## Key Features

### 1. Transaction Management Feature

#### Overview

The Transaction Management feature is a core component of FinBro that allows users to add, delete, search, and filter financial transactions. Transactions can be either income or expenses, each with different attributes and behaviors.

This section explains the design considerations and implementation details of the Transaction Management system, focusing on adding and deleting transactions.

#### Design Considerations

#### Transaction Hierarchy

The Transaction Management system uses inheritance to model different types of financial transactions:

- `Transaction` (abstract): Base class that defines common attributes and behaviors
  - `Income` : Extends `Transaction`, representing money received
  - `Expense` : Extends `Transaction`, representing money spent, with additional attributes like category

This approach provides several benefits:

1. Code reuse through inheritance of common attributes and methods
2. Polymorphism enabling operations on collections of different transaction types
3. Type safety provided by Java's type system

## Alternative Designs Considered

### 1. Single Transaction Class with Type Enum

```
class Transaction {  
    enum Type { INCOME, EXPENSE }  
    private Type type;  
    private Category category; // Only used for expenses  
    // Other fields  
}
```

This approach was rejected because:

- It would lead to optional fields that are only relevant for specific transaction types
- Type safety would rely on runtime checks rather than compile-time enforcement
- Would violate the Single Responsibility Principle by having one class handle multiple concerns

### 2. Composition-based Approach

```
class Transaction {  
    private TransactionDetails details;  
    // Common fields  
}  
  
interface TransactionDetails { }  
class IncomeDetails implements TransactionDetails { }  
class ExpenseDetails implements TransactionDetails { }
```

This approach was considered but not implemented because:

- Added complexity without significant benefits for our use case
- Inheritance provided a cleaner solution for the current requirements

## Implementation Details

### Adding a Transaction

The process of adding a transaction involves several components interacting together:

1. **UI** captures the user input
2. **Parser** interprets the command and creates the appropriate Command object
3. **Command** (e.g., IncomeCommand, ExpenseCommand) creates the transaction object
4. **TransactionManager** stores the transaction
5. **Storage** persists the transaction to disk

### Duplicate Detection

The system checks for potential duplicate transactions based on amount and description:

```
public ArrayList<Transaction> getTransactionDuplicates(double amount, String description) {
    assert description != null : "Description cannot be null";
    assert amount > 0 : "Amount must be greater than zero";
    return transactions.stream()
        .filter(t -> (t.getDescription().equals(description) && t.getAmount() == amount ))
        .collect(Collectors.toCollection(ArrayList::new));
}
```

If duplicates are found, the user is warned and prompted to confirm before proceeding:

```
if (!transactionManager.getTransactionDuplicates(amount, description).isEmpty()) {
    if (!ui.warnDuplicate()) {
        return "Transaction cancelled by user";
    }
}
```

This helps prevent accidental duplication of transactions while still allowing intentional repetition.

## Deleting a Transaction

Deleting a transaction follows a similar component interaction pattern:

1. **UI** captures the delete command with an index
2. **Parser** creates a DeleteCommand with the specified index
3. **DeleteCommand** removes the transaction from TransactionManager
4. **Storage** persists the updated transaction list

Implementation details:

```
public void deleteTransaction(int index) {
    assert index >= 0 : "Index must be non-negative";
    assert index < transactions.size() : "Index must be within the bounds of the transaction list";

    if (index < 1 || index > transactions.size()) {
        logger.warning("Attempt to delete transaction at invalid index: " + index);
        throw new IndexOutOfBoundsException("Transaction index out of range: " + index);
    }
    Transaction removed = transactions.remove(index - INDEX_OFFSET); // Convert from 1-based to 0-based

    // Update the index numbers for all transactions after the deleted one
    for (int i = index; i < transactions.size(); i++) {
        transactions.get(i).indexNum -= INDEX_OFFSET;
    }

    logger.info("Deleted " + removed.getClass().getSimpleName() +
        " with amount $" + removed.getAmount() +
        " at index " + index);
}
```

---

The implementation maintains proper indexing by updating the index numbers of all transactions following the deleted one.

## Viewing of Balance

The balance viewing feature follows this component interaction pattern:

1. **UI** captures the balance command with optional date parameters
2. **Parser** creates a **BalanceCommand** with specified date parameters
3. **BalanceCommand** requests balance calculation from **TransactionManager**
4. **TransactionManager** calculates balance based on all or filtered transactions
5. **BalanceCommand** formats and returns the balance information
6. **UI** displays the formatted balance to the user

## Implementation Details

### Date-Filtered Balance Calculation

```
public String execute(TransactionManager transactionManager, Ui ui, Storage storage) {
    assert transactionManager != null : "TransactionManager cannot be null";
    assert ui != null : "UI cannot be null";
    assert storage != null : "Storage cannot be null";

    logger.info("Executing balance command");

    double balance = transactionManager.getBalance();
    double totalIncome = transactionManager.getTotalIncome();
    double totalExpenses = transactionManager.getTotalExpenses();

    // Verify the relationship between balance, income, and expenses
    assert Math.abs((totalIncome - totalExpenses) - balance) < 0.001 :
        "Balance calculation error: " + balance + " != " + totalIncome + " - " + totalExpenses;

    String formattedBalance = CURRENCY_FORMAT.format(balance);
    String formattedIncome = CURRENCY_FORMAT.format(totalIncome);
    String formattedExpenses = CURRENCY_FORMAT.format(totalExpenses);

    return "Current Balance: " + formattedBalance + "\n" +
        "Total Income: " + formattedIncome + "\n" +
        "Total Expenses: " + formattedExpenses;
}
```

## Key Design Features

1. Flexible date filtering: Users can view overall balance or balance from a specific date
2. Comprehensive information: Shows income, expenses, and net balance in a single view
3. Clean formatting: Presents financial information in a well-organized, readable format
4. Integration with budgeting: Displays budget status when applicable
5. Error handling: Validates date parameters and provides clear error messages
6. Separation of concerns: Calculation logic remains in **TransactionManager** while presentation is handled by **BalanceCommand**



This implementation provides users with a quick overview of their financial position, either overall or from a specific date forward, enhancing financial awareness.

## Editing a Transaction

Editing a transaction also follows a similar component interaction pattern:

1. **UI** captures the edit command with a keyword and parameters to update
2. **Parser** creates an **EditCommand** with the specified keyword and parameters
3. **UI** asks for user confirmation before proceeding
4. **EditCommand** retrieves and updates the transaction at the specified index
5. **TransactionManager** updates the transaction in its collection
6. **Storage** persists the updated transaction list

## Implementation Details

### Index-Based Transaction Selection

```
public String execute(TransactionManager transactionManager, Ui ui, Storage storage) {
    // Check if index is valid (1-based indexing for user interface)
    if (index < 1 || index > transactionManager.getTransactionCount()) {
        return "Invalid index. Please provide a valid transaction index.";
    }

    try {
        // Get original transaction (accounting for INDEX_OFFSET)
        Transaction originalTransaction = transactionManager.getTransaction(index - 1);

        // Create updated transaction based on parameters
        Transaction updatedTransaction = createUpdatedTransaction(originalTransaction, parameters);

        if (updatedTransaction != null) {
            // Replace transaction at index
            transactionManager.updateTransactionAt(index - 1, updatedTransaction);
            storage.saveTransactions(transactionManager);
            return "Transaction at index " + index + " successfully updated:\n" + updatedTransaction;
        }
        return "Failed to update transaction.";
    } catch (Exception e) {
        logger.log(Level.WARNING, "Error updating transaction", e);
        return "Failed to update transaction: " + e.getMessage();
    }
}
```

### User Confirmation via UI

The `parseEditCommand` method in `Parser.java` now includes a confirmation step:

```
private Command parseEditCommand(Ui ui) {
    try {
        // Get index of transaction to edit
        int index = ui.readIndex("Enter the index of transaction to edit:\n> ");

        // Add confirmation step
```

```

        boolean confirmed = ui.readConfirmation("Do you want to edit transaction at index " + index +
        if (!confirmed) {
            return new Command() {
                @Override
                public String execute(TransactionManager transactionManager, Ui ui, Storage storage) {
                    return "Edit operation cancelled.";
                }

                @Override
                public boolean isExit() {
                    return false;
                }
            };
        }

        // Proceed with collecting parameters for the edit
        Map<String, String> parameters = new HashMap<>();

        // Collect parameters with UI interaction
        String amountStr = ui.readAmount("Enter new amount (press Enter to skip):\n> ");
        if (!amountStr.isEmpty()) {
            parameters.put("a", amountStr);
        }

        // [Additional parameter collection]

        return new EditCommand(index, parameters);
    } catch (Exception e) {
        logger.log(Level.WARNING, "Error parsing edit command", e);
        return new InvalidCommand("Invalid edit command: " + e.getMessage());
    }
}

```

## Transaction Update Logic

The selective field update approach is retained:

```

private Transaction createUpdatedTransaction(Transaction original, Map<String, String> parameters) {
    try {
        // Default values from original transaction
        double amount = original.getAmount();
        String description = original.getDescription();
        LocalDate date = original.getDate();
        List<String> tags = new ArrayList<>(original.getTags());

        // Update values based on parameters
        if (parameters.containsKey("a")) {
            amount = Double.parseDouble(parameters.get("a"));
        }
        if (parameters.containsKey("d")) {
            description = parameters.get("d");
        }
        if (parameters.containsKey("date")) {
            date = LocalDate.parse(parameters.get("date"));
        }
        if (parameters.containsKey("t")) {
            tags = Arrays.asList(parameters.get("t").split(", "));
        }
    }
}

```

```

    }

    // Create new transaction based on the type of the original
    if (original instanceof Income) {
        return new Income(amount, description, date, tags);
    } else if (original instanceof Expense) {
        Expense originalExpense = (Expense) original;
        Expense.Category category = originalExpense.getCategory();

        if (parameters.containsKey("c")) {
            category = Expense.Category.fromString(parameters.get("c"));
        }

        return new Expense(amount, description, date, category, tags);
    }
    return null;
} catch (NumberFormatException e) {
    logger.log(Level.WARNING, "Invalid amount format in edit command", e);
    return null;
} catch (DateTimeParseException e) {
    logger.log(Level.WARNING, "Invalid date format in edit command", e);
    return null;
}
}

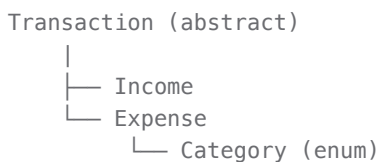
```

## Key Design Features

- 1. Direct index reference:** Uses explicit index numbers for unambiguous transaction targeting
- 2. User confirmation:** Prevents accidental edits through a confirmation prompt
- 3. Type preservation:** Maintains the original transaction type (Income or Expense)
- 4. Selective updates:** Only modifies fields explicitly specified in the edit command
- 5. Robust validation:** Handles invalid indices, amounts, dates, and categories
- 6. 1-based user indexing:** Presents user-friendly 1-based indexing while using 0-based indexing internally

This implementation balances user experience with data integrity and provides clear feedback throughout the editing process.

## Class Diagram of Transaction Component



The Transaction class provides common attributes and methods:

- amount** : The monetary value

- `description` : Text description of the transaction
- `date` : When the transaction occurred
- `tags` : Optional categorization labels
- `getAmount()` , `getDescription()` , etc.: Accessor methods
- `toString()` : Abstract method implemented by subclasses

## Storage Considerations

Transactions are persisted to disk in a text file format where fields are separated by a pipe character ('|'):

```
INCOME|2025-03-15|1000.00|Salary|work
EXPENSE|2025-03-16|50.00|Groceries|FOOD|essential
```

When saving and loading transactions, the system performs conversion between the object model and this text representation. This approach was chosen for its simplicity and human readability, while still providing adequate structure for reliable parsing.

## Defensive Programming Aspects

The Transaction Management system uses several defensive programming techniques:

1. **Assertions:** Pre-conditions and post-conditions are verified using assertions

```
assert amount > 0 : "Expense amount must be greater than zero";
```

2. **Logging:** Key operations are logged for debugging and auditing

```
logger.info("Added " + transaction.getClass().getSimpleName() +
    " with amount $" + transaction.getAmount());
```

3. **Immutability:** Transaction objects are immutable once created, preventing accidental state changes

```
public List<String> getTags() {
    return new ArrayList<>(tags); // Return a copy to prevent modification
}
```

4. **Null checks:** Methods verify parameters are valid before proceeding

```
if (tags != null) { ... }
```

These techniques enhance the robustness of the system and make debugging easier.

## 2. Command Parsing

The `Parser` class converts user input into appropriate command objects through several phases:

1. Tokenization of input
2. Extraction of command word
3. Parameter parsing
4. Command object creation

### Implementation Example:

```
public Command parseCommand(String userInput) {
    String[] parts = userInput.split("\\s+", 2);
    String commandWord = parts[0].toLowerCase();
    String arguments = parts.length > 1 ? parts[1] : "";

    switch (commandWord) {
        case "income":
            return parseIncomeCommand(arguments);
        case "expense":
            return parseExpenseCommand(arguments);
        // ... other commands
    }
}
```

### 3. Data Persistence

The `Storage` class manages saving and loading of transaction data using a custom text-based format.

#### File formats:

- **Internal storage:** Text file with fields separated by '|' delimiter
- **Export formats:** CSV and TXT

#### Implementation:

- Transactions are serialized to text format for persistence
- Data is loaded into memory at application startup
- Changes are saved to disk after each transaction modification

### 4. Financial Summaries

The `SummaryCommand` generates financial reports with the following capabilities:

- Filtering by time period (month/year)
- Categorized expense breakdown
- Tag-based transaction analysis
- Income vs. expense comparison

## Testing

### Structure

Tests are organized following the same package structure as the main code:

```
test/java/seedu/finbro/
├── logic/
│   ├── command/
│   │   ├── IncomeCommandTest.java
│   │   └── ...
│   └── parser/
│       └── ParserTest.java
├── model/
│   ├── TransactionTest.java
│   └── TransactionManagerTest.java
└── storage/
    └── StorageTest.java
```

## Running Tests

Run all tests:

```
./gradlew test
```

Run a specific test:

```
./gradlew test --tests "seedu.finbro.model.TransactionTest"
```

## Text UI Testing

Text UI testing verifies application behavior by comparing output against expected results:

1. Run tests:

```
cd text-ui-test
./runtest.sh
```

2. The script compares the actual output against predefined expected output.

## Future Enhancements

### Planned Features

#### 1. Recurring Transactions

- Automatic addition of regular income/expenses
- Customizable recurrence patterns

#### 2. Budget Management

- Setting spending limits by category
- Alerts when approaching budget thresholds
- Visual budget utilization indicators

### 3. Data Visualization

- Text-based charts for spending patterns
- Trend analysis for income/expenses over time
- Category distribution visualization

### 4. Multiple Accounts

- Support for tracking different financial accounts
- Transfer operations between accounts
- Consolidated and per-account reporting

### 5. Investment Tracking

- Basic portfolio management
- Investment performance metrics
- Asset allocation tracking

## Appendix

### Glossary

- **CLI:** Command Line Interface
- **Transaction:** Any financial event (income or expense)
- **Tag:** User-defined label for categorizing transactions
- **Category:** Predefined classification for expenses

### References

- Java SE 17 Documentation
- JUnit 5 User Guide
- Gradle User Manual