Project Documentation for Currency Exchange Rate Statistical Analysis System

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Contents

1 Introduction

The goal of this project is to develop an IT system capable of performing statistical analyses of currency exchange rates based on data retrieved from the National Bank of Poland (NBP). The system operates in console mode and allows for calculating statistical measures (median, mode, standard deviation) and generating distributions of currency rate changes.

2 System Architecture

The system is designed in a layered architecture, ensuring separation of concerns and testability.

2.1 Layer Description

- **Presentation Layer (CLI)**: Responsible for user interaction. Implemented in `app/main.py` using the `argparse` library. It validates input data and invokes appropriate services.
- **Service Layer**: Contains business logic.
  - `CurrencyAnalysisService`: Calculates statistics and growth/decline sessions.
  - `DistributionService`: Calculates change distribution for currency pairs.
- **Domain Layer**: Defines Data Transfer Objects (DTOs) such as `ExchangeRateDTO`, `AnalyzeDTO`, `DistributionDTO`, ensuring data consistency between layers.
- **Infrastructure Layer (API)**: Responsible for communication with the external NBP API. The `NBPClient` class fetches data and maps it to domain objects.

2.2 Component Diagram

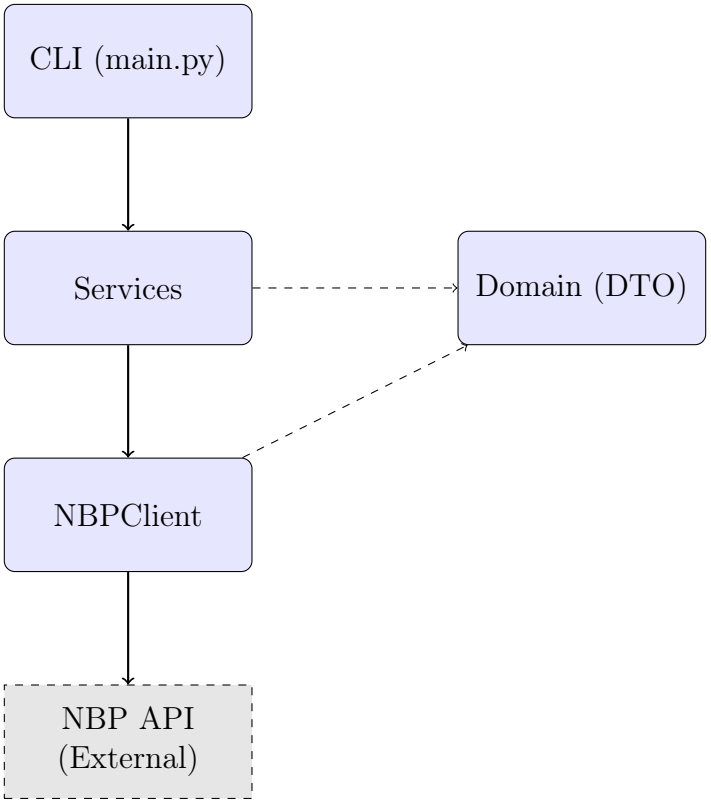

Figure 1: System Component Diagram

2.3 Use Case Diagram

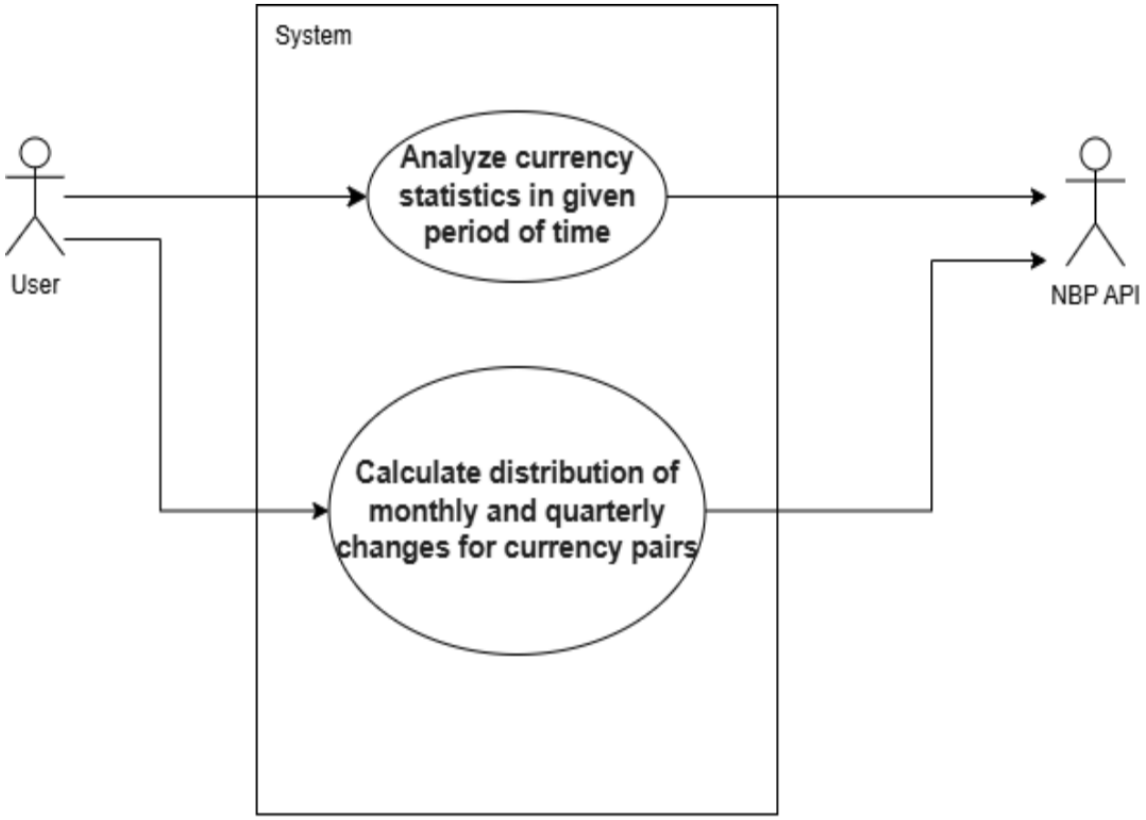

Figure 2: Use Case Diagram

Use Case	Input Parameters	Output Description

Analyze currency statistics in given period of time	`analyze`
	`<currency>`
	`<period>`
	`<start>`
		The middle value of the exchange rates for the specified period.
		
		The most frequently occurring exchange rate value(s) in the dataset.
		
		A numerical value representing the amount of variation or dispersion of the exchange rates.
		
		The ratio of the standard deviation to the mean (expressed as a percentage or decimal).
		
		The count of sessions within the period where the currency value increased, decreased and remained unchanged.

Calculate distribution of monthly and quarterly changes for currency pairs	`change-distribution`
	`<currency_1>`
	`<currency_2>`
	`<period>`
	`<start>`
		A histogram of the frequency of value changes within a given interval, presented graphically with ASCII characters.

Table 1: Input/output of Use Cases

3 System Behavior

3.1 Sequence Diagram - Analyze Command

The diagram illustrates the control flow for the `analyze` command.

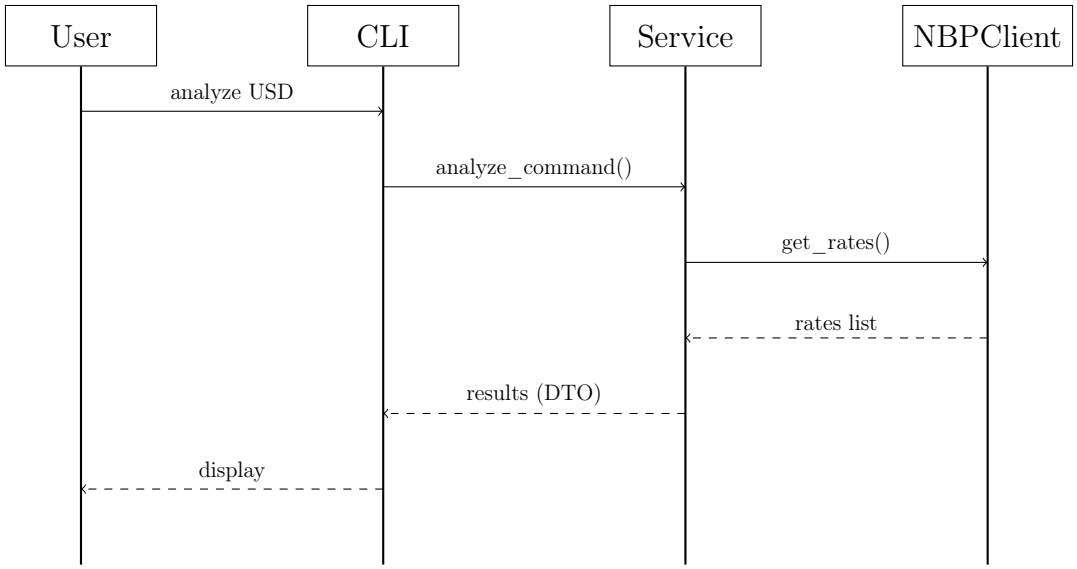

Figure 3: Sequence Diagram for analyze command

3.2 Sequence Diagram - Change Distribution Command

The diagram illustrates the control flow for the `change-distribution` command.

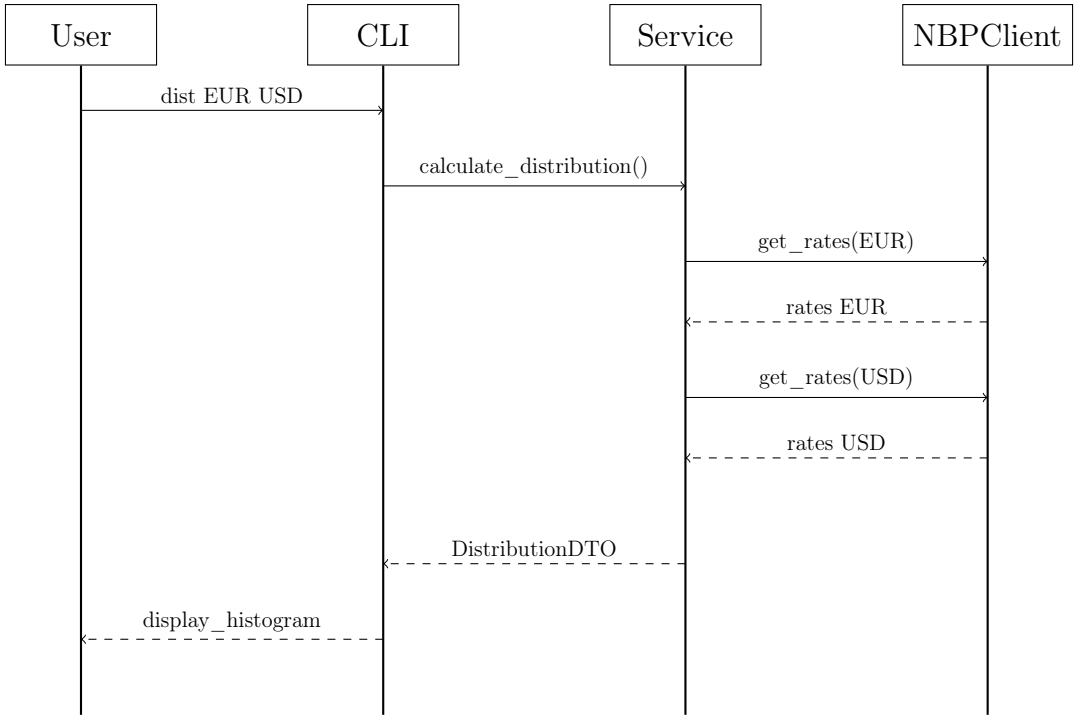

Figure 4: Sequence Diagram for change-distribution command

3.3 Activity Diagram - Main Loop

Command processing flow in the main application loop.

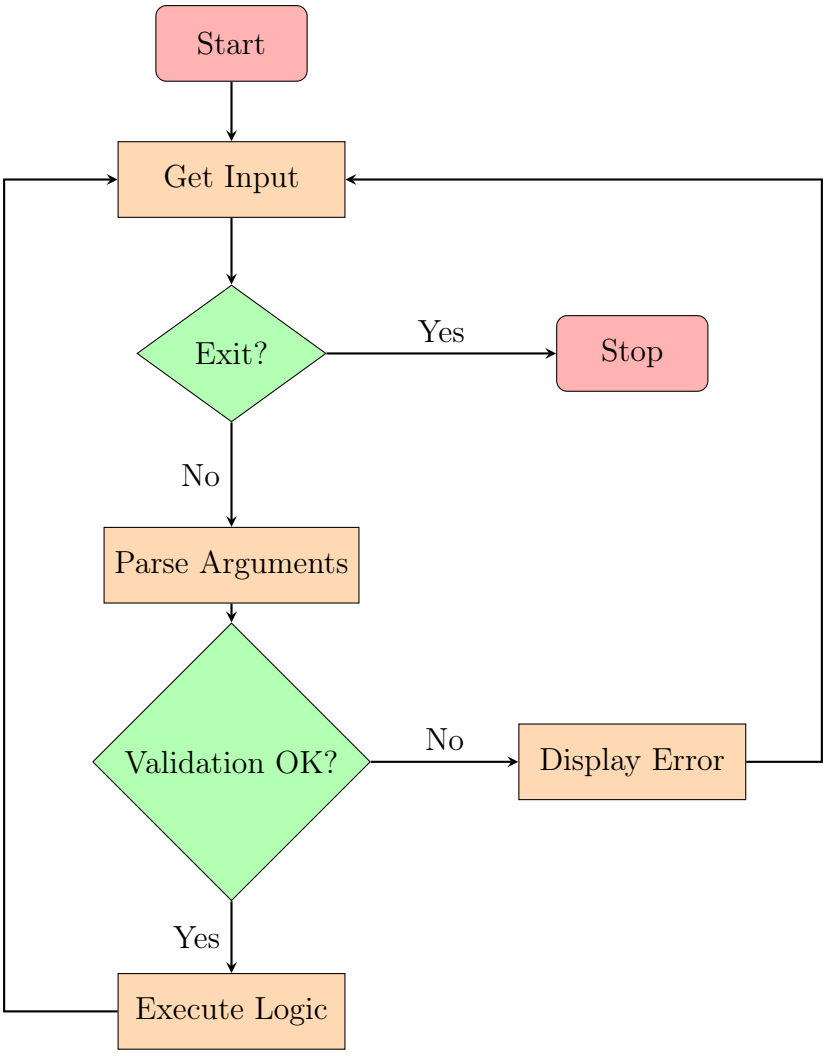

Figure 5: Main Loop Activity Diagram

4 User Manual

The system interacts with the user via a command-line interface (CLI). All commands are case-insensitive regarding the command name, but currency codes should ideally be upper-case (though the system normalizes them).

4.1 General Usage

Upon starting the application, the user is presented with a prompt `NBP_APP>`. The system waits for commands.

- `exit`: Terminates the application.
- `help`: Displays the list of available commands and their syntax.

4.2 Analyze Command

Calculates statistical measures (median, mode, standard deviation, coefficient of variation) and session counts (increase, decrease, stable) for a given currency.

Syntax:

```
analyze <currency> --period <period> [--start <YYYY-MM-DD>]
```

Parameters:

- `currency`: ISO 4217 3-letter currency code (e.g., USD, EUR, CHF).
- `-period`: The time range for analysis. Supported values:
  - `1-week`, `2-weeks`, `1-month`, `1-quarter`, `6-months`, `1-year`.
- `-start` (Optional): The anchor date (end date of the analysis period). If omitted, defaults to the current date. The start date of the analysis is calculated retrospectively from this anchor date based on the period.

Constraints:

- Dates cannot be earlier than 2002-01-02.
- If `-period 1-quarter` is used, the anchor date must be the first day of a quarter (Jan 1, Apr 1, Jul 1, Oct 1).

Example Output:

```
Currency: USD
Period: 2025-01-01 - 2025-01-08
Median: 4.1234
Mode: [4.1200]
Standard deviation: 0.0543
coefficient_of_variation: 0.0132
Increased: 3
Decreased: 2
Unchanged: 0
```

4.3 Change Distribution Command

Calculates the distribution of changes (growth/decline) for a pair of currencies and displays a histogram.

Syntax:

```
change-distribution <currency_1> <currency_2> --period <period> [--start <YYYY-MM-DD>]
```

Parameters:

- `currency_1`: First currency code (e.g., EUR).
- `currency_2`: Second currency code (e.g., USD).
- `-period`: The time range. Supported values:
  - `1-month`, `1-quarter`.
- `-start` (Optional): The anchor date. Defaults to current date.

Constraints:

- `currency_1` and `currency_2` must be different.
- Dates cannot be earlier than 2002-01-02.
- 1-quarter logic applies similarly to the analyze command.

Example Output: Displays an ASCII histogram representing the frequency of daily changes in the exchange rate ratio of the two currencies.