

Project - Configurable Data Processing System in C++

# **Project Overview:**

This project is a sophisticated C++ application designed to enhance your understanding of core C++ concepts, including Object-Oriented Programming (OOP), Standard Template Library (STL), Templates, File Handling, and Exception Handling. The application focuses on creating a dynamic and extensible system for processing different types of data based on user-provided configuration files.

Through this project, you will develop a configurable system that demonstrates the power of abstraction, polymorphism, and modular design while ensuring robust error handling and maintainability.

#### **Key Features**

#### 1. Dynamic Configuration Parsing:

- o Reads and parses a text-based configuration file.
- Supports nested structures using dot (.) notation for organizing options hierarchically.
- Dynamically selects the appropriate processor type based on configuration options.

#### 2. Processor Abstraction:

- Uses an abstract base class (Processor) with multiple derived classes (TextProcessor, NumericProcessor, ImageProcessor, AudioProcessor).
- Leverages polymorphism to allow dynamic runtime behavior based on configuration.

# 3. Factory Design Pattern:

 Implements a factory class (ProcessorFactory) to instantiate processor objects based on configuration inputs.

#### 4. Template-Based Processing:

o Demonstrates the use of templates to process collections of data generically.

#### 5. Exception Handling:

 Provides robust error handling for invalid configurations, missing files, or unsupported processor types.

# **Learning Objectives**

By completing this project, students will:

#### 1. Master Core C++ Concepts:

- Understand and implement polymorphism using abstract classes and inheritance.
- Use STL containers like std::map and std::vector for efficient data management.

#### 2. Apply Design Patterns:

Implement the Factory Design Pattern to decouple object creation from application logic.

#### 3. Handle File Operations:

Read and parse text files dynamically to influence runtime behavior.

# 4. Develop Robust Applications:

Utilize exception handling to ensure the application remains stable under erroneous conditions.

# 5. **Explore Templates**:

o Create reusable, type-agnostic code for processing collections of data.

# **Project Workflow**

### 1. Configuration File:

- o Prepare a configuration file (settings.txt) specifying the processor type and related options.
- o Example:

Processor.Options.Type=Image Processor.Options.Threshold=0.5

Processor.Options.MaxRetries=3

## 2. Dynamic Processor Creation:

The system reads the configuration file at runtime and dynamically selects the appropriate processor class.

### 3. Data Processing:

 Provide sample data to the system, and the chosen processor will process it based on its specialization.

#### 4. Robust Error Handling:

 Handle missing configuration files, invalid processor types, and unexpected runtime issues gracefully.

#### **Example Execution**

# **Configuration File:**

Processor.Options.Type=Image Processor.Options.Quality=High

# Output:

ImageProcessor processing: Sample Data (interpreted as image data)

#### **Evaluation Criteria**

#### 1. Correctness:

o Does the application parse configuration files correctly and create the appropriate processor?

#### 2. Use of Concepts:

o Are OOP, STL, templates, and exception handling effectively utilized?

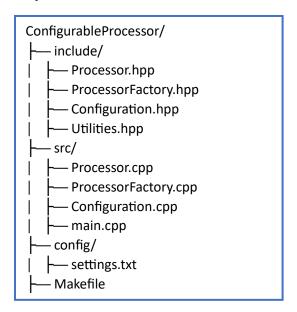
# 3. Code Quality:

o Is the code modular, readable, and well-documented?

# 4. Creativity:

o Have you added unique features or extended the system in innovative ways?

# **Project Structure:**



#### Makefile:

```
CXX = g++

CXXFLAGS = -std=c++11 -Wall

SRCDIR = src

INCDIR = include

BUILDDIR = build

TARGET = main

SRC = $(wildcard $(SRCDIR)/*.cpp)

OBJ = $(patsubst $(SRCDIR)/%.cpp,
$(BUILDDIR)/%.o, $(SRC))

all: $(TARGET)

$(TARGET): $(OBJ)
$(CXX) $(CXXFLAGS) -o $@ $^

$(BUILDDIR)/%.o: $(SRCDIR)/%.cpp
@mkdir -p $(BUILDDIR)
$(CXX) $(CXXFLAGS) -I$(INCDIR) -c $< -o $@
```

# Thank You **Edges For Training Team** 5