DEVELOPMENT OF AN APPLICATION FOR THE SIMULATION OF BIRTH AND DEATH MODELS

1. Introduction

This project addresses the simulation and analysis of population evolution models, focusing on birth and death rates in a country over time. The application allows users to interactively explore various mathematical models, generate reports, and analyze results.

2. Purpose and Objectives

The main objective is to develop a complete desktop application that helps users understand and simulate demographic models, using technologies such as C++, Qt, and Python (for plotting with Matplotlib).

3. Technologies Used

- C++ and Qt Framework for GUI and PDF generation
- Python (Matplotlib) for generating graphical charts
- CSV for data input (countries)
- QFile, QPainter, QPdfWriter, QFileDialog, etc.

4. Application Description

The application is structured into four main simulation modules:
1. Country Details: Displays population, birth and death rates and a growth chart.
2. Global Crisis Simulation: Temporarily increases the death rate.
3. Scenario Analysis: Compares two different birth rate scenarios.
4. General Report: Displays exponential and logistic growth with calculations and conclusions.

Each module generates a detailed PDF report that includes readable, structured text and high-quality plots.

5. Results and Reports

Each PDF report includes:
- A header with title and date
- Calculations shown clearly (ex: P_exp, P_log)
- Visual graphs (centered and labeled)
- Footer with page number
- Conclusion section based on the chosen model

All images (.png) are automatically deleted after use.

6. Conclusions

The application offers an intuitive interface for simulating demographic changes. Using Qt and Python allowed a hybrid solution that combines strong UI capabilities with advanced charting via Matplotlib. The project improves understanding of population models in educational and analytical contexts.