Data Communication – Autumn 2025

ITT036: Programming Assignment 1 – Digital Signal Generator

Objective:

Implement a digital signal generator and decoder that supports multiple line coding schemes, scrambling, and basic analog-to-digital conversions (PCM and Delta Modulation).

Language Used:

C++17

Libraries:

SFML 2.x (for graphical waveform visualization), Standard Template Library (STL)

Implemented Features:

- Line Coding Schemes: NRZ-L, NRZ-I, Manchester, Differential Manchester, AMI
- Scrambling Techniques (for AMI): B8ZS and HDB3
- Analog Input Modes: Pulse Code Modulation (PCM) and Delta Modulation (DM)
- Longest Palindrome Detection using Manacher's Algorithm (O(n))
- Optional Signal Decoding for extra credit (+5 marks)
- Graphical display of encoded waveform using SFML

Assumptions:

- Binary inputs are limited to 0 and 1 only.
- Analog samples are manually input by the user.
- For PCM, uniform quantization is assumed.
- For Delta Modulation, a fixed step size is chosen by the user.
- Waveform visualization assumes fixed window size (1200×650 px).

How to Run the Code:

1. Install SFML 2.x using Homebrew (macOS):

- brew install sfml@2

2. Compile the code using the following command:

- g++ -std=c++17 signal_generator_sfml_enhanced.cpp -o signal_gen \
  -I/opt/homebrew/Cellar/sfml@2/2.6.2_1/include \
  -L/opt/homebrew/Cellar/sfml@2/2.6.2_1/lib \
  -lsfml-graphics -lsfml-window -lsfml-system

3. Run the executable:

- ./signal_gen

References:

- SFML Official Documentation: https://www.sfml-dev.org/documentation/2.6.1/
- Manacher's Algorithm – Linear Time Longest Palindromic Substring (GeeksforGeeks)
- Course Material: Module 5 – Digital Transmission (ITT036, NIT Srinagar, Autumn 2025)

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