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2023BITE040
Data Communications
Section - B

17/October/2025

Report

Programming Assignment

Objective:

The objective was to Implement a digital signal generator.

- Line Encoding Schemes : NRZ-L, NRZ-I, AMI, Manchester, Differential Manchester, and Scrambling Schemes(B8ZS and HDB3).
- Pulse Code Modulation(PCM) and Delta Modulation(DM).

Language Used: C++

Libraries Used:

- SFML (Graphics, Audio, Window, Font, Text), iostream, string, ncurses

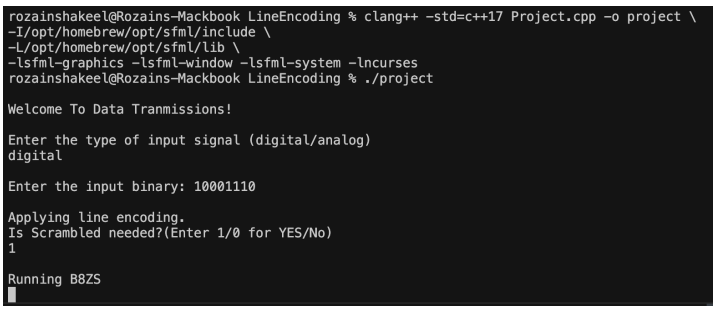
Flow of the Project:

- **Input:**
  - User selects signal type: analog or digital
  - Program takes either binary input (for digital) or sample values (for analog)
- **Encoding:**
  - User selects encoding scheme:
    - **a)** NRZ-L, NRZ-I, AMI (with or without B8ZS/HDB3), Manchester, Differential Manchester for digital signals.
    - **b)** PCM or DM for analog signals
- **Output:**
  - Signal waveform is generated and displayed on a GUI window using SFML.

The project first takes input from the user using the ncurses library, then visualizes the signal waveform in a GUI window using SFML.

SFML (Simple and Fast Multimedia Library) is used to render the digital/analog signal waveforms in a GUI window.

A snippet of how it appears:-



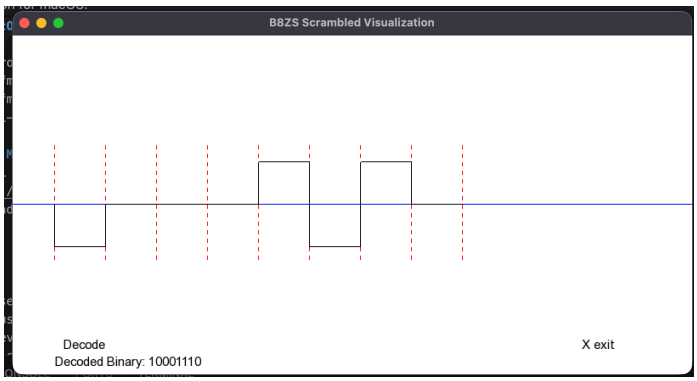


Figure 1: Terminal input
Figure 2: SFML waveform

- How to Run The code:

- **Compilation:-**

  clang++ -std=c++17 ProjectName.cpp -o project \

  -I/opt/homebrew/opt/sfml/include \

  -L/opt/homebrew/opt/sfml/lib \

  -lsfml-graphics -lsfml-window -lsfml-system -lncurses

- **Run:-**

  ./project (run executable file)

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- Added Decoder:

Flow of Decoder:-

1. Our Encoding functions(NRZL,NRZI,AMI,PCM etc) calls windowLogic function which sends:-

- Binary,

- Lines,
- Title,
- decodeFunction
- signalLevels (this basically stores our each level so that we can decode).

2. Also Added a decoder button and its handler in the windowLogic function. (each technique have separate function for encoding and decoding.)
3. The decoder function is first analysing the waveform and then producing binary output.

- Conclusion:

This project successfully simulates various digital line encoding and modulation techniques, allowing the user to visualise how digital signals are represented and transmitted.

- References:

1. SFML documentation : -
   - https://www.sfml-dev.org/documentation/3.0.2/
2. Github:-
   - https://github.com/SFML/SFML
3. Chat GPT
4. N-curses Library:-
   - https://tldp.org/HOWTO/NCURSES-Programming-HOWTO/index.html