Project Report: DNA Barcode Generator

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1. Title

DNA Barcode Generator Software

2. Abstract

DNA barcoding is an essential process in molecular biology used to identify organisms based on short genetic sequences. To simplify and automate barcode creation from genetic sequences, a Python-based desktop application was developed using Tkinter. The DNA Barcode Generator allows users to input DNA sequences, generate barcode images, and store them for later retrieval. SQLite is used to maintain a lightweight local database of stored barcodes. The software includes a professional user interface with menu-driven navigation, an About section, and an image-based profile branding component. This project demonstrates the integration of bioinformatics utilities with a graphical user interface to make DNA barcode generation accessible and user-friendly.

3. Introduction

Molecular biologists frequently require barcode labels representing DNA sequences for easy identification and cataloging of biological samples. Manual barcode creation is prone to error and lacks standardization. This project aims to automate barcode generation using commonly used biological sequence formats.

Key motivations:

- Reduce manual effort and human error
- Provide instant barcode visualization
- Maintain a sequence record for referencing
- Offer a simple software UI that anyone can operate

Programming tools used:

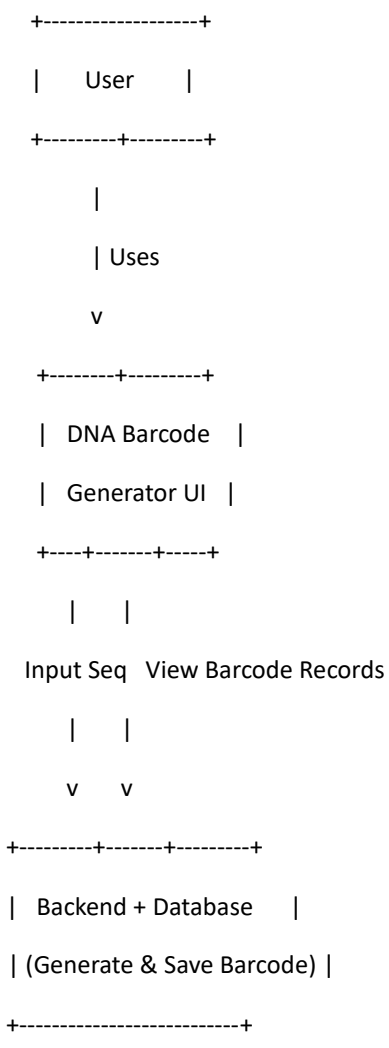
- **Python (Tkinter)**: GUI development
- **Pillow**: Image and barcode rendering
- **SQLite**: Storage of DNA sequences and barcode mapping
- **Python Barcode Libraries**: Code128 encoding for barcode creation

4. System Architecture

The software follows a **modular structure**:

Module	Description
User Interface (UI)	Tkinter-based GUI for interaction
Backend Logic	Functions to generate and store barcode
Database Module	SQLite to store & retrieve sequences
Media Files	Profile image, barcode images

5. Use-Case Diagram



6. Features

✅ Generate barcodes instantly from DNA sequences
✅ Store sequence + barcode in local database
✅ View stored barcode history
✅ Professional UI with About section & profile image
✅ Modular file architecture for easy updates

7. Database Design (SQLite)

Table: barcodes

Field	Type	Description
id	INTEGER PRIMARY KEY AUTOINCREMENT	Unique identifier
sequence	TEXT	DNA sequence entered by user
image_path	TEXT	Path of the generated barcode image
timestamp	DATETIME	Time of creation

8. Results

The software successfully achieves:

- Stable barcode generation (Code128 encoding)
- Database storage and retrieval functionality
- Professional and user-friendly UI layout

Example barcode generated:

DNA Sequence: ATGCTAGTACGTAGC

Barcode: Code128 generated and saved

User can view historical barcodes with one click.

9. Future Improvements

- Multi-format support: QR-Code, EAN, custom prefix
- Cloud storage integration
- Sequence validation (A, T, G, C only)
- Image/theme customization
- Mobile application version

10. Conclusion

The “DNA Barcode Generator” software provides an efficient method for generating and managing DNA barcodes with a reliable backend and intuitive UI. Its modularity and integration of SQLite make it a practical solution for laboratory workflow automation.

11. References

- Pillow Imaging Library documentation
- SQLite3 usage in Python
- Code128 Barcode Standard Manuals
- Bioinformatics workflow case studies