A project

ANNEX PAY

CSE 100 : Software Development Project **I**

SUBMITTED BY

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Abstract

ANNEX PAY is an advanced console-based banking management system developed entirely in C programming language that uniquely integrates traditional banking operations with an entertainment module. This comprehensive system simulates real-world banking workflows including secure account management, PIN-based authentication, financial transactions (deposits, withdrawals, transfers), bill payments, mobile recharges, loan processing, and a novel feature – an integrated Rock, Paper, Scissors game for user engagement during banking sessions. The system implements persistent data storage through binary files for structured data and text files for transaction logs. It features a dedicated admin panel for system management, cross-platform compatibility (Windows/Linux), and a user-friendly color-coded interface. The integrated entertainment module provides users with a refreshing break option while maintaining banking session continuity. ANNEX PAY demonstrates advanced C programming concepts including modular design, file I/O, secure input handling, and software integration, effectively addressing both banking management needs and user experience enhancement through entertainment integration.

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Chapter 1: Introduction

1.1 Problem Specification/Statement

In the digital era, while large financial institutions have sophisticated online banking systems, educational institutions and small organizations often lack integrated solutions that combine financial management with user engagement features. Traditional banking systems focus solely on financial transactions, overlooking the importance of user experience and engagement. ANNEX PAY addresses this gap by integrating a comprehensive banking system with an entertainment module, creating a unique platform that serves both practical banking needs and user engagement requirements.

Existing C-based banking projects typically offer basic financial functionalities but lack interactive features that enhance user experience during banking sessions. This limitation becomes apparent during extended banking activities where users might appreciate brief diversions. ANNEX PAY solves this by providing a sophisticated banking system with an integrated game, allowing users to take refreshing breaks without leaving their banking session.

1.2 Objectives

The primary objectives of the ANNEX PAY project are:

1. Dual-Function System Development: To design and implement a secure banking system with integrated entertainment features using C programming language.
2. User Experience Enhancement: To improve banking session engagement through strategic entertainment integration without compromising security or functionality.
3. Seamless Integration: To ensure smooth transition between banking operations and entertainment features while maintaining session continuity.
4. Data Persistence: To establish reliable file-based storage for both banking data and game statistics across multiple sessions.
5. Security Implementation: To maintain robust security measures while providing accessible entertainment options.
6. Cross-Platform Compatibility: To ensure consistent operation across Windows and Linux environments for both banking and gaming modules.

1.3 Scope

The ANNEX PAY project encompasses:

Included Functionalities:

- Complete banking operations (account management, transactions, services)
- Integrated Rock, Paper, Scissors game with score tracking
- Secure session management between banking and gaming modes
- Comprehensive administrative controls
- User engagement features (referral program, messaging system)
- Detailed reporting and search capabilities

Technical Specifications:

- Support for 1000+ user accounts
- Real-time game processing with visual animations
- Daily banking limits enforcement (20,000 BDT)
- Cross-platform implementation with consistent user experience
- Modular architecture for both banking and gaming components

Limitations:

- Console-based interface (no graphical UI)
- Single-user access mode
- File-based storage system

Deliverables:

- Complete C source code with integrated gaming module
- Comprehensive project documentation
- User manual covering both banking and gaming features
- Installation and configuration guide

1.4 Organization of Project Report

This report is organized to provide comprehensive understanding:

Chapter 2: Background examines existing systems and literature informing the integrated approach.

Chapter 3: System Analysis & Design details the architectural models and integration strategies.

Chapter 4: Implementation explains the development process of both banking and gaming modules.

Chapter 5: User Manual provides complete guidance for system operation including gaming features.

Chapter 6: Conclusion summarizes achievements, discusses limitations, and proposes enhancements.

Chapter 2: Background

2.1 Existing System Analysis

Current banking systems can be categorized into three tiers, each with specific characteristics:

Traditional Banking Systems:
Focus exclusively on financial operations with no consideration for user engagement. These systems, while functionally complete, often lead to

user fatigue during extended sessions and lack features that make banking more enjoyable.

Educational Banking Projects:
Basic C/C++ implementations demonstrating core concepts but lacking real-world features and user engagement elements. These typically serve as academic exercises rather than practical applications.

Entertainment Systems:
Standalone games or entertainment applications with no integration with practical systems. These lack the utility of banking systems while demonstrating engagement strategies.

ANNEX PAY Innovation:
By integrating banking operations with entertainment features, ANNEX PAY creates a unique hybrid system that addresses the limitations of existing solutions. This approach recognizes that modern users expect engaging experiences even in utility applications.

2.2 Supporting Literatures

Technical Integration:
Software engineering literature on modular design and system integration informed the approach to combining banking and gaming functionalities.

Research on user experience design provided insights into maintaining engagement during utility tasks.

Game Development Principles:
Basic game design principles from interactive computing literature guided the implementation of the Rock, Paper, Scissors game with appropriate feedback mechanisms, score tracking, and visual elements.

User Engagement Strategies:
Studies on user engagement in software applications influenced the decision to integrate entertainment as a value-added feature rather than a distraction from core functionality.

Methodological Approach:
The incremental development model supported the phased implementation of banking features followed by seamless integration of gaming elements. This approach ensured stable banking operations before adding entertainment features.

Chapter 3: System Analysis & Design

3.1 Technology & Tools

Programming Environment:

- Primary Language: ANSI C (C99 standard)
- Compilers: GCC for Linux, MinGW for Windows
- Development Tools: Code::Blocks, Visual Studio Code

Libraries:

- Standard C Libraries: <stdio.h>, <stdlib.h>, <string.h>, <time.h>, <ctype.h>
- Platform-Specific: <conio.h> (Windows), <termios.h> (Linux)

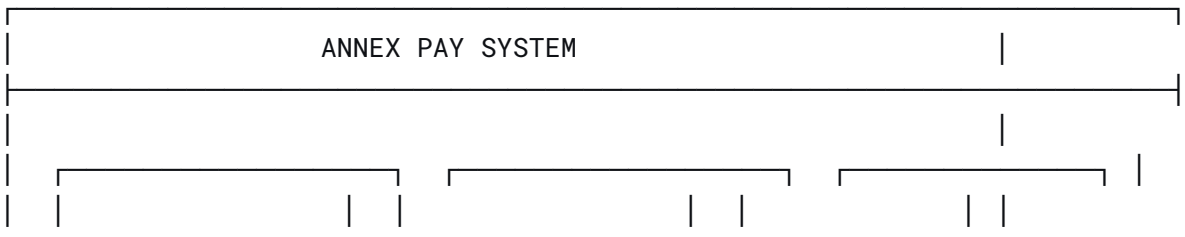
Storage Architecture:

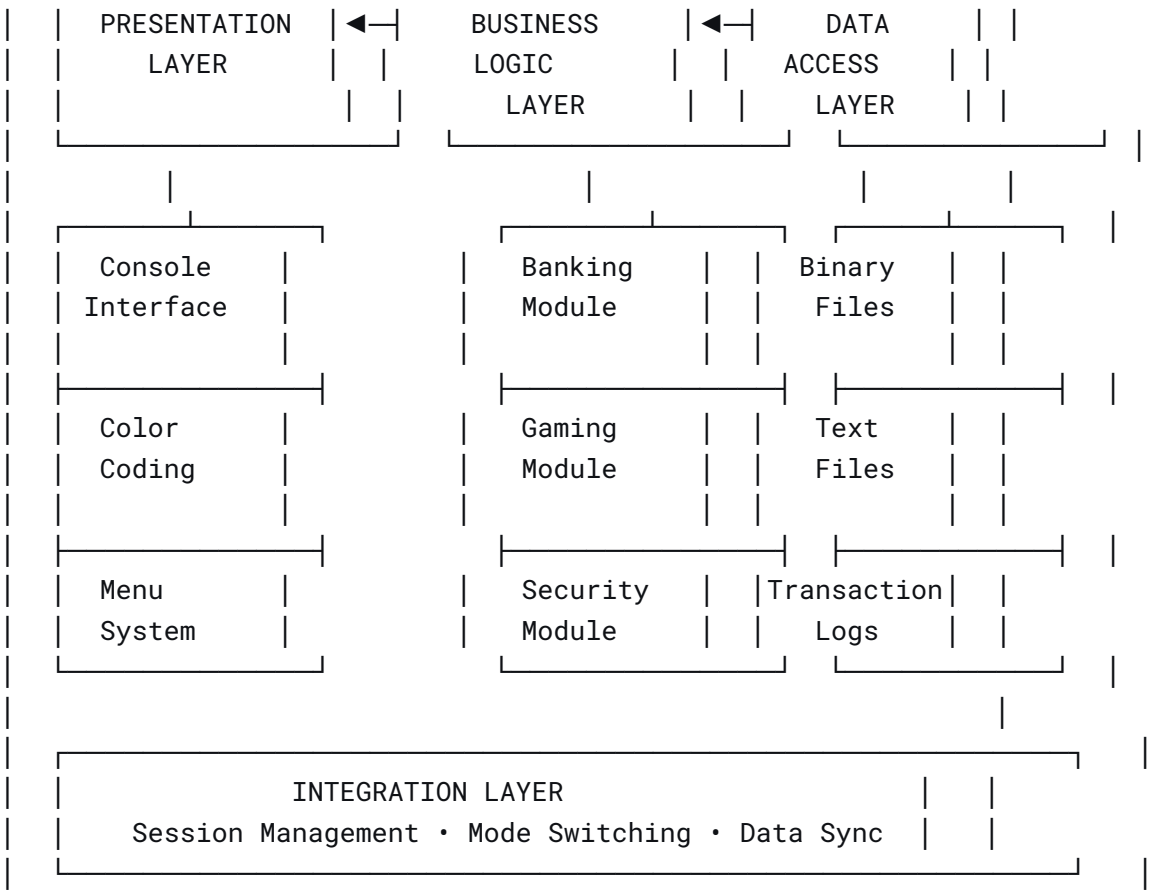
- Binary files for structured data
- Text files for transaction logs
- Hierarchical directory structure

3.2 System Architecture

Figure 1: System Architecture Diagram

```
text
```





The system employs a modular architecture with three primary layers:

Presentation Layer:

- Console interface with ANSI color coding
- Integrated menu system (banking + gaming)
- Consistent navigation across modules

Business Logic Layer:

- Banking operations module
- Gaming module with score management
- Session management for mode switching
- Security and validation systems

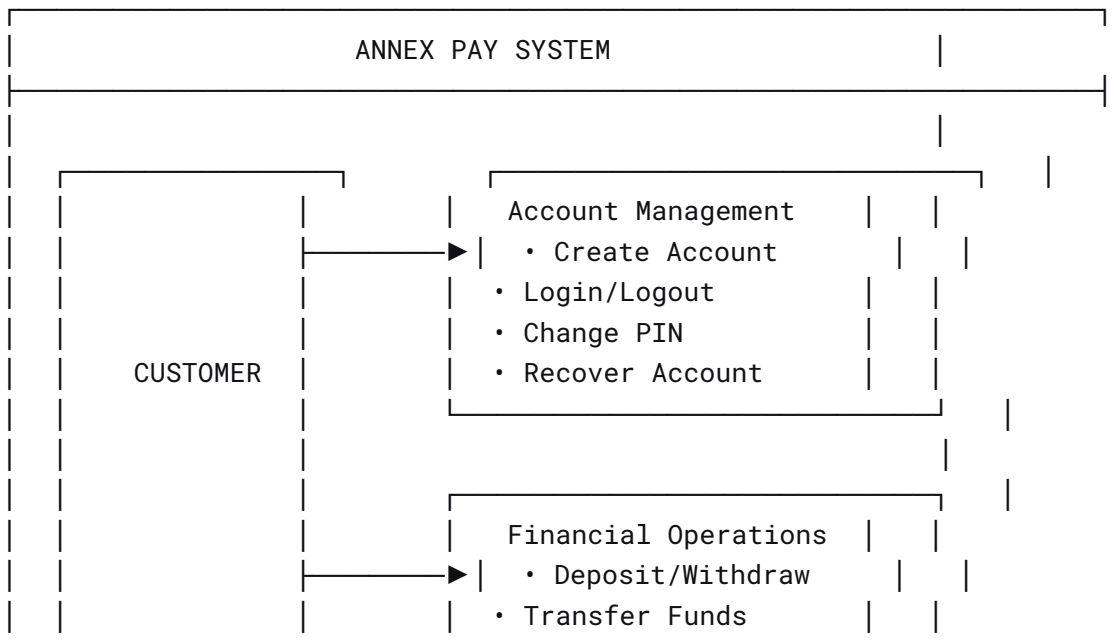
Data Access Layer:

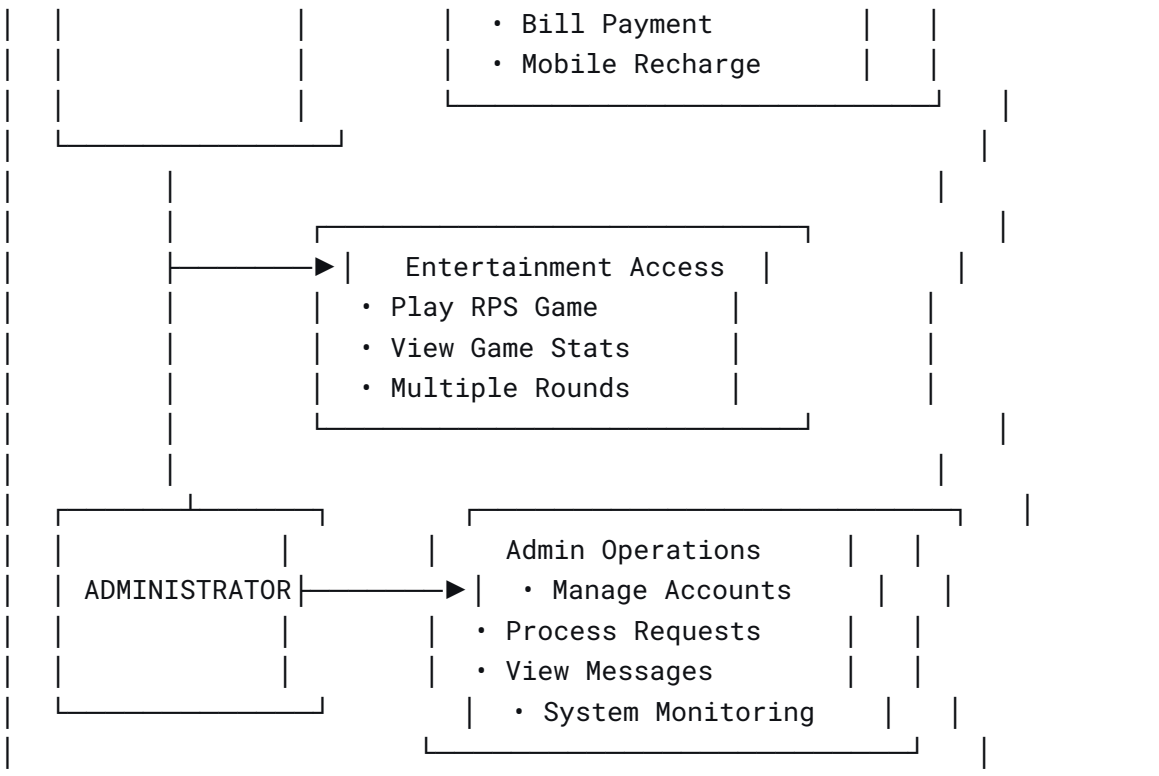
- File I/O for banking data
- Game statistics tracking
- Transaction logging
- Cross-module data consistency

3.3 Use Case Diagram

Figure 2: Use Case Diagram

```
text
```





Primary Actors:

Customer:

- Banking Operations (all standard features)
- Entertainment Access:
  - Launch Rock, Paper, Scissors game
  - Play multiple rounds
  - View game statistics
  - Return to banking operations

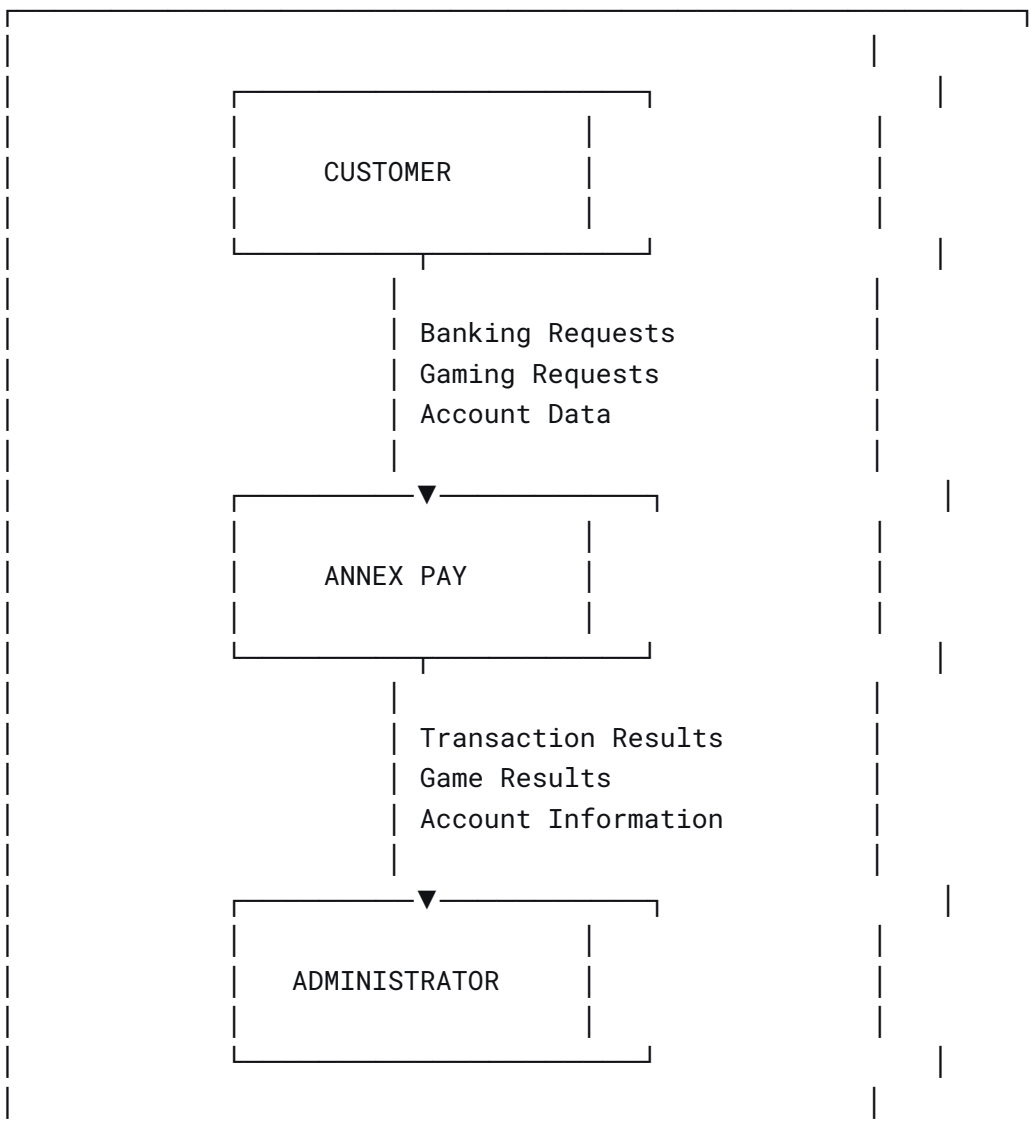
Administrator:

- Standard administrative functions
- System oversight including usage monitoring

3.4 Data Flow Diagrams

Figure 3: Context Level Diagram (DFD-0)

```
text
```



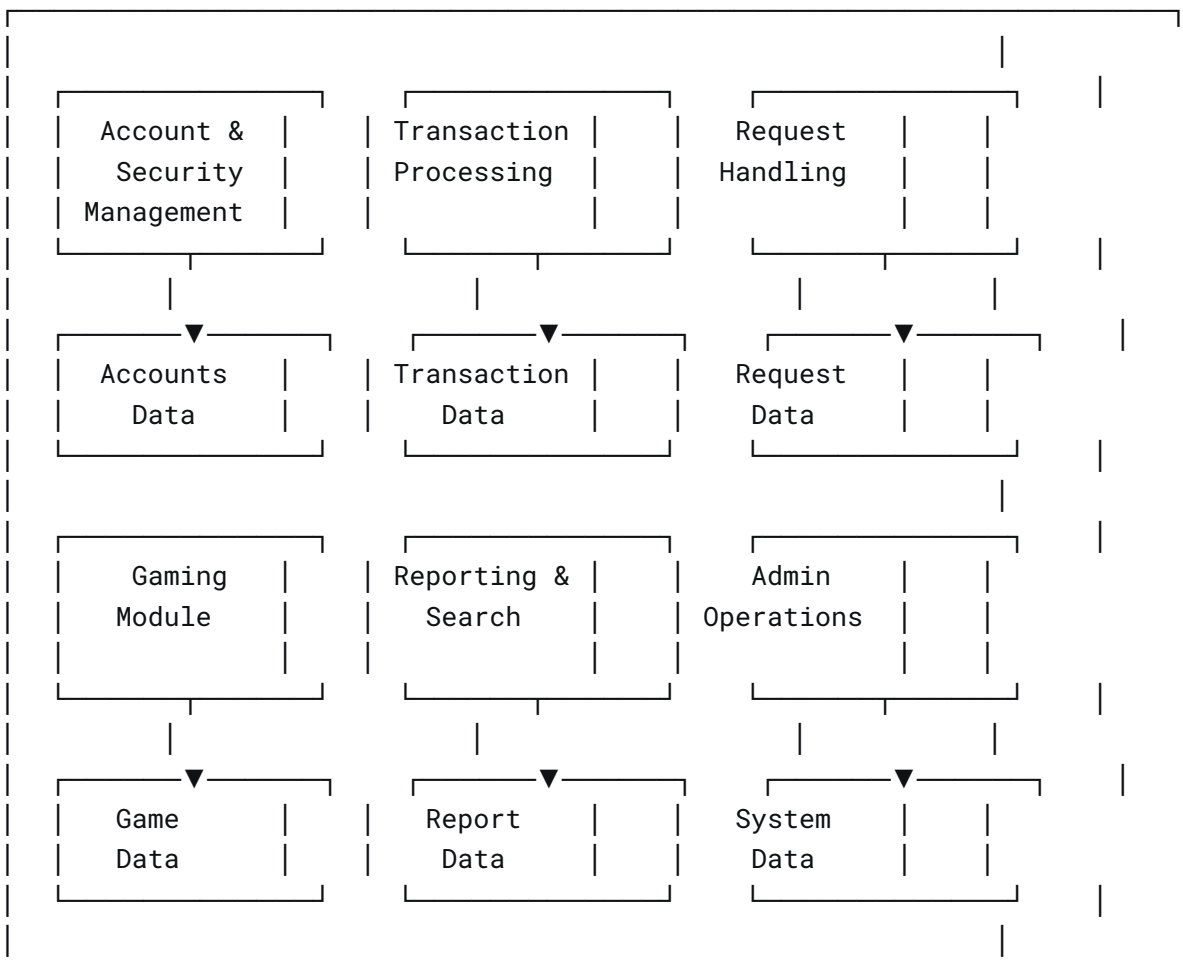
```
└──────────────────────────────────────────────────────────────────────────┘
```

Shows ANNEX PAY as an integrated system interacting with:

- Customer (provides banking/gaming inputs)
- Administrator (system management)

Figure 4: Level-1 Data Flow Diagram

```
text
```



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```

Decomposes system into six processes:

1. Account & Security Management
2. Transaction Processing
3. Request Handling
4. Gaming Module
5. Reporting & Search
6. Admin Operations

3.5 Database Schema

Figure 5: Database Schema

```
text
```

```
┌──────────────────────────────────────────────────────────────────────────┐
│                    DATABASE SCHEMA                                       │
├──────────────────────────────────────────────────────────────────────────┤
│                                                                          │
│  ACCOUNTS (accounts.dat)                                                 │
│  ┌──────────────────────────────────────────────────────────────────┐    │
│  │ accNo (PK) | name | pin | balance | locked | refBy  |    |      │    │
│  ├──────────────┼──────┼─────┼─────────┼────────┼────────┼────┤      │    │
│  │    1001     | John |1234 | 1500.00 |   0    |   0    |    |      │    │
│  │    1002     | Mary |5678 | 2500.00 |   0    |  1001  |    |      │    │
│  └──────────────────────────────────────────────────────────────────┘    │
│                                                                          │
│  TRANSACTION LOGS (acc_XXXX_tx.txt)                                      │
│  ┌──────────────────────────────────────────────────────────────────┐    │
│  │ [2024-12-29 14:30] Deposit: 1500.00                  |    |      │    │
│  │ [2024-12-29 15:45] Transfer Out: 500.00             |    |      │
```

```
|   | [2024-12-29 16:20] Payment: 850.00                |   |
|   └──────────────────────────────────────────────────────┘   |
|                                                             |
|   LOAN REQUESTS (loan_requests.dat)                         |
|   ┌──────────────────────────────────────────────────────┐   |
|   | id | accNo | amount | tenure | status |           |   |
|   ├────┼───────┼────────┼────────┼────────┤           |   |
|   | 1  | 1001  |5000.00 |   12   |   0    |           |   |
|   └──────────────────────────────────────────────────────┘   |
|                                                             |
|   GAME STATISTICS (In-memory during session)                |
|   ┌──────────────────────────────────────────────────────┐   |
|   | user_wins | comp_wins | ties | last_played |       |   |
|   ├───────────┼───────────┼──────┼─────────────┤       |   |
|   |     3     |     2     |   1  | 2024-12-29  |       |   |
|   └──────────────────────────────────────────────────────┘   |
|                                                             |
```

```
└──────────────────────────────────────────────────────────────
──────┘
```

Enhanced Structures:

```
c
```

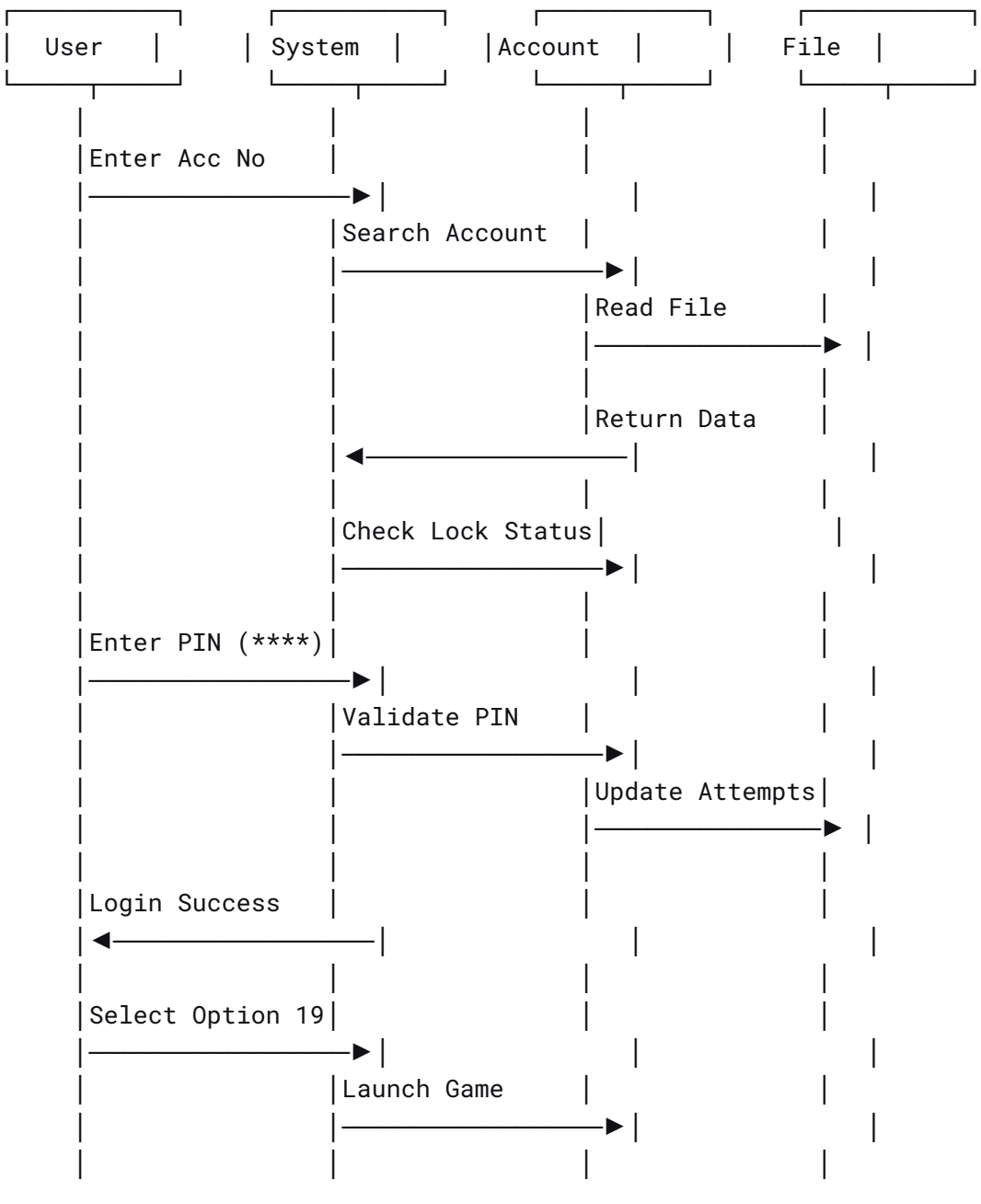
```c
// Gaming statistics (integrated with session)
typedef struct {
    int user_wins;
    int annex_pay_wins;
    int ties;
    char last_played[20];
```

```
} GameStats;
```

3.6 Behavioral Diagrams

Figure 6: Login Sequence Diagram

```
text
```



Enhanced to show gaming option access after authentication.

Game Integration Sequence:

```
text
```

```
User → System: Select "Play Game" (Option 19)
System → Gaming Module: Initialize game environment
Gaming Module → User: Display game interface
User → Gaming Module: Make game choice
Gaming Module: Process game logic
Gaming Module → User: Display results
User → System: Choose to play again or return
```

```
System: Restore banking session context
```

Chapter 4: Implementation

4.1 Interface Design/Front-End

Enhanced Visual Design:

- Extended color scheme for gaming elements:
  - Bright Green (COLOR_GAME_WIN): User wins
  - Bright Red (COLOR_GAME_LOSE): Annex Pay wins
  - Bright Yellow (COLOR_GAME_TIE): Ties
  - Bright Cyan (COLOR_GAME_APP_NAME): Branding

Navigation Architecture:

- Enhanced user dashboard with 20 options:
  - Options 1-18: Banking operations
  - Option 19: Play Game (new integration)
  - Option 20: Logout (relocated)

Gaming Interface Components:

- Animated choice display with frame sequencing
- Score tracking interface with color coding
- Seamless transition animations
- Play-again prompt with flexible input

4.2 Back-End Implementation

Gaming Module Architecture:

Game Initialization:

```
c
```

```c
void playRockPaperScissors() {
    // Initialize game variables
    int user_wins = 0, annex_pay_wins = 0, ties = 0;
    srand(time(NULL)); // Seed random generator
    // Display welcome message with branding

    }
```

Animation System:

c

```
void game_animate_choice() {
    // Display thinking animation
    const char* frames[] = {rock_frame, paper_frame, scissors_frame};
    for (int i = 0; i < 6; i++) {
        printf("%s", frames[i % 3]);
        sleep_ms(300);
        printf("\033[F\033[F\033[F\033[F"); // Move cursor up
    }
```

}

Game Logic Processing:

c

```
void game_determine_winner(char user_choice, char computer_choice,
                           int *user_wins, int *annex_pay_wins, int *ties) {
    // Enhanced game logic with score updating
    if (user_choice == computer_choice) {
        (*ties)++;
        display_tie_message();
    } else if ((user_choice == 'R' && computer_choice == 'S') ||
               (user_choice == 'P' && computer_choice == 'R') ||
               (user_choice == 'S' && computer_choice == 'P')) {
        (*user_wins)++;
        display_win_message();
    } else {
        (*annex_pay_wins)++;
        display_lose_message();
    }
```

}

Session Management:

- Maintain banking session context during gameplay
- Preserve account information for return transition
- Clear game state after session completion

4.3 System Modules

Enhanced Module Structure:

Module 9: Entertainment Integration

- `playRockPaperScissors()`: Main game function with complete gameplay loop
- `game_animate_choice()`: Visual animation for computer "thinking"
- `game_determine_winner()`: Game logic and outcome processing
- `game_display_score()`: Real-time score tracking display
- `game_get_user_choice()`: Validated user input for game choices

Integration Points:

- Seamless calling from user dashboard (option 19)
- Consistent input/output handling across modules
- Shared utility functions (sleep_ms, clearScreen)
- Unified color management system

Cross-Module Consistency:

- Banking security maintained during gameplay
- Session continuity preserved
- Consistent user experience standards
- Shared platform compatibility layer

Chapter 5: User Manual

5.1 System Requirements

Hardware Specifications:

- Processor: 1 GHz or faster
- RAM: 512 MB minimum (1 GB recommended)
- Storage: 50 MB available space
- Display: Console supporting ANSI color sequences

Software Prerequisites:

- Operating Systems: Windows 7+, Linux distributions, macOS
- Compilers: GCC or MinGW
- Terminal applications with color support

5.2 User Interfaces

Figure 7: Main Menu Interface

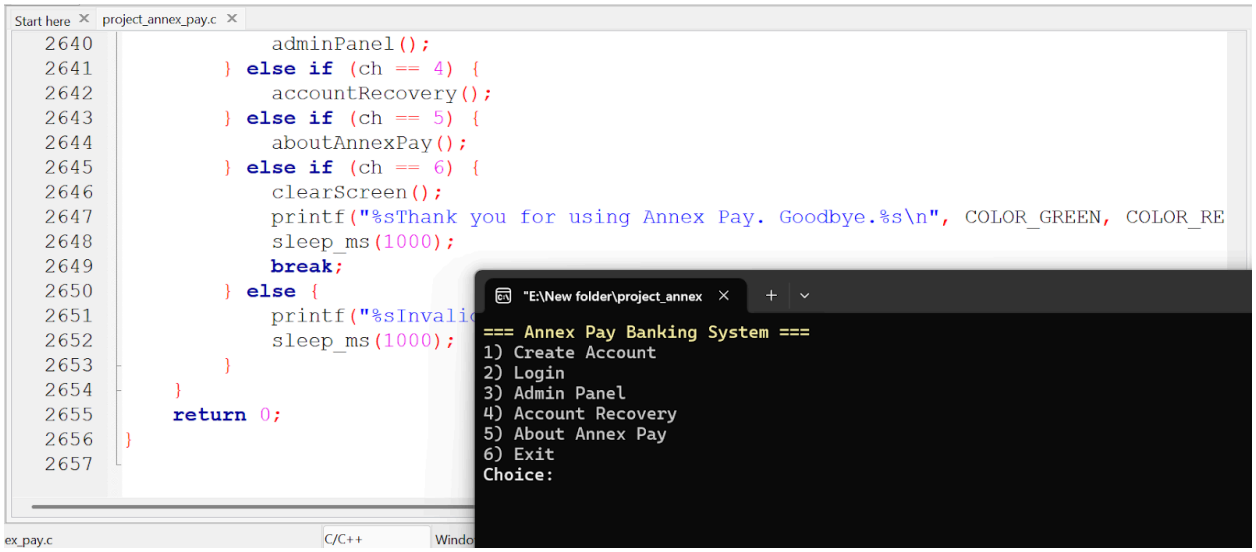


Figure 8: User Dashboard

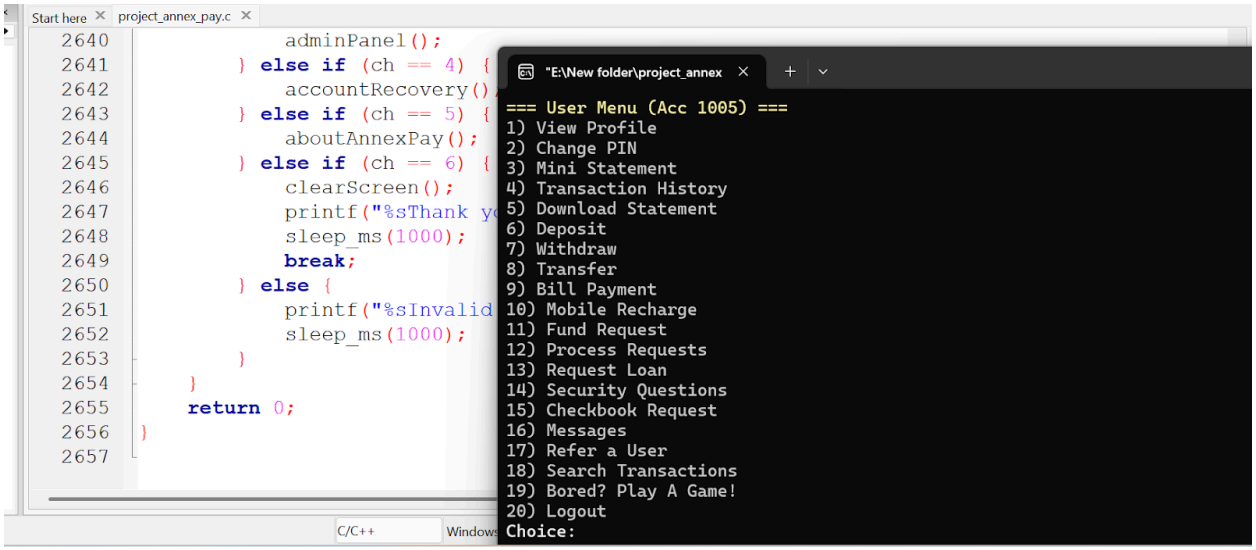
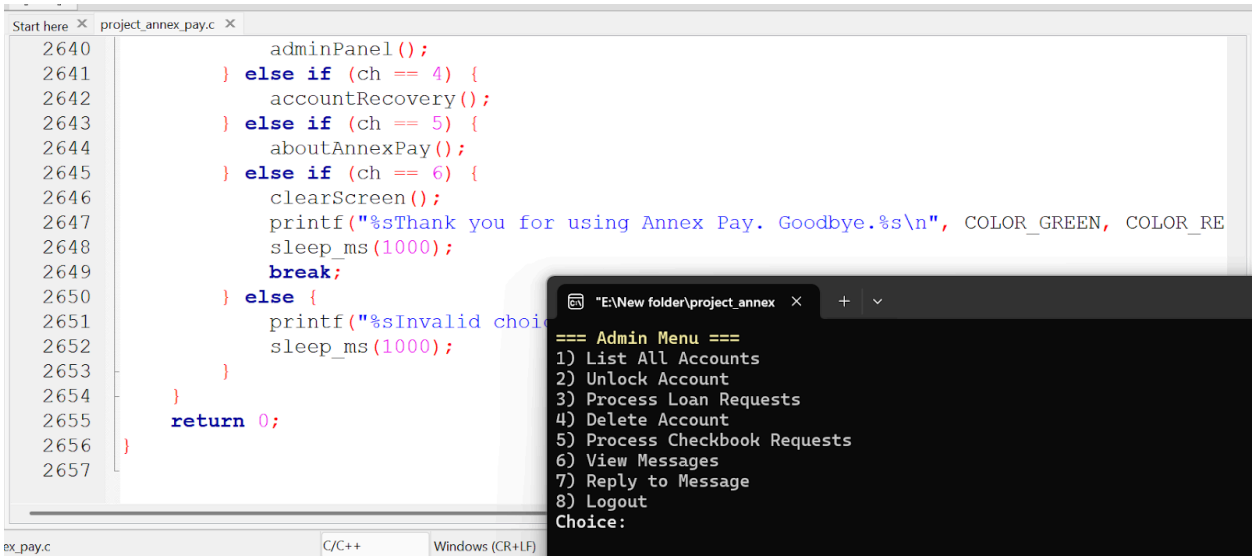


Figure 9: Admin Panel



5.3 Screenshot Gallery

Account Management Screenshots:

Figure 10: Account Creation Screen

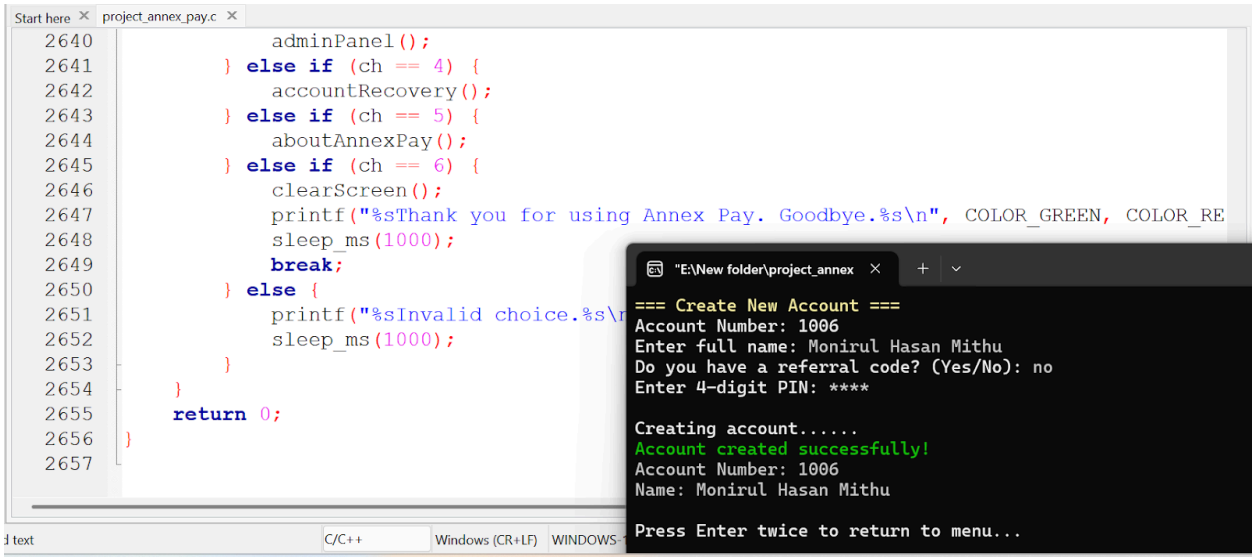


Figure 11: Secure PIN Entry

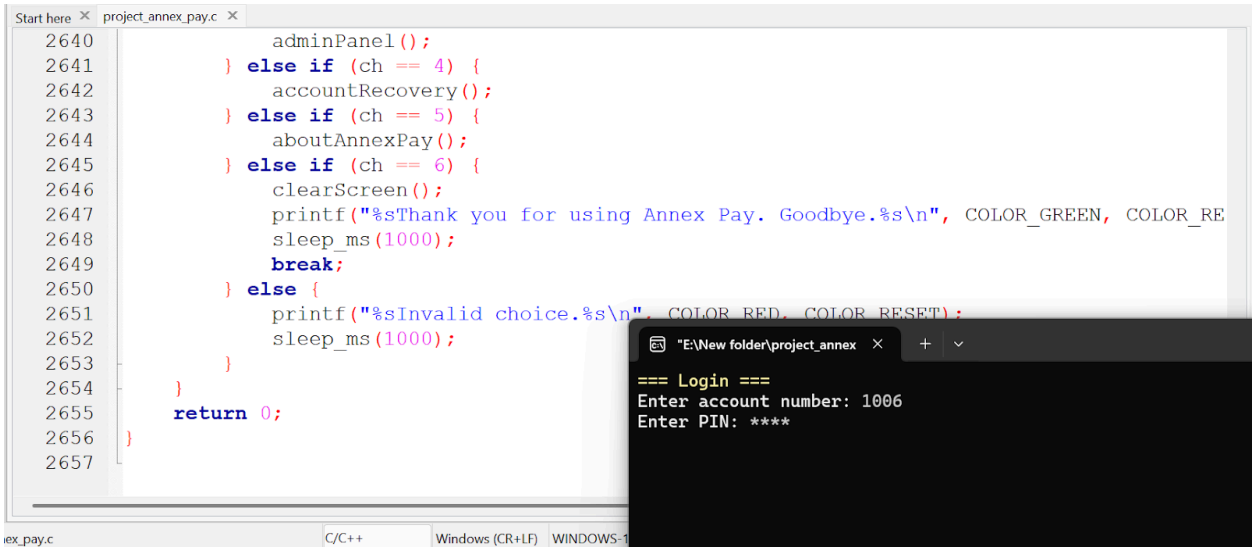
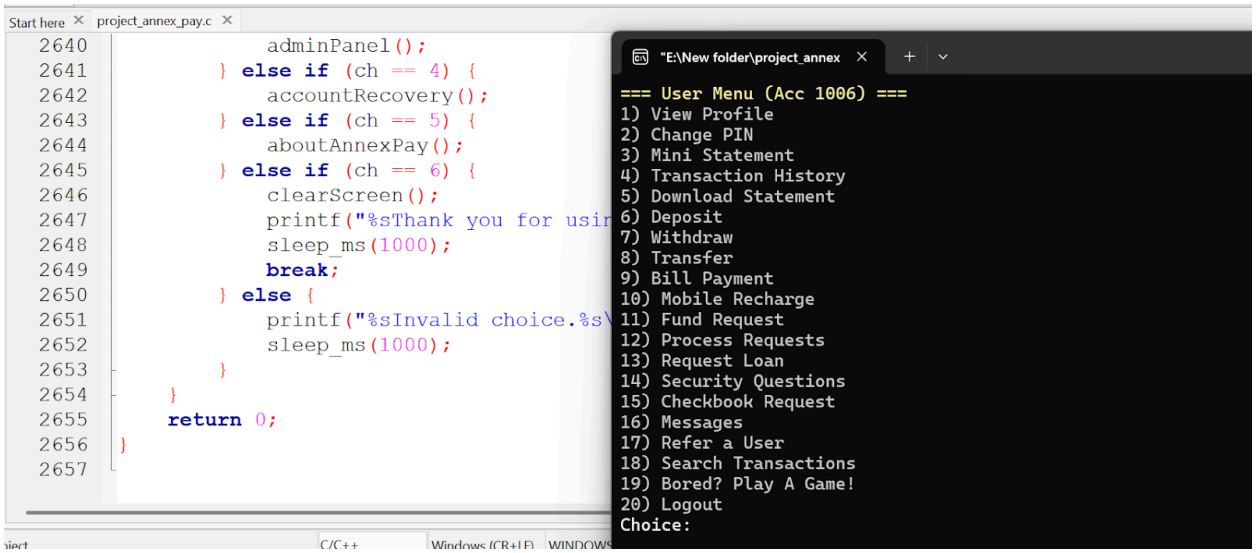


Figure 12: User Login Interface



Transaction Operations Screenshots:

Figure 13: Deposit Operation

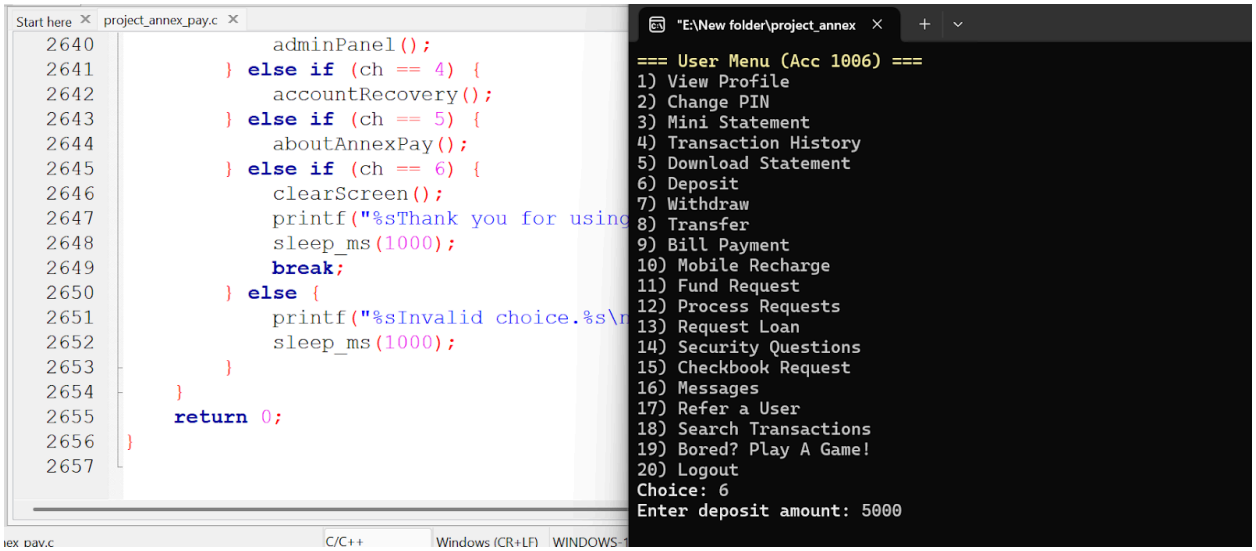


Figure 14: Withdrawal Operation

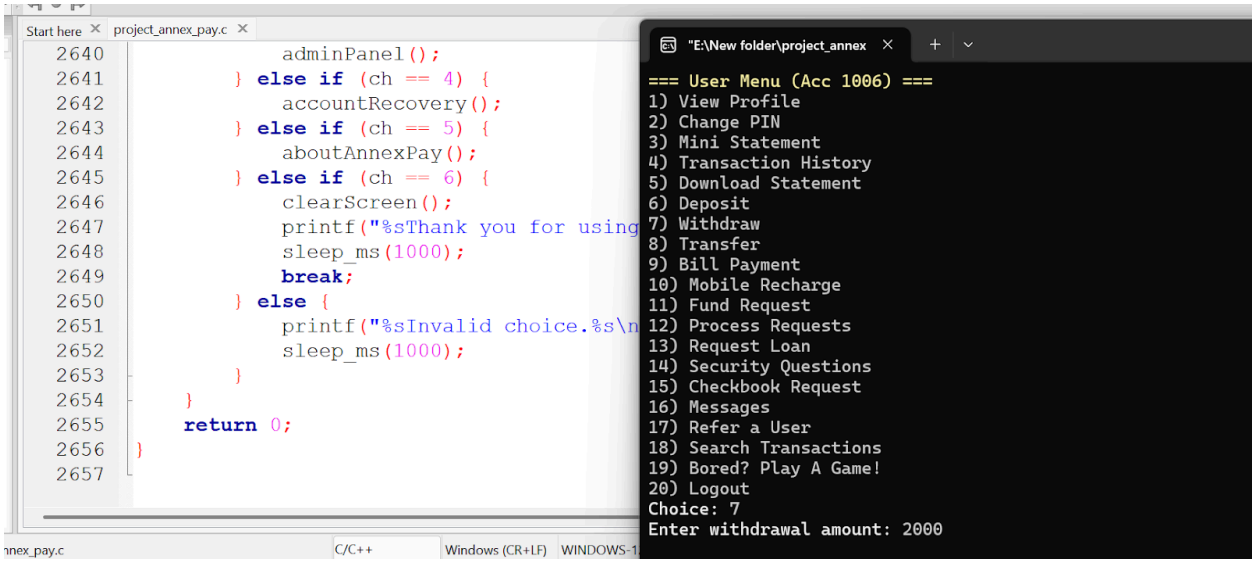
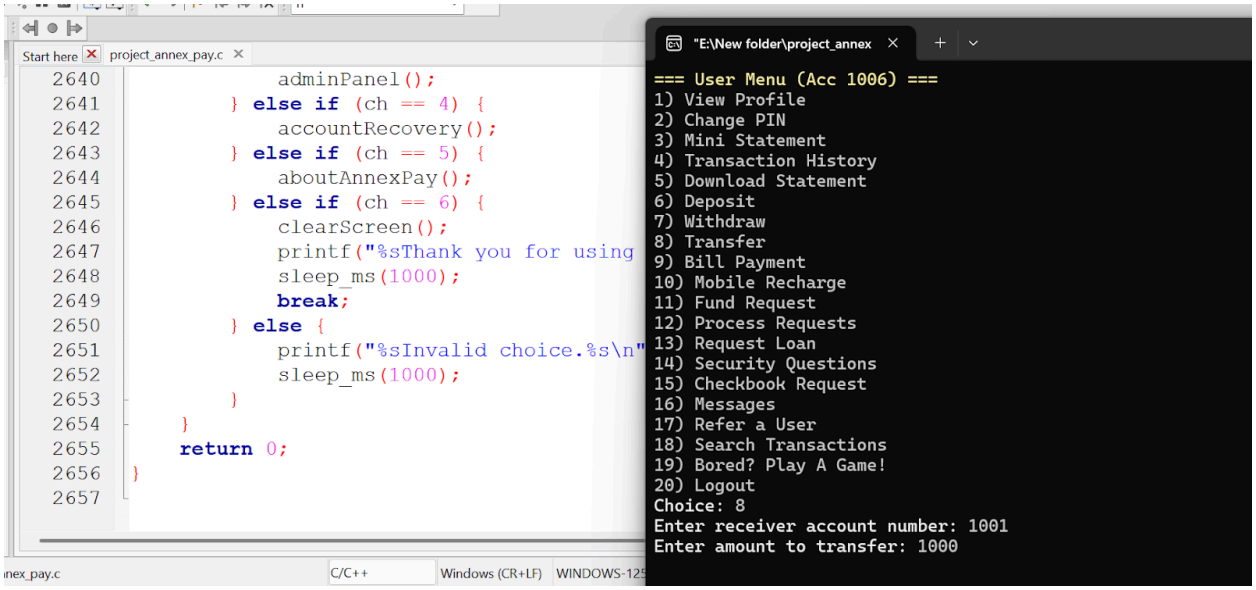


Figure 15: Fund Transfer Screen



Banking Services Screenshots:

Figure 16: Bill Payment Menu

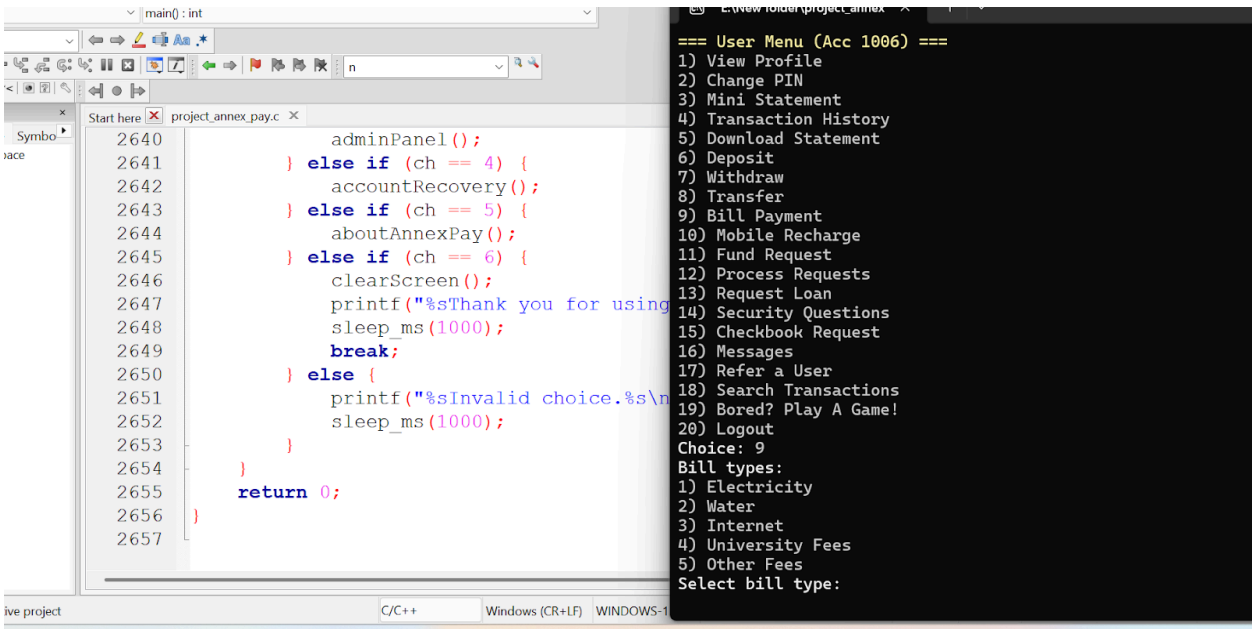
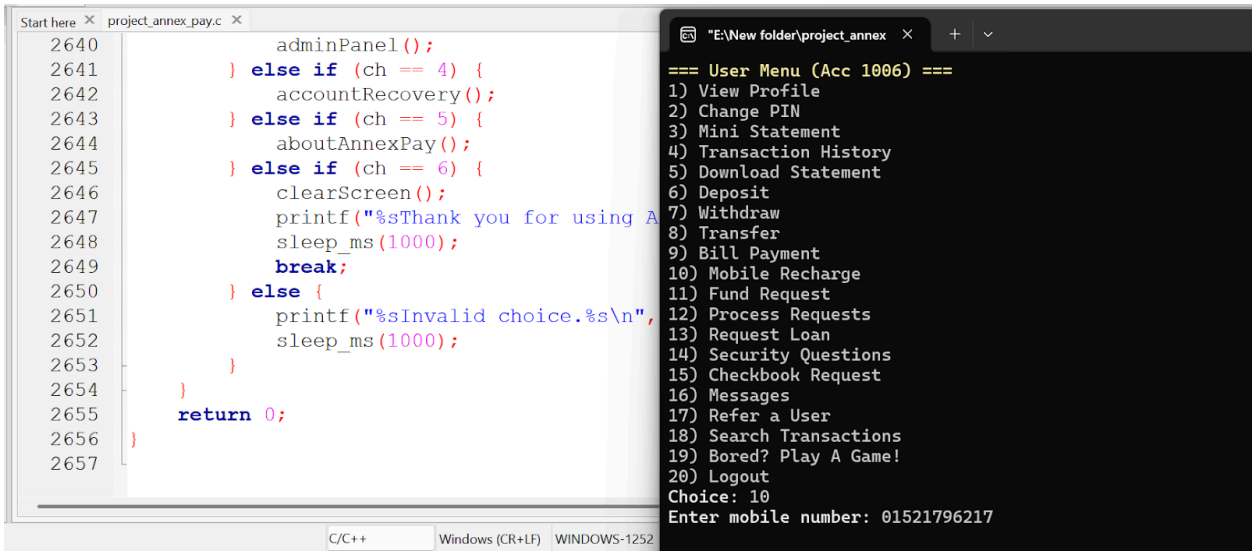


Figure 17: Mobile Recharge Interface



Request System Screenshots:

Figure 18: Fund Request Screen

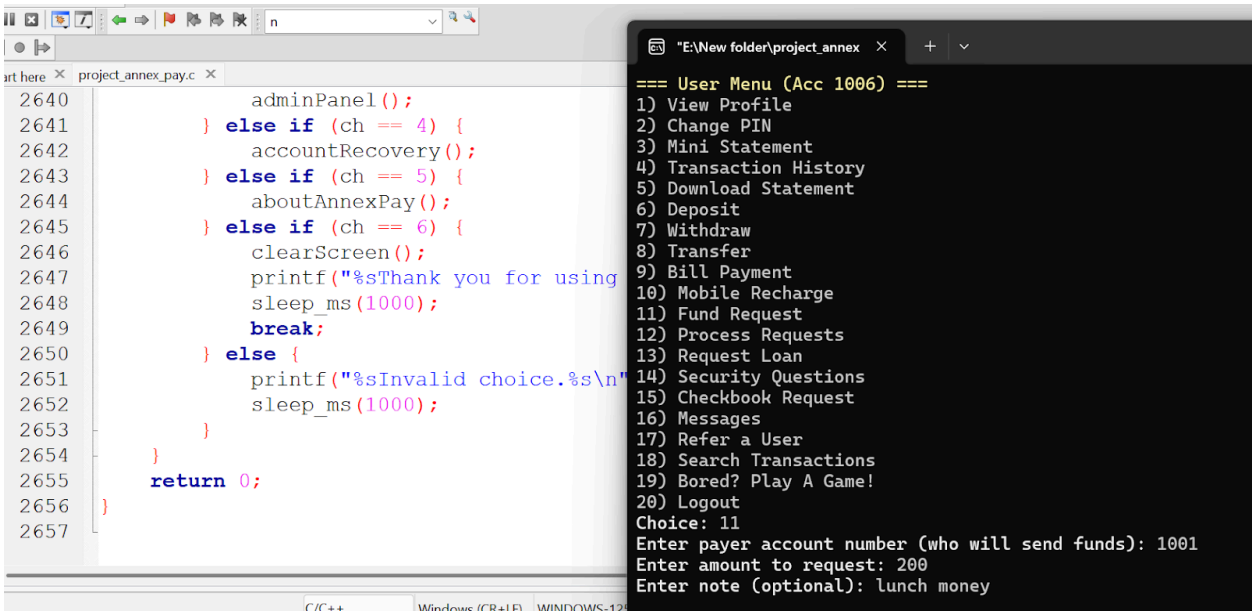
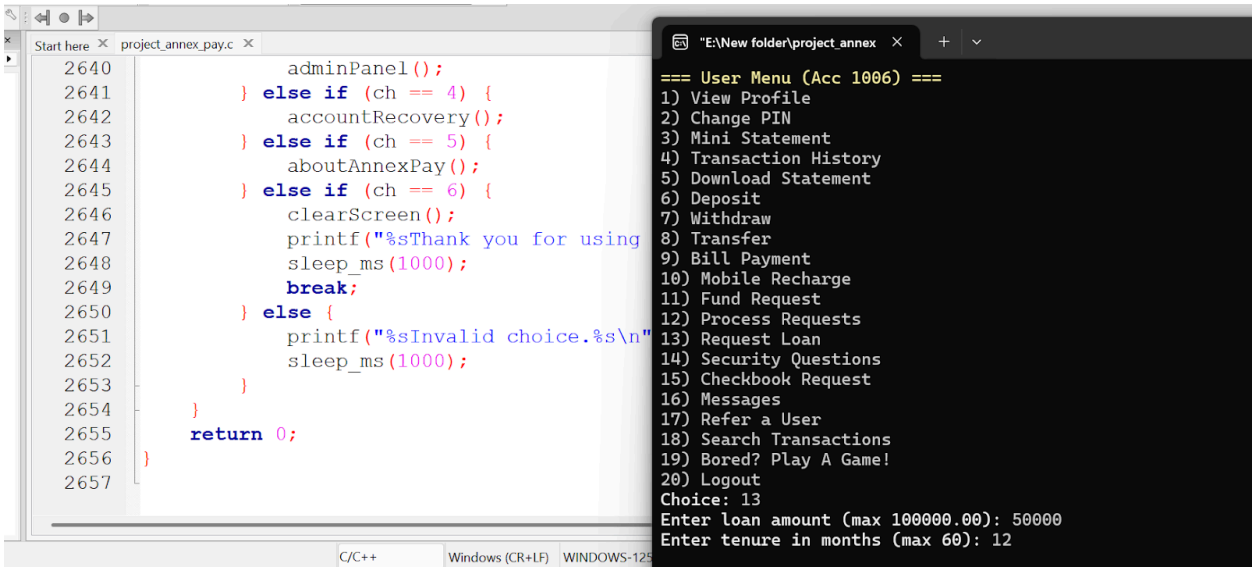
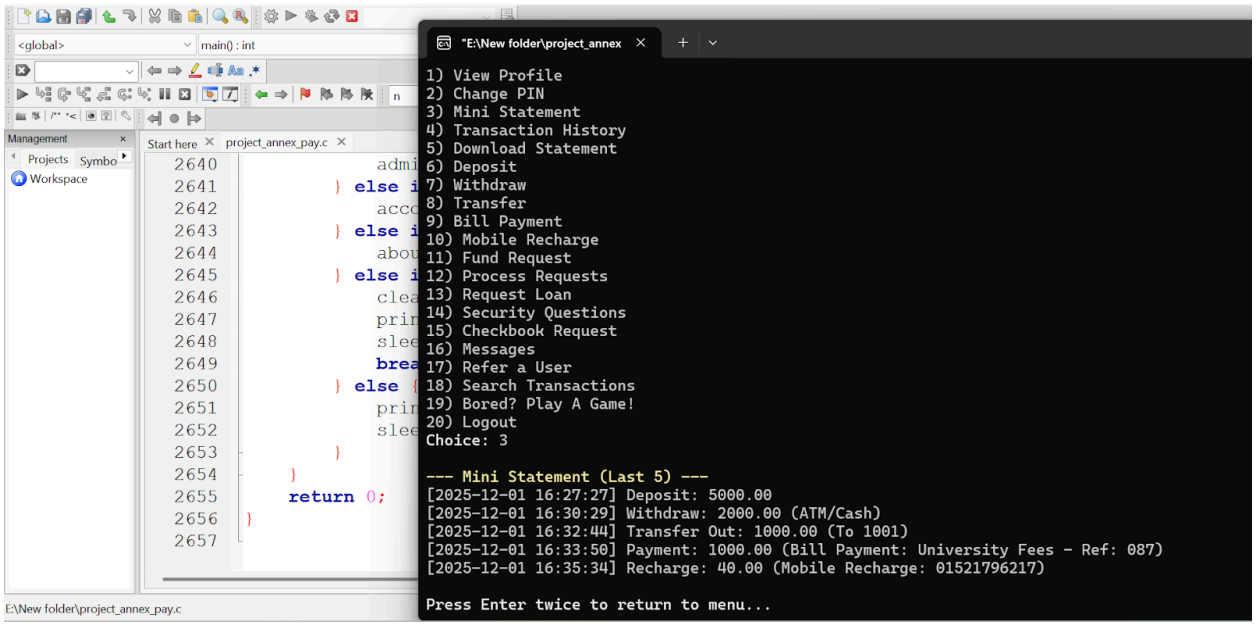


Figure 19: Loan Application



Reporting & Search Screenshots:

Figure 20: Mini Statement Display



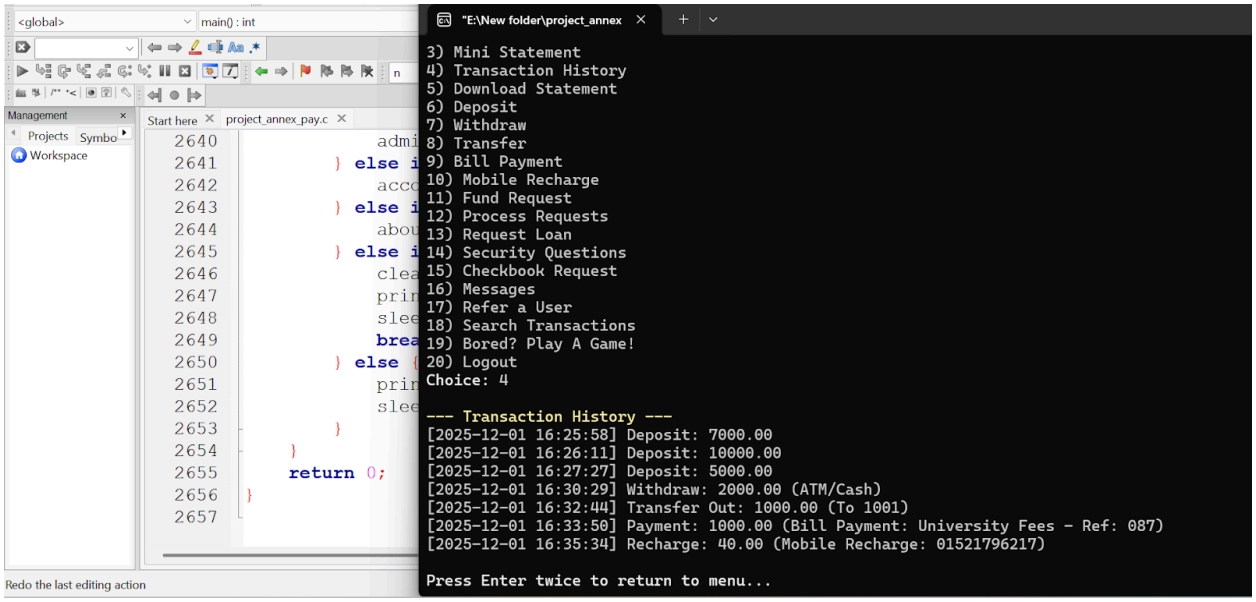
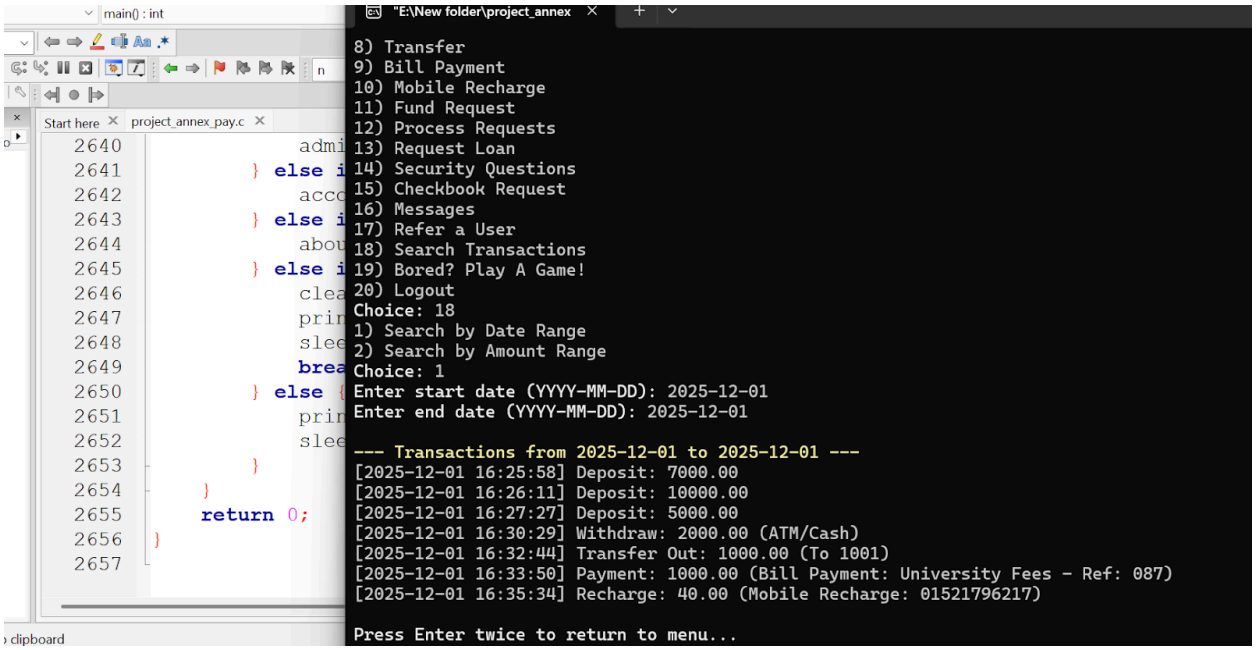


Figure 22: Search Transactions



Security & Support Screenshots:

Figure 23: Security Questions Setup

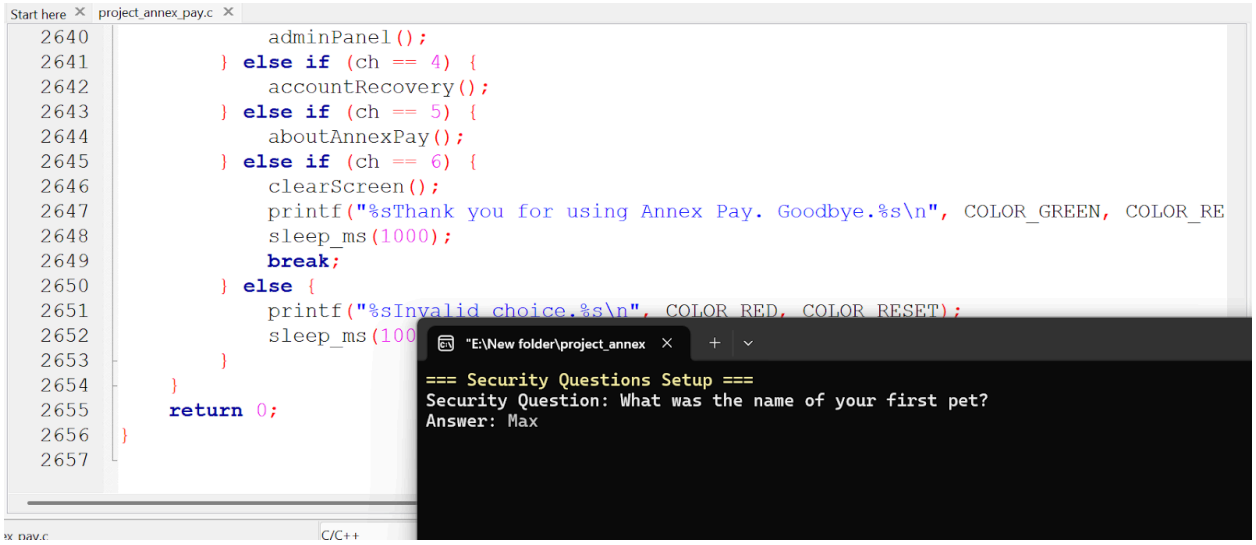


Figure 24: Checkbook Request

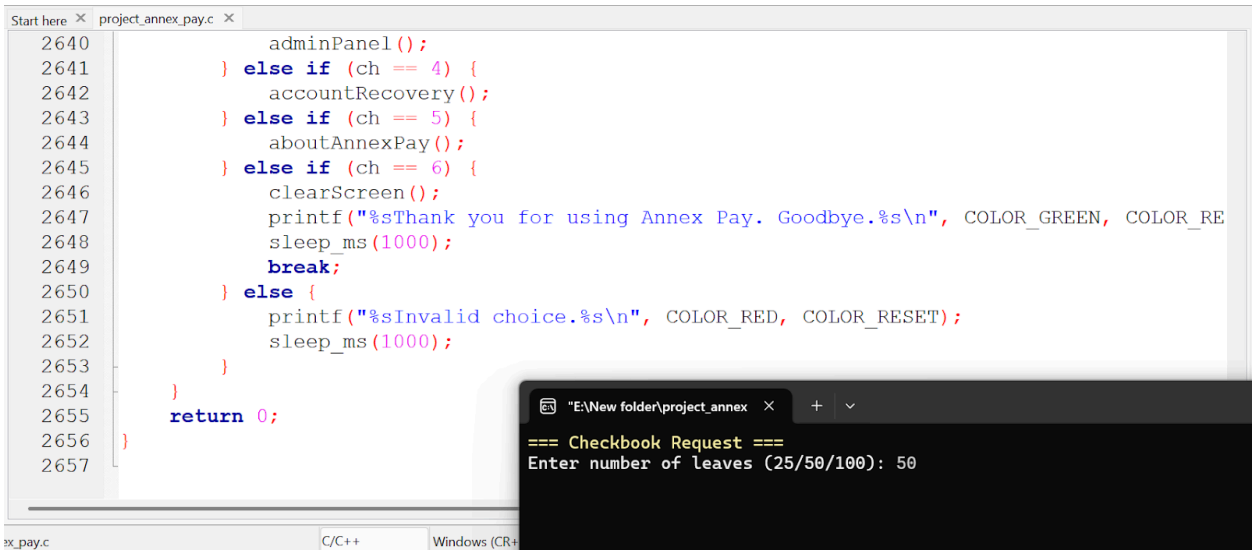
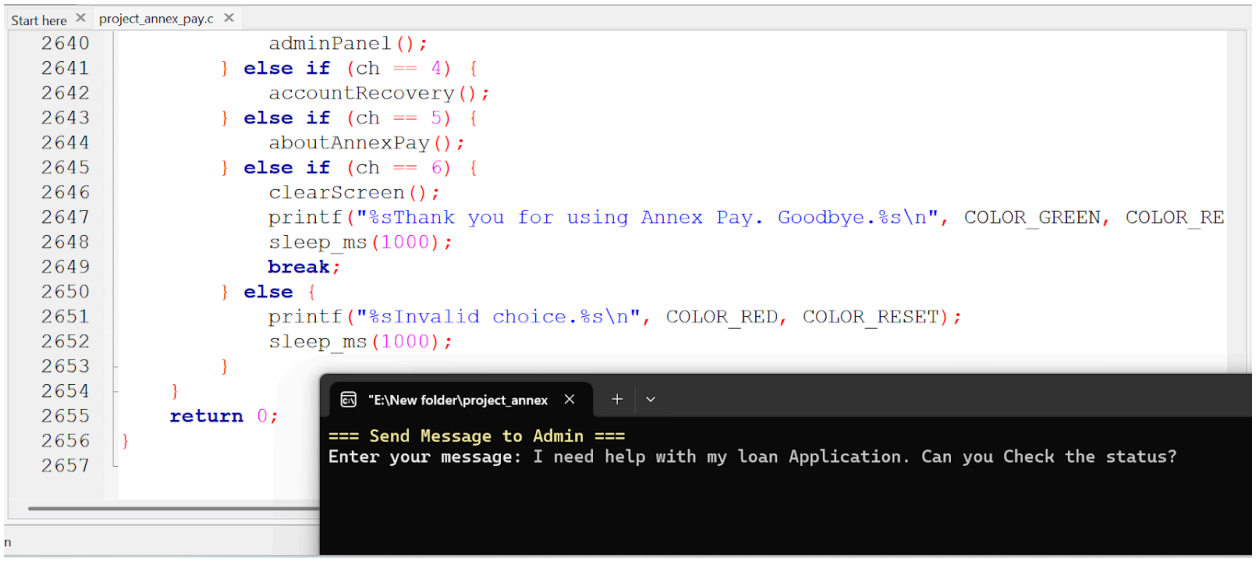
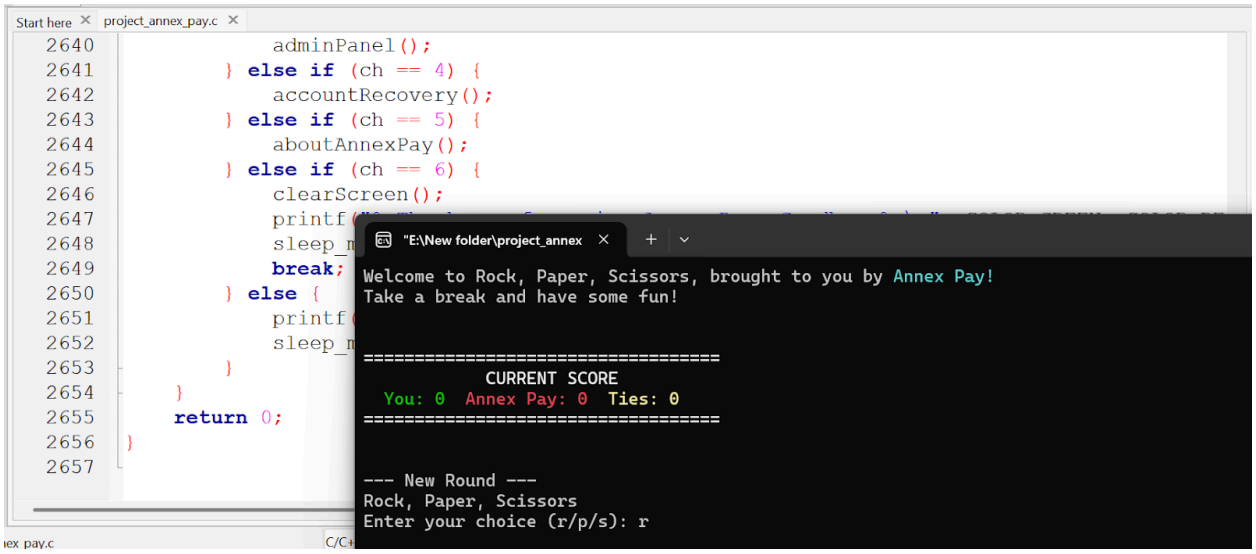


Figure 25: Messaging System



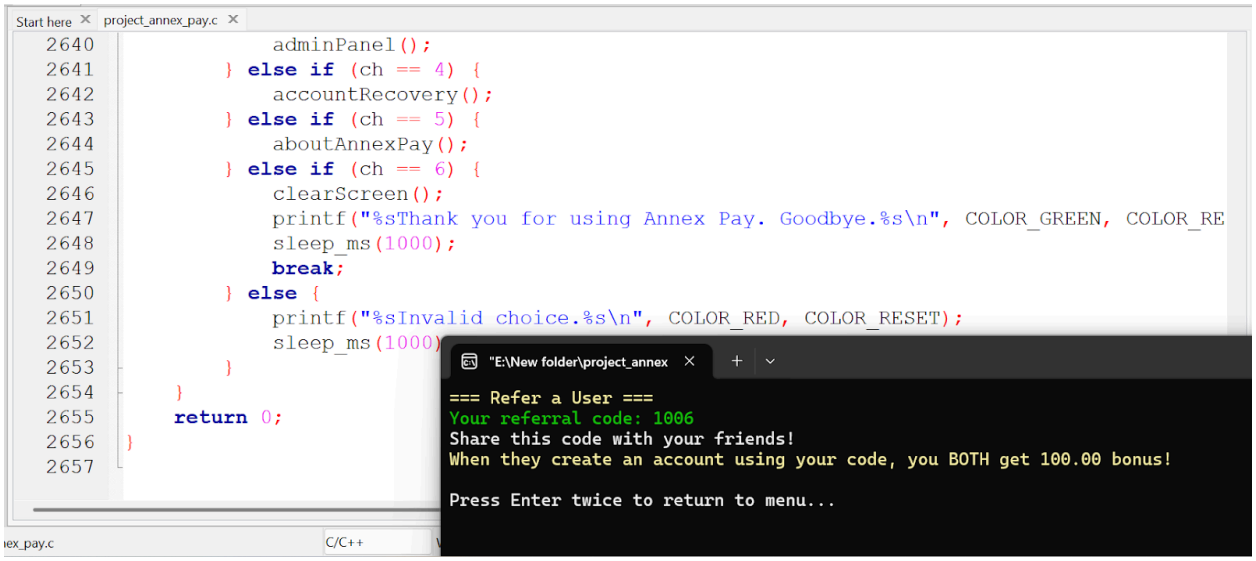
Gaming Module Screenshots:

Figure 26: Integrated Game Interface



Additional Features Screenshots:

Figure 27: Referral Program



Admin Panel Screenshots:

Figure 28: Admin Login

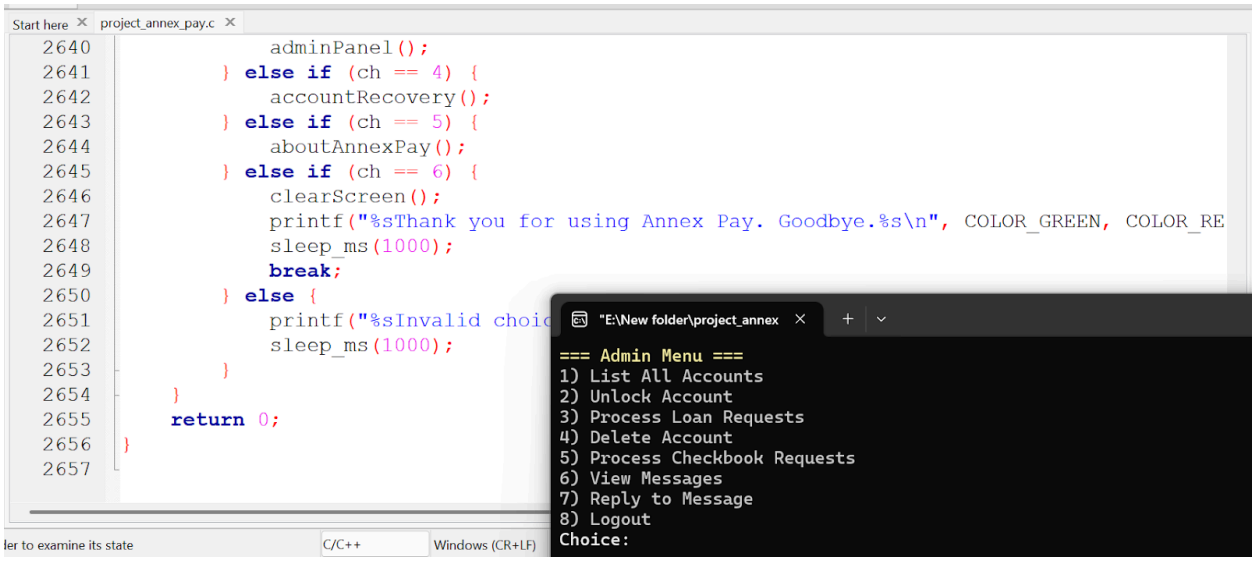


Figure 29: Admin Account Management

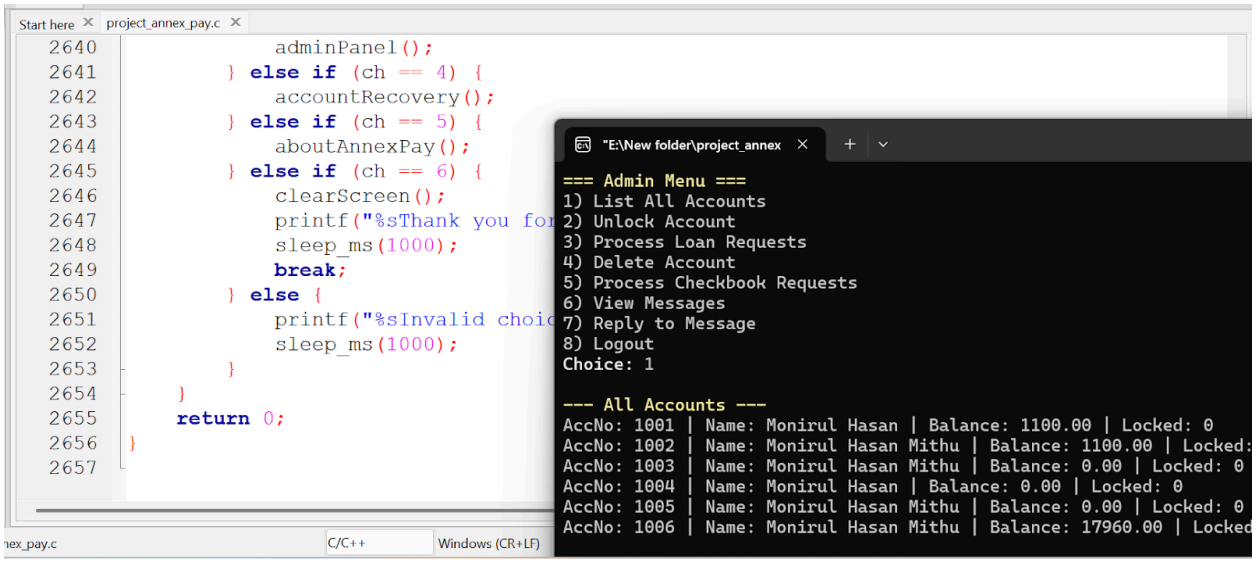
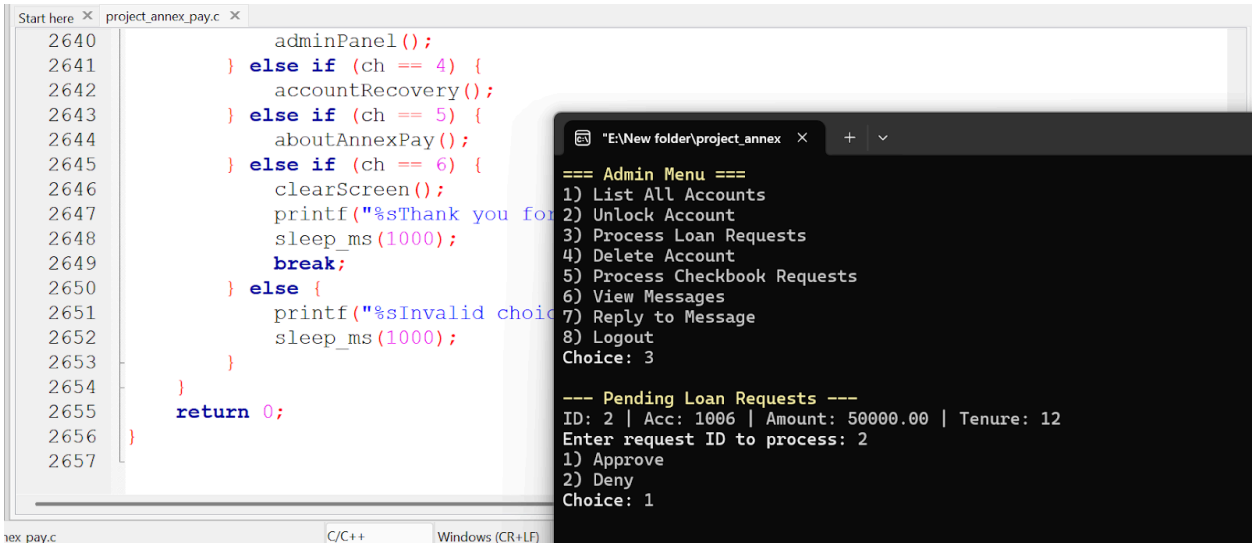


Figure 30: Loan Approval Process



5.4 System Operation Procedures

Gaming Module Procedures:

Procedure for Accessing Game:

1. Login to banking system using account credentials
2. From user dashboard, select option 19) Play Game
3. System displays game welcome screen with branding
4. Follow on-screen instructions for gameplay

Procedure for Gameplay:

1. View current score display (initialized to 0-0-0)
2. Enter choice: R (Rock), P (Paper), or S (Scissors)
3. Watch animation as computer makes choice
4. View results with color-coded outcome
5. Choose to play another round or return to banking

Procedure for Returning to Banking:

1. After final game round, select "N" or "No" when prompted to play again
2. System automatically returns to user dashboard
3. Banking session context is fully restored
4. Continue with banking operations from option menu

5.5 Installation Guide

bash

```
# Windows
gcc annex_pay.c -o annex_pay.exe

# Linux/macOS
```

```
gcc annex_pay.c -o annex_pay
```

Execution:

```
bash
```

```
# Windows
annex_pay.exe

# Linux/macOS
```

```
./annex_pay
```

First-Time Setup:

1. Compile source code
2. Execute binary
3. System creates data directory structure
4. Create initial accounts
5. Access admin features with default credentials

Default Credentials:

- Admin Password: bubt1234
- Account Numbers: Auto-generated from 1001

Chapter 6: Conclusion

6.1 Conclusion

ANNEX PAY has successfully achieved its objectives by creating an innovative banking system that integrates entertainment features without compromising core functionality. The project demonstrates that utility applications can be enhanced with engaging elements to improve user experience and session enjoyment.

The integrated Rock, Paper, Scissors game provides a refreshing break option during banking sessions, addressing user fatigue while maintaining session continuity. This approach represents a novel application of gaming principles in utility software, creating a more enjoyable banking experience.

Technical achievements include seamless module integration, consistent user experience across banking and gaming modes, robust session management, and cross-platform compatibility. The system successfully balances security requirements with accessibility needs, proving that entertainment features can be integrated into secure systems without compromising protection measures.

From an educational perspective, ANNEX PAY demonstrates advanced software engineering concepts including modular design, system

integration, user experience optimization, and practical application of gaming principles in non-gaming contexts.

6.2 Limitations

Security Considerations:

- Gaming module operates within authenticated sessions only
- No persistent storage of game statistics across sessions
- Limited game complexity due to console interface constraints

User Experience Constraints:

- Basic game graphics limited by console capabilities
- No sound effects or advanced animations
- Limited game variations available

Technical Limitations:

- Game state not preserved between banking sessions
- No multiplayer or competitive features
- Basic scoring system without achievement tracking

Integration Challenges:

- Separate modules with minimal data sharing
- Basic transition animations
- Limited customization options for gaming experience

6.3 Future Works

Enhanced Gaming Features:

- Multiple game options (Tic-Tac-Toe, Number Guessing, Memory Games)
- Achievement system linked to banking activities
- Tournament mode with leaderboards
- Sound effects and enhanced animations

Integration Improvements:

- Persistent game statistics across sessions
- Banking rewards for gaming achievements
- Social features (challenge friends, share scores)
- Game customization options

Technical Enhancements:

- Graphical user interface for both banking and gaming
- Network capabilities for multiplayer gaming
- Database integration for game statistics
- Mobile app version with touch controls

Educational Extensions:

- Financial literacy mini-games
- Budgeting and saving challenges
- Investment simulation games
- Financial quiz competitions

Enterprise Applications:

- Corporate banking with team challenges
- Educational banking simulations
- Financial training through gamification
- Customer engagement analytics

References

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4. Rogers, S. (2014). *Level Up! The Guide to Great Video Game Design*. Wiley.
5. "Game Development Principles in Utility Applications." (2022). *Journal of Interactive Systems*.
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Stevens, W. R. (1992). *Advanced Programming in the UNIX Environment*. Addison-Wesley.

Appendix A: Source Code

Source Code Overview:

Complete source code in `annex_pay.c` (~2,500 lines) featuring:

- Integrated banking and gaming modules
- Comprehensive documentation
- Consistent coding standards
- Cross-platform compatibility

Compilation Instructions:

```
bash
```

```
# Recommended compilation
gcc -Wall -Wextra -std=c99 -O2 annex_pay.c -o annex_pay
```

Execution:

```
bash
```

```
./annex_pay    # Linux/macOS
annex_pay.exe # Windows
```

Test Cases for Gaming Module:

1. Basic Gameplay Test:
    - Login to banking system
    - Select option 19 (Play Game)
    - Play multiple rounds

    - Verify score tracking
    - Return to banking menu
2. Session Continuity Test:
    - Perform banking transactions
    - Play game
    - Return to banking
    - Verify session context preserved
3. Input Validation Test:
    - Test valid game inputs (R, P, S)
    - Test invalid inputs (other characters)
    - Verify error handling and re-prompting
4. Cross-Platform Test:
    - Compile and run on Windows
    - Compile and run on Linux
    - Verify consistent gaming experience

Key Gaming Features Demonstrated:

- Real-time game processing
- Visual animations
- Score tracking
- Input validation
- Seamless banking integration
- Cross-platform compatibility
- User-friendly interface

File Structure After Gaming Sessions:

```
text
```

```
AnnexPay/
├── annex_pay (executable)
├── AnnexPay/ (Data Directory)
│   ├── accounts.dat
│   ├── transaction files
```

```
|   └── (Gaming statistics maintained in memory)
```

```
└── (No separate game files - integrated storage)
```

END OF PROJECT REPORT