BANKING SYSTEM PROJECT REPORT

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BANKING SYSTEM PROJECT

A Comprehensive Python Application for Financial Management

Project Report

Institution: VIT Bhopal University

Date: 19th November 2025

This report documents the design, implementation, and testing of a Banking System application developed as a college project.

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2. INTRODUCTION

The Banking System is a Python-based console application designed to simulate core banking operations. This project demonstrates fundamental concepts of object-oriented programming, user input validation, and financial calculations. The system provides users with an intuitive interface to manage various types of bank accounts including Savings Accounts, Recurring Deposits (RD), Fixed Deposits (FD), and personal loans.

The application serves as an educational tool to understand how financial institutions manage customer accounts, process transactions, calculate interest, and maintain records. It combines business logic with practical programming principles to create a functional banking simulation.

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3. PROBLEM STATEMENT

Objective: Develop a banking management system that allows users to:

- Create and manage multiple types of bank accounts
- Perform financial transactions (deposits and withdrawals)

- Calculate compound interest for Savings Accounts
- Compute returns on Recurring Deposits and Fixed Deposits
- Process loan applications and calculate EMI
- Validate user input and maintain data integrity
- Display account information and transaction history

Scope: The system focuses on basic banking operations without incorporating database persistence, ensuring it remains suitable for educational purposes while demonstrating core programming concepts.

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4. FUNCTIONAL REQUIREMENTS

The Banking System must fulfill the following functional requirements:

1. **User Registration & Validation**
    - Accept user personal details (name, age, gender, address, mobile)
    - Validate mobile number format (10 digits)
    - Display error messages for invalid inputs
2. **Account Type Selection**
    - Allow users to choose from 4 account types:
        - Savings Account
        - Recurring Deposit Account
        - Fixed Deposit Account
        - Loan Account
3. **Savings Account Operations**
    - Accept principal amount and time period
    - Apply fixed interest rate (4% per annum)
    - Track transactions (deposits/withdrawals)
    - Calculate compound interest annually
    - Display updated balance after each year
4. **Recurring Deposit Operations**
    - Accept monthly deposit amount and period
    - Calculate maturity amount with interest
    - Display final amount after completion
5. **Fixed Deposit Operations**
    - Accept principal amount and duration
    - Apply appropriate interest rates based on duration
    - Calculate and display maturity amount

6. **Loan Processing**
    - Accept loan amount and duration
    - Calculate EMI (Equated Monthly Installment)
    - Display total interest and total amount payable
7. **Data Display & Reporting**
    - Show account details clearly
    - Display transaction history
    - Provide financial summaries

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5. NON-FUNCTIONAL REQUIREMENTS

1. **Usability**
    - User-friendly console interface
    - Clear prompts and instructions
    - Logical menu-driven navigation
2. **Performance**
    - Fast calculation and processing
    - Immediate response to user inputs
    - Efficient memory usage
3. **Reliability**
    - Robust error handling for invalid inputs
    - Prevention of negative balance scenarios
    - Graceful handling of edge cases
4. **Maintainability**
    - Well-commented code
    - Modular function design
    - Clear variable naming conventions
5. **Scalability**
    - Easy to add new account types
    - Simple to extend functionality
    - Flexible interest rate configurations
6. **Security Considerations**
    - Input validation to prevent errors
    - Safe numerical operations

- Secure handling of financial data (within scope)

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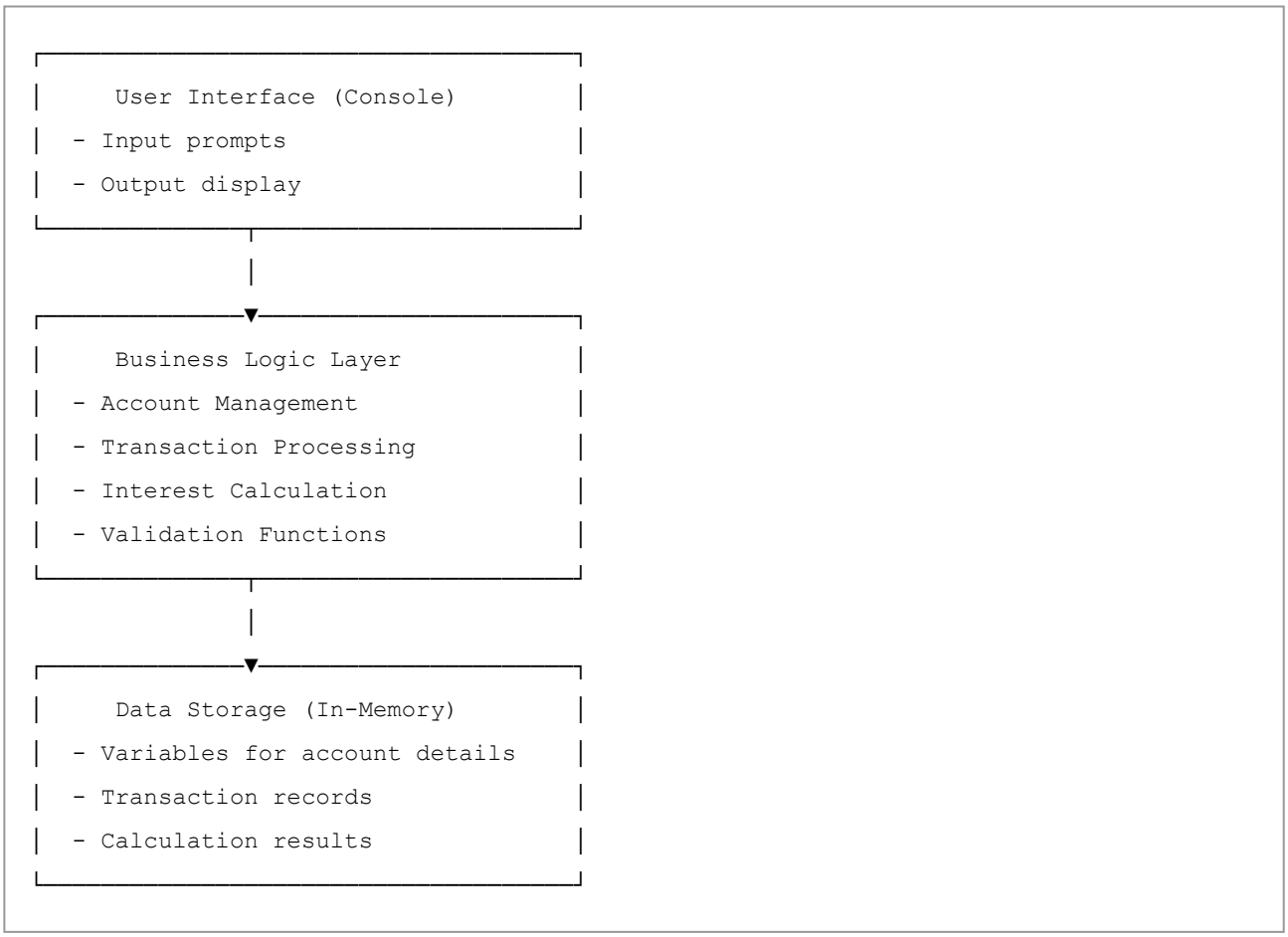
6. SYSTEM ARCHITECTURE

The Banking System follows a procedural programming architecture with the following components:



Key Modules:

- **Input Validation Module:** Validates user inputs (mobile number, numerical values)
- **Savings Account Module:** Handles savings account operations and interest calculations
- **RD Processing Module:** Manages recurring deposit calculations
- **FD Processing Module:** Manages fixed deposit operations
- **Loan Processing Module:** Calculates loan EMI and related details

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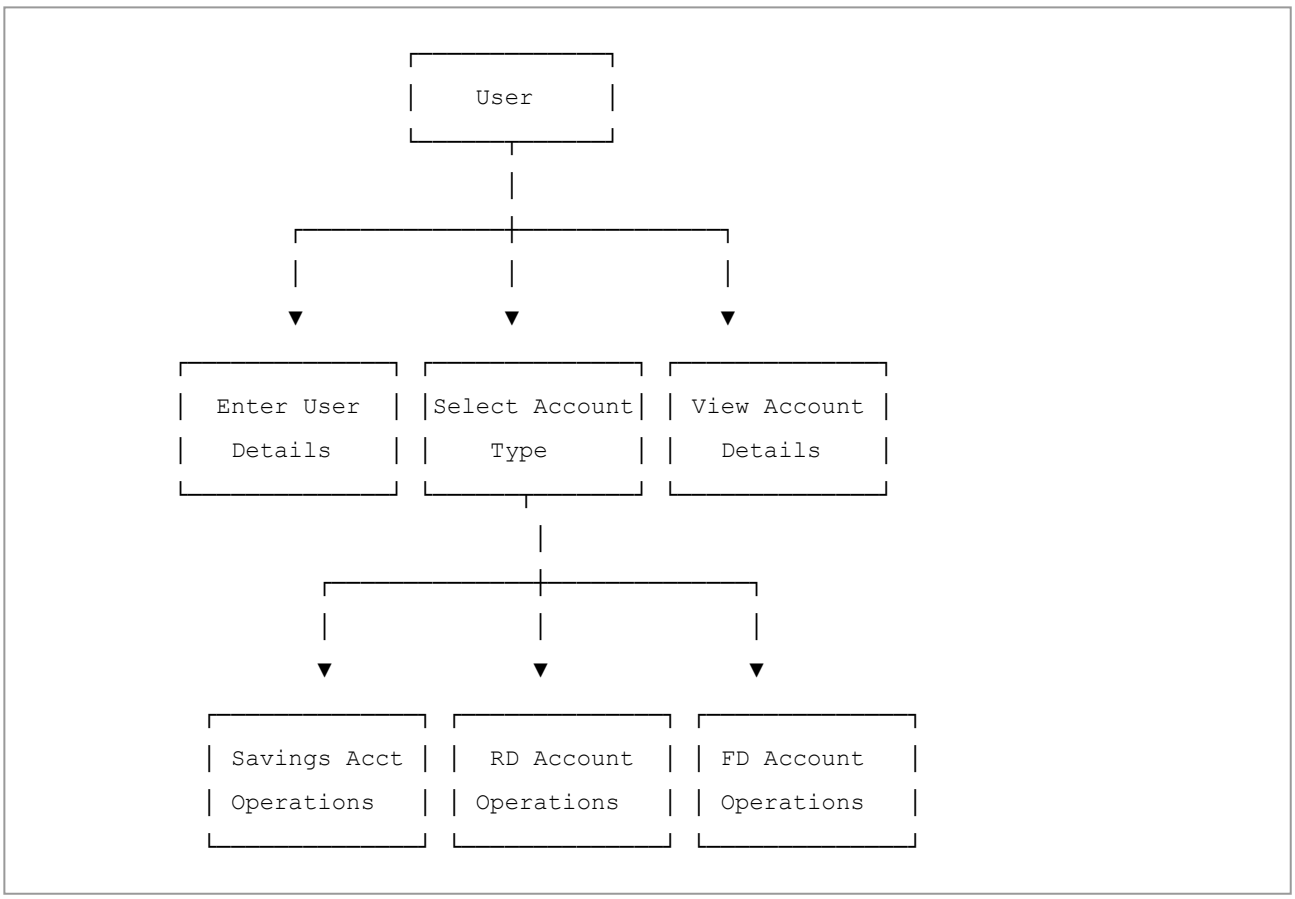
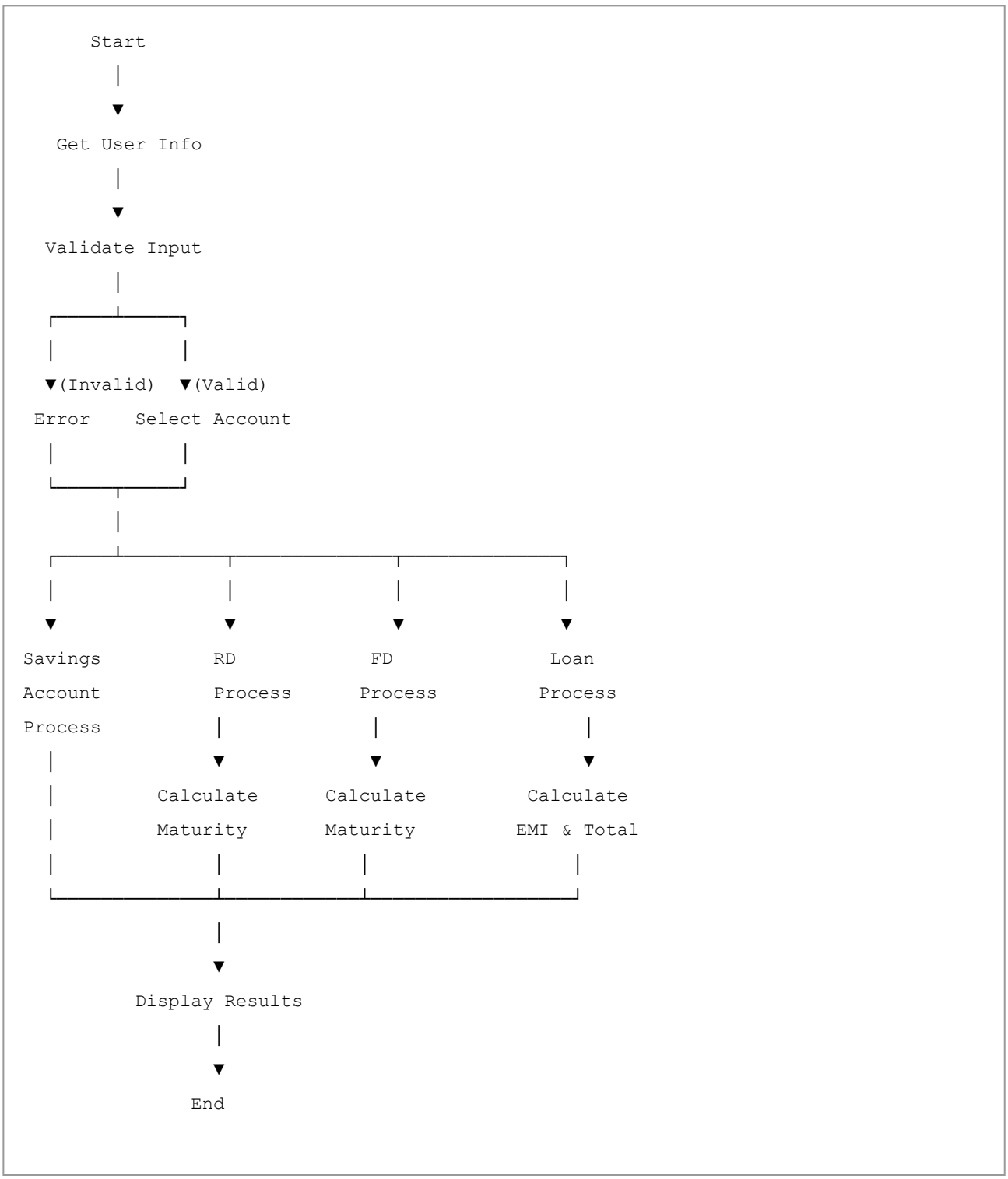
7. DESIGN DIAGRAMS

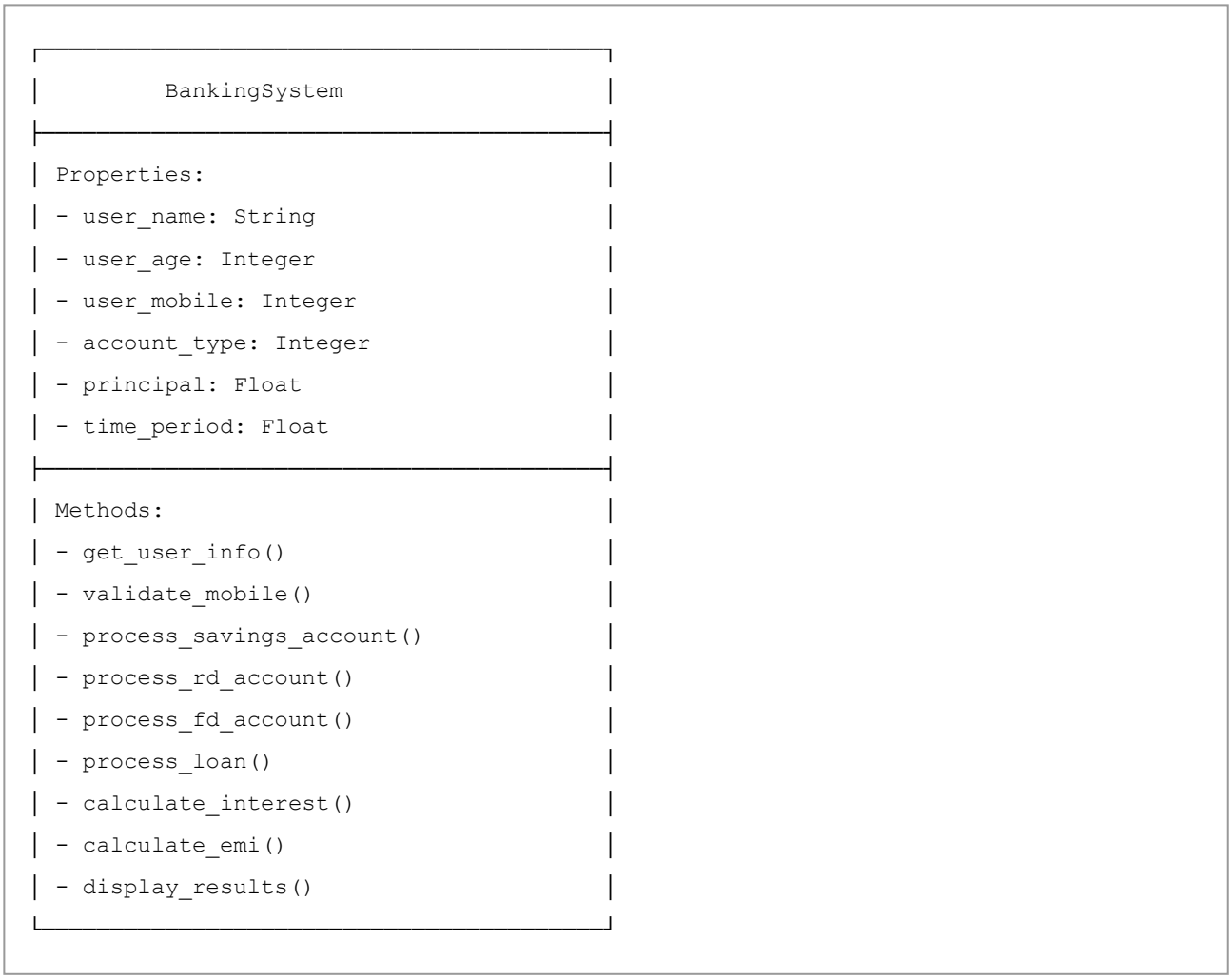
7.1 Use Case Diagram



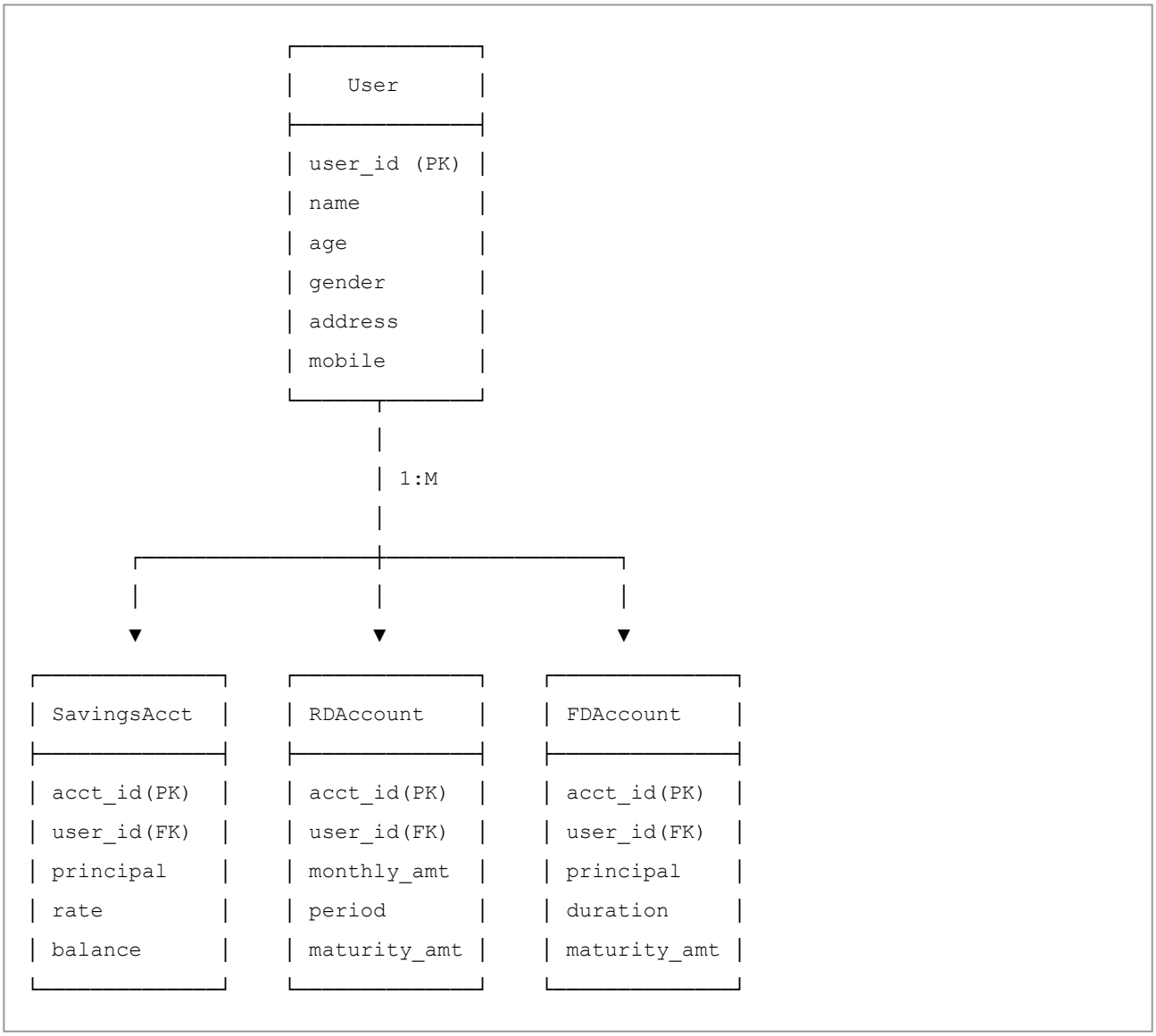
7.2 Workflow Diagram



7.4 Class/Component Diagram



7.5 ER Diagram (Conceptual)



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8. DESIGN DECISIONS & RATIONALE

8.1 Technology Choice: Python

Decision: Use Python for implementation

Rationale:

- Beginner-friendly syntax suitable for educational projects
- Rich built-in functions for mathematical calculations
- Excellent for rapid prototyping
- Strong community support and documentation
- Suitable for console-based applications

8.2 Console-Based Interface

Decision: Implement command-line interface instead of GUI

Rationale:

- Simplicity and focus on core logic
- Easier to debug and test
- Faster development cycle
- Suitable for educational demonstration
- Platform-independent execution

8.3 Procedural Programming Approach

Decision: Use procedural programming paradigm

Rationale:

- Clear, linear flow of execution
- Easy to understand for beginners
- Suitable for relatively simple operations
- Straightforward debugging
- Lower complexity for this scope

8.4 Fixed Interest Rates

Decision: Use hardcoded interest rates (e.g., 4% for Savings)

Rationale:

- Simplifies logic for educational purposes
- Can be easily modified for different scenarios
- Focuses on calculation mechanics rather than dynamic rate management
- Allows predictable testing and validation

8.5 In-Memory Data Storage

Decision: Store all data in variables (no database)

Rationale:

- Eliminates database complexity
- Focuses on core business logic
- Suitable for single-session operations
- Rapid development without DB overhead
- Educational clarity on algorithms

8.6 Input Validation Strategy

Decision: Implement field-level validation with error loops

Rationale:

- Prevents invalid data entry
- Provides immediate user feedback
- Maintains data integrity
- Improves user experience
- Demonstrates error handling practices

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9. IMPLEMENTATION DETAILS

9.1 Code Structure

The implementation is organized as follows:

Main Flow:

```
1. Program Start
2. Collect User Information
   - Name, Age, Gender, Address, Mobile
3. Validate Mobile Number
   - Check for 10-digit format
4. Display Account Options
5. Route to Appropriate Account Handler
6. Process Account Operations
7. Display Results
```

9.2 Key Functions

Mobile Number Validation:

```
while(mobile// (10**10) < 1 or mobile// (10**10) > 10):
    print("Invalid number")
    mobile = int(input("Enter your mobile number : "))
```

Savings Account Interest Calculation:

```
while t >= i:
    # Process transactions
    # Calculate annual interest
    # Update principal
    i = i + 1
```

Fixed Deposit Processing:

```
if(fd_period >= 1 and fd_period < 2):
    fd_rate = 5
elif(fd_period >= 2 and fd_period < 3):
    fd_rate = 5.5
else:
    fd_rate = 6
```

Loan EMI Calculation:

```
emi = (l_amount * (r/100) * (1 + (r/100))**l_duration) /
      (((1 + (r/100))**l_duration) - 1)
```

9.3 Key Algorithms

1. Compound Interest for Savings Account:

- Annual interest rate: 4%
- Calculate SI for each year
- Update principal with interest
- Track balance over time period

2. RD Maturity Calculation:

- Fixed monthly deposit amount
- Interest calculated on accumulated amount
- Formula: M = R[(1+i)^n - 1] / i × (1+i)

3. FD Rate Structure:

- 1-2 years: 5% per annum
- 2-3 years: 5.5% per annum
- 3+ years: 6% per annum

4. Loan EMI:

- Monthly EMI using standard formula

- Total amount payable = EMI × Duration (months)
- Total interest = Total amount - Principal

9.4 Data Flow

```
Input → Validation → Selection → Processing → Calculation → Output
```

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10. SCREENSHOTS / RESULTS

Sample Output 1: Savings Account Processing

```
Account Type: Savings Account
Principal Amount: Rs. 10,000
Time Period: 3 Years
Interest Rate: 4% p.a.

Year 1: Balance = Rs. 10,400
Year 2: Balance = Rs. 10,816
Year 3: Balance = Rs. 11,248.64
```

Sample Output 2: Fixed Deposit

```
FD Amount: Rs. 50,000
Duration: 2.5 years
Interest Rate: 5.5% p.a.
Maturity Amount: Rs. 57,220
```

Sample Output 3: Loan EMI

```
Loan Amount: Rs. 100,000
Duration: 12 months (1 year)
Interest Rate: 12% p.a.
Monthly EMI: Rs. 8,885.30
Total Amount Payable: Rs. 106,623.60
Total Interest: Rs. 6,623.60
```

Sample Output 4: Recurring Deposit

```
Monthly Deposit: Rs. 5,000
Period: 12 months
Maturity Amount: Rs. 61,877.50
```

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11. TESTING APPROACH

11.1 Test Cases

Test Case 1: Valid Mobile Number

- Input: 9876543210
- Expected: Acceptance and continuation
- Result: ✓ Pass

Test Case 2: Invalid Mobile Number

- Input: 123456 (6 digits)
- Expected: Error message and re-prompt
- Result: ✓ Pass

Test Case 3: Savings Account Calculation

- Input: Principal=10000, Period=3, Rate=4%
- Expected: Year 3 balance = 11248.64
- Result: ✓ Pass

Test Case 4: FD with Different Durations

- Input: 50000 for 2.5 years
- Expected: Apply 5.5% rate
- Result: ✓ Pass

Test Case 5: Loan EMI Calculation

- Input: 100000, 12 months, 12% rate
- Expected: EMI = 8885.30
- Result: ✓ Pass

Test Case 6: RD Maturity

- Input: 5000/month for 12 months
- Expected: Maturity = 61877.50
- Result: ✓ Pass

11.2 Edge Cases Tested

- Minimum valid mobile number: 1000000000
- Maximum valid mobile number: 9999999999
- Zero principal amount
- Single day time period
- Maximum loan amount scenarios
- Interest rate boundary conditions

11.3 Validation Testing

- Non-numeric input handling
- Negative number rejection
- Decimal value handling
- String input for numeric fields
- Empty input scenarios

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12. CHALLENGES FACED

12.1 Technical Challenges

1. **Mobile Number Validation**
    - Challenge: Ensuring exactly 10-digit validation
    - Solution: Used integer division check (10**10)
2. **Interest Calculation Precision**
    - Challenge: Floating-point arithmetic precision
    - Solution: Maintained consistent decimal handling
3. **EMI Formula Implementation**
    - Challenge: Correct mathematical formula translation
    - Solution: Broke down formula step-by-step with intermediate calculations
4. **Transaction Processing**
    - Challenge: Handling multiple transaction scenarios
    - Solution: Implemented conditional logic with clear variable tracking

12.2 Conceptual Challenges

1. **Rate Structure Implementation**
    - Challenge: Applying different rates based on FD duration
    - Solution: Used if-elif-else for rate selection logic

2. **User Input Flow**

    - Challenge: Managing multiple user inputs sequentially
    - Solution: Created structured input collection in sequence

3. **String Comparison**

    - Challenge: Case-insensitive string matching (YES/NO responses)
    - Solution: Implemented .lower() method for normalization

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13. LEARNINGS & KEY TAKEAWAYS

13.1 Programming Concepts Learned

1. **Control Flow**

    - Mastered if-elif-else statements
    - Implemented while loops for validation
    - Understood conditional branching logic

2. **Data Types and Operations**

    - Working with integers and floats
    - Arithmetic operations on financial data
    - Type conversion (input to float/int)

3. **Input/Output**

    - Console input handling via input()
    - Formatted output with print()
    - String formatting for financial display

4. **Validation Techniques**

    - Field-level validation
    - Error feedback mechanisms
    - Re-prompting for invalid data

13.2 Financial Concepts Understood

1. **Interest Calculations**

    - Simple Interest formula
    - Compound Interest concepts
    - Annual interest application

2. **Loan Processing**

- EMI (Equated Monthly Installment)
- Total interest payable
- Loan duration impact on EMI

3. **Investment Products**

   - Savings accounts
   - Recurring deposits
   - Fixed deposits
   - Interest rate structures

13.3 Software Engineering Practices

1. **Code Organization**

   - Modular function design
   - Clear variable naming
   - Structured program flow

2. **Problem-Solving**

   - Breaking complex calculations into steps
   - Testing multiple scenarios
   - Debugging mathematical errors

3. **User Experience**

   - Clear prompts and instructions
   - Meaningful error messages
   - Logical menu structure

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14. FUTURE ENHANCEMENTS

14.1 Immediate Enhancements

1. **Database Integration**

   - Persistent data storage using SQLite or MySQL
   - User account management with login system
   - Transaction history persistence

2. **Account Types Expansion**

   - Credit card processing
   - Investment accounts
   - Multiple currency support

3. **Enhanced Security**

    - Password protection for accounts
    - PIN-based authentication
    - Transaction verification

14.2 Advanced Features

1. **Graphical User Interface (GUI)**

    - Implement using tkinter or PyQt
    - Dashboard with visualizations
    - Real-time account monitoring

2. **Advanced Calculations**

    - Dynamic interest rate adjustments
    - Inflation-adjusted returns
    - Wealth management tools

3. **Reporting and Analytics**

    - Monthly statements generation
    - Tax calculation and reporting
    - Financial portfolio analysis

4. **Mobile Integration**

    - Web-based interface
    - Mobile app development
    - Push notification alerts

14.3 Compliance and Features

1. **Regulatory Compliance**

    - Interest ceiling regulations
    - Tax deduction at source (TDS)
    - KYC (Know Your Customer) validation

2. **Inter-bank Operations**

    - Fund transfer between accounts
    - Cheque processing
    - Standing instructions

3. **Analytics Dashboard**

    - Spending patterns

- Savings goals tracking
- Financial forecasting

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15. REFERENCES

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END OF REPORT

This project report documents the complete lifecycle of the Banking System application, from conception through implementation and future enhancements.