

# OBJECT ORIENTED ANALYSIS & DESIGN WITH JAVA

## Module Integration & Testing Report

The PrimeBank Application project successfully delivers a functional, object-oriented application for basic banking operations, built using JavaFX for the graphical user interface and SQLite for data persistence. This system models core components of a commercial bank, including customer management, various account types, and transaction processing.

### a) Sign Up

*Navigate to the sign up and enter user details:*

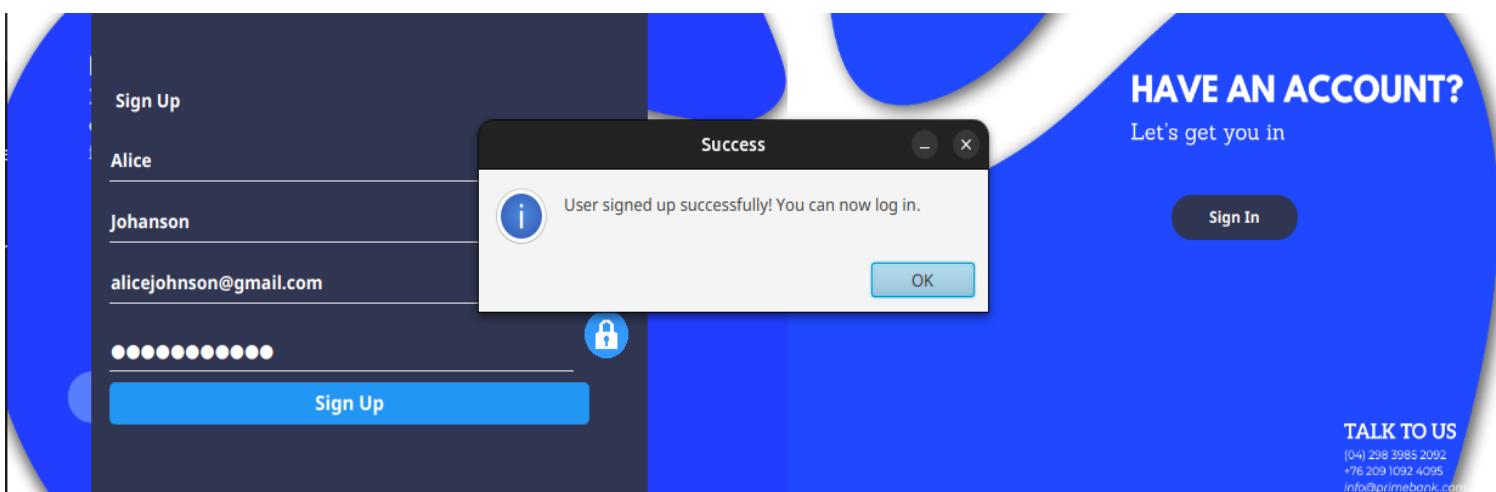
*first name: Alice*

*surname: Johnson*

*email: alicejohnson@gmail.com*

*password: alicepwd123*

*click sign up*



Tables Database Metadata																													
Table: users		Page: 0	Jump	<< < 1-1 > >> Refresh																									
<table border="1"><thead><tr><th>id</th><th>first_na...</th><th>surname</th><th>email</th><th>passw...</th></tr></thead><tbody><tr><td>1</td><td>johanson</td><td>Sebudi</td><td>johanso...</td><td>b6bc315...</td></tr><tr><td>2</td><td>Karabo</td><td>Johannes</td><td>karanojo...</td><td>0bc7ada...</td></tr><tr><td>3</td><td>Lolly</td><td>Rasina</td><td>lollyrasin...</td><td>dfdad06...</td></tr><tr><td>4</td><td>Alice</td><td>Johanson</td><td>alicejohn...</td><td>b18001a...</td></tr></tbody></table>					id	first_na...	surname	email	passw...	1	johanson	Sebudi	johanso...	b6bc315...	2	Karabo	Johannes	karanojo...	0bc7ada...	3	Lolly	Rasina	lollyrasin...	dfdad06...	4	Alice	Johanson	alicejohn...	b18001a...
id	first_na...	surname	email	passw...																									
1	johanson	Sebudi	johanso...	b6bc315...																									
2	Karabo	Johannes	karanojo...	0bc7ada...																									
3	Lolly	Rasina	lollyrasin...	dfdad06...																									
4	Alice	Johanson	alicejohn...	b18001a...																									

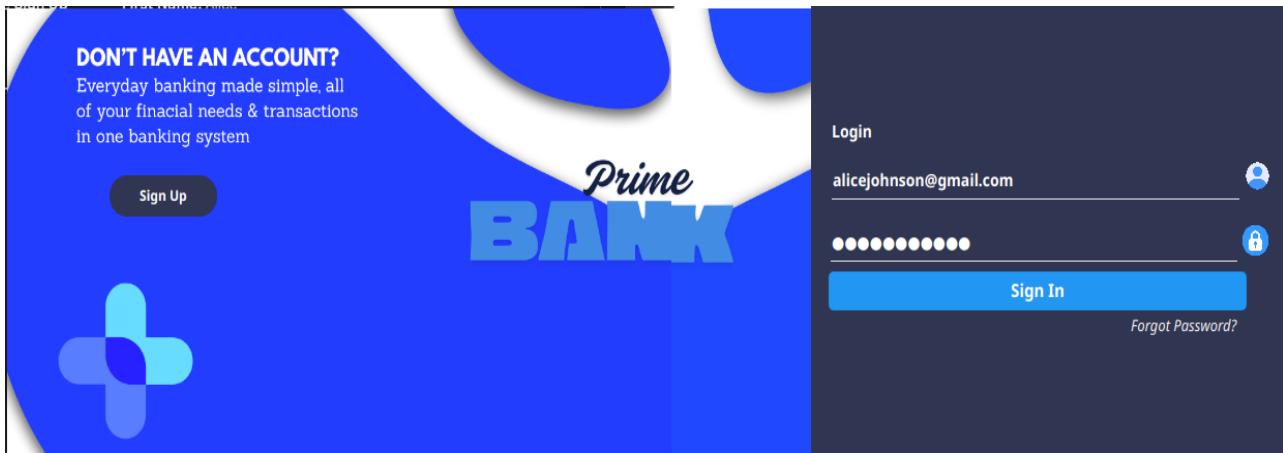
## b) Sign In & Profile setup

*Navigate to the sign in screen and login.*

*email: alicejohnson@gmail.com*

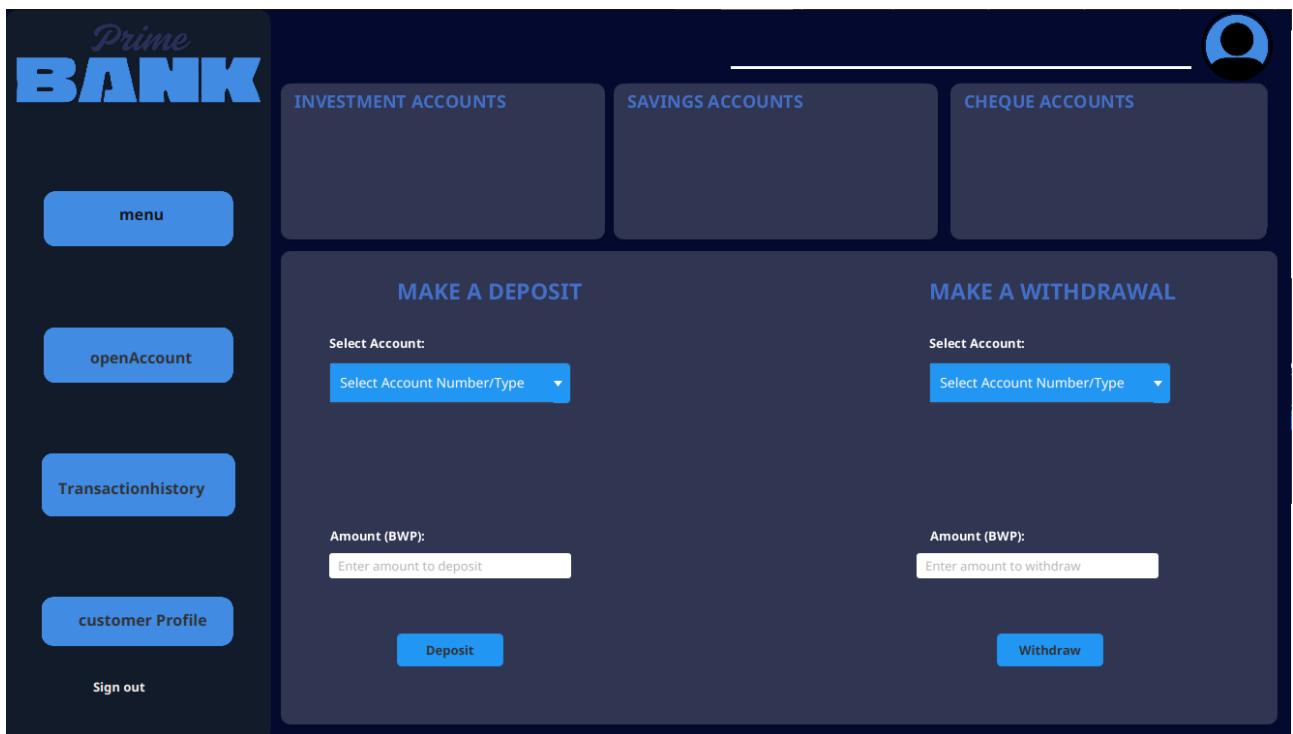
*password: alicepwd123*

*click login*



*click login*

*Dashboard is then loaded*



## c)Open Accounts

*Navigate to openAccount, select individual customer & fill out the form but your full names and email is already auto-filled.*

menu

openAccount

Transactionhistory

customer Profile

Sign out

INVESTMENT ACCOUNTS

SAVINGS ACCOUNTS

CHEQUE ACCOUNTS

Select Account Type: Choose Type (Savings, Cheque, Investment)

Initial Deposit Amount (BWP): Investment requires min BWP500.00

Full Name: Alice Johanson

Date of Birth:

Gender:

Contact Number:

Email Address: alicejohnson@gmail.com

Residential Address:

Next of Kin:

Occupation:

Customer Type:  Individual  Company

National ID: Enter National ID

Open Account

Input the remaining details

menu

openAccount

Transactionhistory

customer Profile

Sign out

INVESTMENT ACCOUNTS

SAVINGS ACCOUNTS

CHEQUE ACCOUNTS

Select Account Type: Savings Account

Initial Deposit Amount (BWP): Investment requires min BWP500.00

Full Name: Alice Johanson

Date of Birth: 1990-05-15

Gender: Female

Contact Number: 71234567

Email Address: alicejohnson@gmail.com

Residential Address: Plot 123, Gaborone

Next of Kin: Bob Johanson

Occupation: software engineer

Customer Type:  Individual  Company

National ID: 1505901234A

Open Account

Account opened successfully! Account Number: 123456789, Current Balance: BWP1000.00

alet msg: Saving account opened successfully.

Account details are immediately displayed at the saving account card and the customer profile.

The screenshot shows the Prime BANK mobile application interface. On the left, there's a vertical sidebar with buttons for "menu", "openAccount", "Transactionhistory", "customer Profile", and "Sign out". The main content area has a header "Welcome, Alice Johanson!" with a user icon. It displays three sections: "INVESTMENT ACCOUNTS" (empty), "SAVINGS ACCOUNTS" (listing Acct No: E3E722AB, Balance: BWP1000.00, Rate: 2.5%, Est. Interest: BWP25.00, Applied Bal: BWP1025.00), and "CHEQUE ACCOUNTS" (empty). Below these is a "Customer Profile" section with fields for Full Name (Alice Johanson), Email Address (alicejohnson@gmail.com), Date of Birth (1990-05-15), Gender (Female), National ID (1505901234A), Contact Number (71234567), Residential Address (Plot 123, Gaborone), Next of Kin (Bob Johnson), and Occupation (software engineer). A blue "Update Profile" button is at the bottom right.

Table: customers											
customer_id	user_id	national_id	full_name	date_of_birth	gender	contact_number	email_address	residential_address	next_of_kin	occupation	
Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter
1	1	1 919882288	johanson Sebudi	30 November 2004	male	77923803	johansonsebudi@gmail.com	829802	Moitse	engineer	
2	2	3 e33545tg234	Lolly Rasina	30 JULY 2003	MALE	+267 79984092	lollyrasina@gmail.com	Plot number 234	Katlego	cashier	
3	3	2 N/A	Karabo Johannes	5 JUNE 1987	Female	763839289	karanojohannes@gmail.com	23232	Prince	CEO	
4	4	4 150590123...	Alice Johanson	1990-05-15	Female	71234567	alicejohnson@gmail.com	Plot 123, Gaborone	Bob ...	software ...	

Table: accounts							
account_number	customer_id	account_type	balance	interest_rate	overdraft_limit	cheque_name	company_address
Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter
1 E3E722AB	4	SavingsAccount	1000.0	0.025	NULL	NULL	NULL



menu

openAccount

Transactionhistory

customer Profile

Sign out

Welcome, Alice Johanson!



#### INVESTMENT ACCOUNTS

#### SAVINGS ACCOUNTS

#### CHEQUE ACCOUNTS

- Acct No: E3E722AB
- Balance: BWP1000.00
- Rate: 2.5%
- Est. Interest: BWP25.00
- Applied Bal: BWP1025.00

#### OPEN NEW ACCOUNT

Select Account Type:

Investment Account

Initial Deposit Amount (BWP):

200

Full Name:

Alice Johanson

Date of Birth:

Gender:

Contact Number:

Email Address:

alicejohnson@gmail.com

Residential Address:

Next of Kin:

Occupation:

Customer Type:

Individual  Company

Investment requires minimum BWP 500.00

National ID:

Enter National ID

Open Account

alert msg; investment requires minimum initial deposit of BWP 500



menu

openAccount

Transactionhistory

customer Profile

Sign out

Welcome, Alice Johanson!



#### INVESTMENT ACCOUNTS

#### SAVINGS ACCOUNTS

#### CHEQUE ACCOUNTS

- Acct No: 141B2EA1
- Balance: BWP550.00
- Rate: 5.0%
- Est. Interest: BWP27.50
- Applied Bal: BWP577.50

- Acct No: E3E722AB
- Balance: BWP1000.00
- Rate: 2.5%
- Est. Interest: BWP25.00
- Applied Bal: BWP1025.00

- Acct No: 79B21558
- Balance: BWP200.00
- Overdraft Limit: BWP5000.00
- Name on Cheque: Alice Johanson

#### OPEN NEW ACCOUNT

Select Account Type:

Cheque Account

Investment requires min BWP500.00

Full Name:

Alice Johanson

Date of Birth:

Gender:

Contact Number:

Email Address:

alicejohnson@gmail.com

Residential Address:

Next of Kin:

Occupation:

Customer Type:

Individual  Company

ChequeAccount opened successfully! Account Number: PRB21558 Current Balance: BWP200.00

Enter National ID

Open Account

all accounts opened.....

## d) Deposit and withdrawal

deposit 450 on investment account

The screenshot shows the Prime BANK mobile application interface. On the left sidebar, there are buttons for 'menu', 'openAccount', 'Transactionhistory', 'customer Profile', and 'Sign out'. The main content area has a header 'Welcome, Alice Johanson!' with a user icon. It displays three sections: 'INVESTMENT ACCOUNTS' (Acct No: 141B2EA1, Balance: BWP1000.00, Rate: 5.0%, Est. Interest: BWP50.00, Applied Bal: BWP1050.00), 'SAVINGS ACCOUNTS' (Acct No: E3E722AB, Balance: BWP1000.00, Rate: 2.5%, Est. Interest: BWP25.00, Applied Bal: BWP1025.00), and 'CHEQUE ACCOUNTS' (Acct No: 79B21558, Balance: BWP200.00, Overdraft Limit: BWP5000.00, Name on Cheque: Alice Johanson). Below these are two forms: 'MAKE A DEPOSIT' and 'MAKE A WITHDRAWAL'. The 'DEPOSIT' form has a dropdown 'Select Account: Investment - 141B2EA1', an input field 'Amount (BWP): Enter amount to deposit', and a blue 'Deposit' button. The 'WITHDRAWAL' form has a dropdown 'Select Account: Savings - E3E722AB', an input field 'Amount (BWP): Enter amount to withdraw', and a blue 'Withdraw' button. At the bottom, a green message says 'Deposit successful. Account 141B2EA1. New Balance: BWP1050.00'.

and withdraw 250

The screenshot shows the Prime BANK mobile application interface after a withdrawal. The left sidebar remains the same. The main content area now shows updated account balances: 'INVESTMENT ACCOUNTS' (Acct No: 141B2EA1, Balance: BWP750.00, Rate: 5.0%, Est. Interest: BWP37.50, Applied Bal: BWP787.50), 'SAVINGS ACCOUNTS' (Acct No: E3E722AB, Balance: BWP1000.00, Rate: 2.5%, Est. Interest: BWP25.00, Applied Bal: BWP1025.00), and 'CHEQUE ACCOUNTS' (Acct No: 79B21558, Balance: BWP200.00, Overdraft Limit: BWP5000.00, Name on Cheque: Alice Johanson). The 'DEPOSIT' and 'WITHDRAWAL' forms are identical to the previous screenshot. At the bottom, a green message says 'Withdrawal successful. Account 141B2EA1. New Balance: BWP750.00'.

### e) Transaction History

Table: transactions

	transaction_id	account_number	transaction_date	type	amount	new_balance
	Filter	Filter	Filter	Filter	Filter	Filter
8	8	E72C1FA9	2025-11-23T14:06:55.229619818	Deposit	34.0	584.0
9	9	E72C1FA9	2025-11-23T14:07:19.870477693	Withdrawal	24.0	560.0
10	10	9802015F	2025-11-23T14:07:58.676120594	Deposit	1.0	50.0
11	11	9802015F	2025-11-23T15:06:16.277196542	Deposit	10.0	60.0
12	12	E72C1FA9	2025-11-23T15:16:56.296690998	Deposit	10.0	570.0
13	13	1559FD7F	2025-11-23T15:29:29.7878569	Initial Deposit	20000.0	20000.0
14	14	7D3644F6	2025-11-23T15:42:35.948968962	Initial Deposit	20.0	20.0
15	15	EC59CB24	2025-11-23T15:45:01.671972013	Initial Deposit	500.0	500.0
16	16	BA4087C1	2025-11-23T15:46:04.218706723	Initial Deposit	3000.0	3000.0
17	17	BA4087C1	2025-11-23T15:47:04.473154236	Withdrawal	5000.0	-2000.0
18	18	BA4087C1	2025-11-23T15:47:23.718667579	Deposit	2000.0	0.0
19	19	EC59CB24	2025-11-23T15:47:40.362549301	Withdrawal	20.0	480.0
20	20	EC59CB24	2025-11-23T15:47:58.645713385	Withdrawal	20.0	460.0
21	21	EC59CB24	2025-11-23T15:48:09.012516994	Withdrawal	20.0	440.0
22	22	BA4087C1	2025-11-23T15:49:44.432969908	Withdrawal	2.0	-2.0
23	23	A18CB0DF	2025-11-26T09:44:25.483344741	Initial Deposit	500.0	500.0
24	24	2FBAD693	2025-11-26T09:45:27.538128419	Initial Deposit	900.0	900.0
25	25	0247FA31	2025-11-26T09:46:42.349274956	Initial Deposit	500.0	500.0
26	26	B5549682	2025-11-26T09:47:21.63440677	Initial Deposit	800.0	800.0
27	27	8D60E375	2025-11-26T09:49:53.461659894	Initial Deposit	34.0	34.0
28	28	11E4D16E	2025-11-26T11:19:34.399552502	Initial Deposit	1000.0	1000.0
29	29	3F77A763	2025-11-26T11:32:42.030678747	Initial Deposit	1000.0	1000.0
30	30	E3E722AB	2025-11-26T11:37:09.415925474	Initial Deposit	1000.0	1000.0
31	31	141B2EA1	2025-11-26T11:48:10.969363847	Initial Deposit	550.0	550.0
32	32	79B21558	2025-11-26T11:48:22.270777514	Initial Deposit	200.0	200.0
33	33	141B2EA1	2025-11-26T11:52:57.841735781	Deposit	450.0	1000.0
34	34	141B2EA1	2025-11-26T11:54:46.016989812	Withdrawal	250.0	750.0

## Conclusion: PrimeBankApplication

### I. Architectural Design and Implementation

The project adheres to a layered architectural pattern, strongly implementing the **Data Access Object (DAO)** pattern to separate business logic from database interactions.

- **GUI Layer (JavaFX Controllers):** The controllers (`LoginController`, `DashboardController`, `TransactionController`, etc.) manage user input and view navigation. The use of FXML allows for a clear separation of presentation logic from the Java code.
- **Business/Model Layer (Core Classes):** This layer contains the core banking logic and data models, including `User`, `Customer` (with subclasses `IndividualCustomer` and `CompanyCustomer`), `Account` (with subclasses `SavingsAccount`, `ChequeAccount`, and `InvestmentAccount`), and `Transaction`. This layer effectively demonstrates polymorphism, inheritance, and interfaces (`Withdrawal`, `InterestCalculation`).
- **Data Access Layer (DAO Interfaces and Implementations):** Interfaces (`UserDAO`, `CustomerDAO`, `AccountDAO`) define standard database operations, implemented by `UserDAOImpl`, `CustomerDAOImpl`, and `AccountDAOImpl`. This design makes the application more maintainable and adaptable to different database technologies in the future.
- **Database:** Two separate SQLite databases (`users.db` and `customer.db`) are used to segregate user authentication data from customer and account-specific transactional data, reflecting good security practice.

## II. Key Features Achieved

1. **Secure User Authentication:** The system includes `Sign Up`, `Sign In`, and `Forgot Password` functionality. User passwords are not stored in plain text; `UserDAOImpl` uses **SHA-256 hashing** for secure storage and comparison.
2. **Polymorphic Account Management:** The application successfully models three distinct account types, each with unique logic:
  - **SavingsAccount:** Calculates interest based on customer type (individual vs. company).
  - **ChequeAccount:** Allows withdrawals with an overdraft limit (demonstrates the `Withdrawal` interface).
  - **InvestmentAccount:** Requires a minimum initial deposit and calculates a higher investment rate (demonstrates both `Withdrawal` and `InterestCalculation`).

3. **Real-Time Transaction Logging:** All deposits, withdrawals, and initial account funding are recorded as **Transaction** objects, ensuring a detailed audit trail. Transactions are displayed in a dedicated view, sorted by date.
4. **Customer Profile Management:** Users can update their contact information and occupation through the Customer Profile