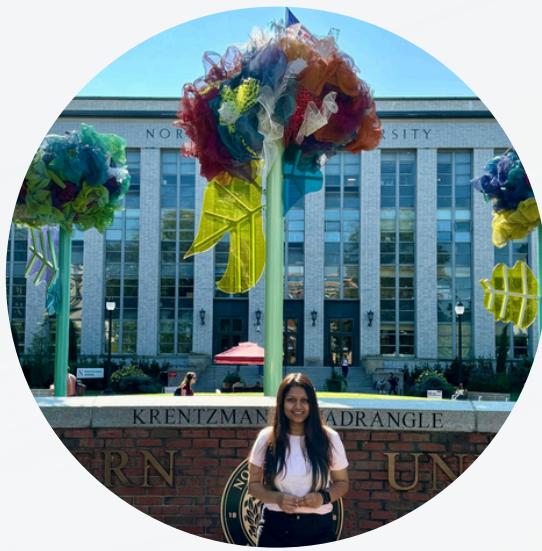


Development of a Scalable and Secure Banking Database System

Team Members



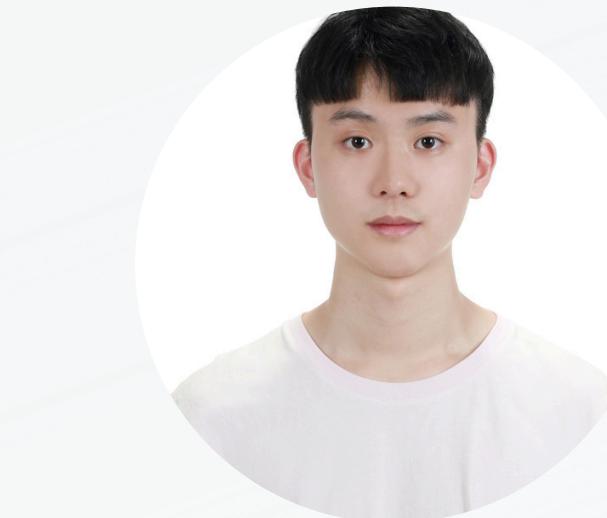
Harshally Mutgekar



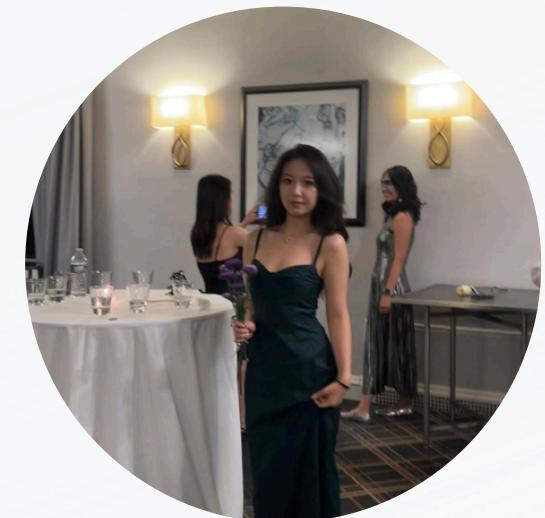
Nikhila B R



Laksh Dhamija



Hanson Chen



GESANGZHUOMA

**DAMG6210 - Data Management and Database Design
Under the guidance of Prof. Manuel D Montrond**

OVERVIEW



The database is designed to help banks manage financial data efficiently by centralizing customer, transaction, and loan information while improving scalability, security, and reporting capabilities for better business decisions.

PURPOSE



- Streamline and secure banking operations through centralized data management
- Improve transaction processing speed, accuracy, and system scalability
- Ensure compliance with data protection regulations and security standards
- Support strategic decision-making with real-time analytics and reporting



OBJECTIVES

#1

Customer Data Management: Maintain comprehensive and centralized customer profiles to enable efficient service delivery and data accuracy.

2

Transaction Tracking:
Record and monitor all customer transactions in real-time to ensure transparency and detect irregularities.

#3

Account Management:
Streamline account creation, maintenance, and closure processes while enforcing banking compliance.

#4

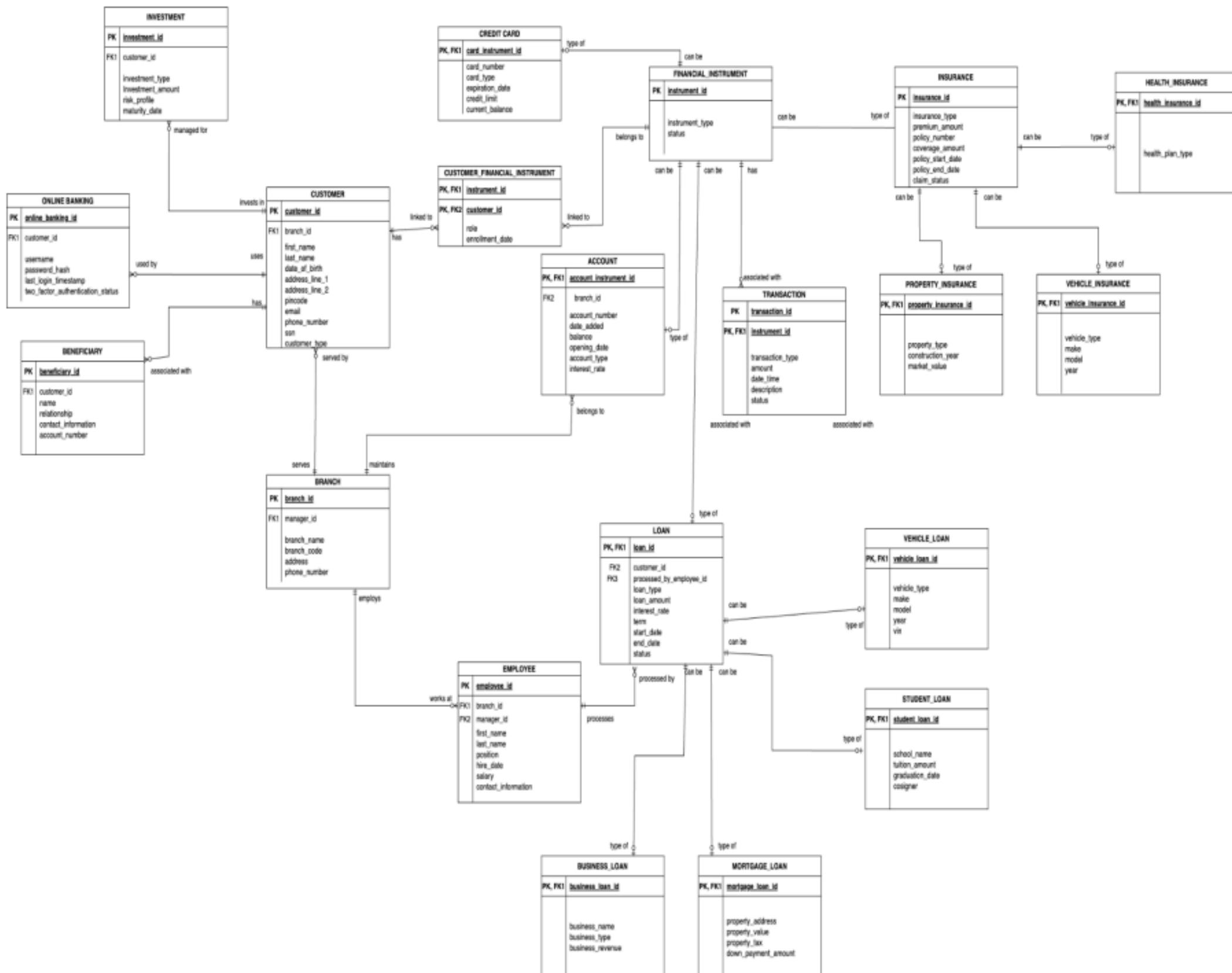
Financial Analytics:
Provide data-driven insights to enhance decision-making, risk assessment, and fraud detection.

#5

Secure Data Handling:
Ensure high-level security and encryption protocols to protect sensitive financial information and meet regulatory standards.



LOGICAL ERD



Views

01

Customer Accounts View

Displays account details per customer with associated branch

02

Loan Summary View

Summarizes loan details per customer, including employee who processed it.

03

Transaction History View

Provides detailed history of transactions linked to customers

04

Branch Employee Summary View

Lists employees along with their branch info and salaries

05

Customer Investment Summary View

Shows customer investment data including risk profile and maturity.

Stored Procedures

01

Get Customer Account Summary

Returns the number of accounts and total balance for a given customer.

02

Transfer Money

Safely transfers money between two accounts with transaction management.

03

Process Loan Application

Inserts and approves a customer's loan application with appropriate linkage.

04

Update Account Balance

Applies a deposit or withdrawal to an account and logs the transaction.

05

Get Customer Loan Details

Fetches loan details associated with a customer.



User Defined Functions

01

Calculate Monthly Payment

Computes the monthly payment for a loan using principal, rate, and term.

02

Calculate Yearly Interest

Returns the annual interest earned on a given balance at a rate.

03

Get Customer Age

Calculates a customer's age based on their date of birth.

04

Calculate Loan Interest

Estimates total loan interest payable over the term.

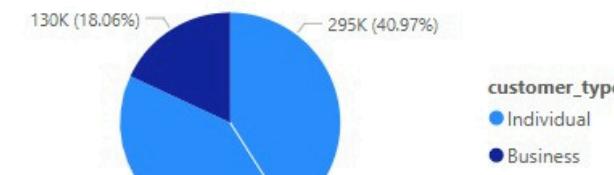
05

Get Branch Employee Count

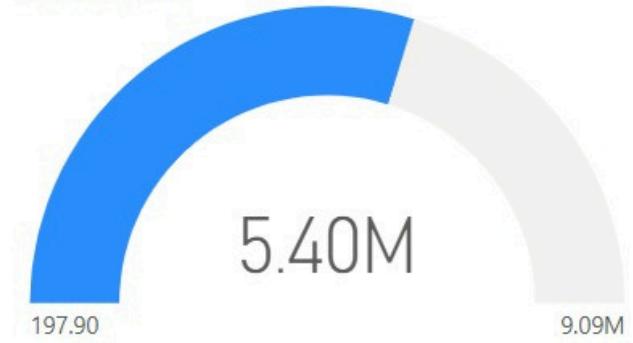
Returns the number of employees working in a specific branch.

DATA VISUALIZATION

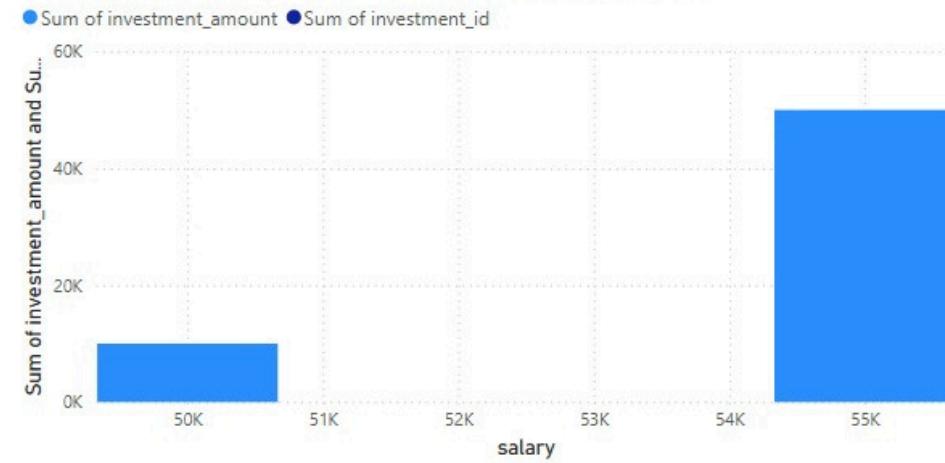
Sum of investment_amount by customer_type and health_plan_type



Sum of business_revenue, Sum of interest_rate and Sum of loan_amount



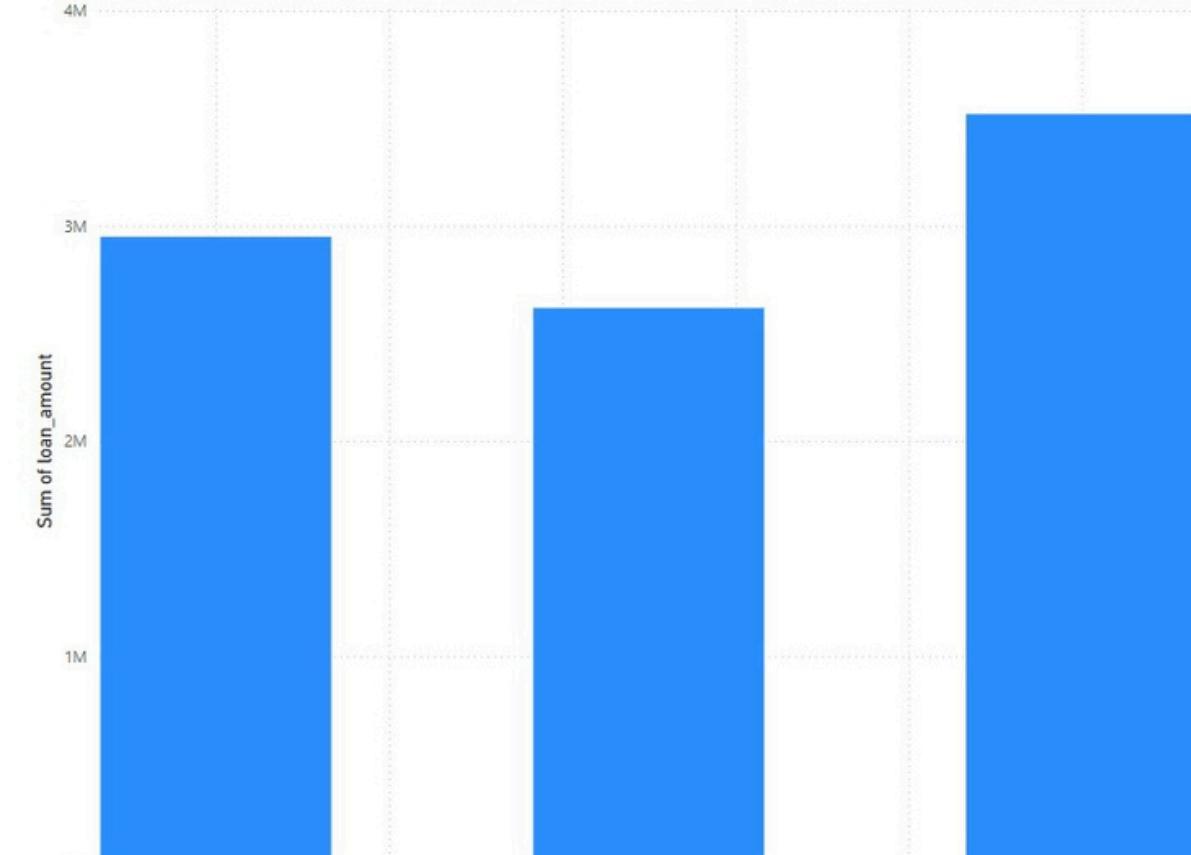
Sum of investment_amount and Sum of investment_id by salary



Sum of down_payment_amount, Sum of property_tax, Sum of property_value, Sum of tuition_amount, Sum of year and Sum of beneficiary_id



Sum of loan_amount by salary



TRIGGERS

01 Automatically logs user ID and timestamp

02 No need for manual logging in application code

03 Helps track user activity and maintain data history

```
INSERT INTO [Transaction] (instrument_id, instrument_type, transaction_type, amount, description, status)  
VALUES (81, 'Account', 'Deposit', 1000.00, 'Initial deposit', 'Completed');
```

-- Verify that the description was updated

```
SELECT transaction_id, description FROM [Transaction] WHERE instrument_id = 81;
```

ENCRYPTION PROCESS

01 protect user data

02 Stored Procedure encrypts name, address, and phone before saving

03 store encrypted values as readable strings

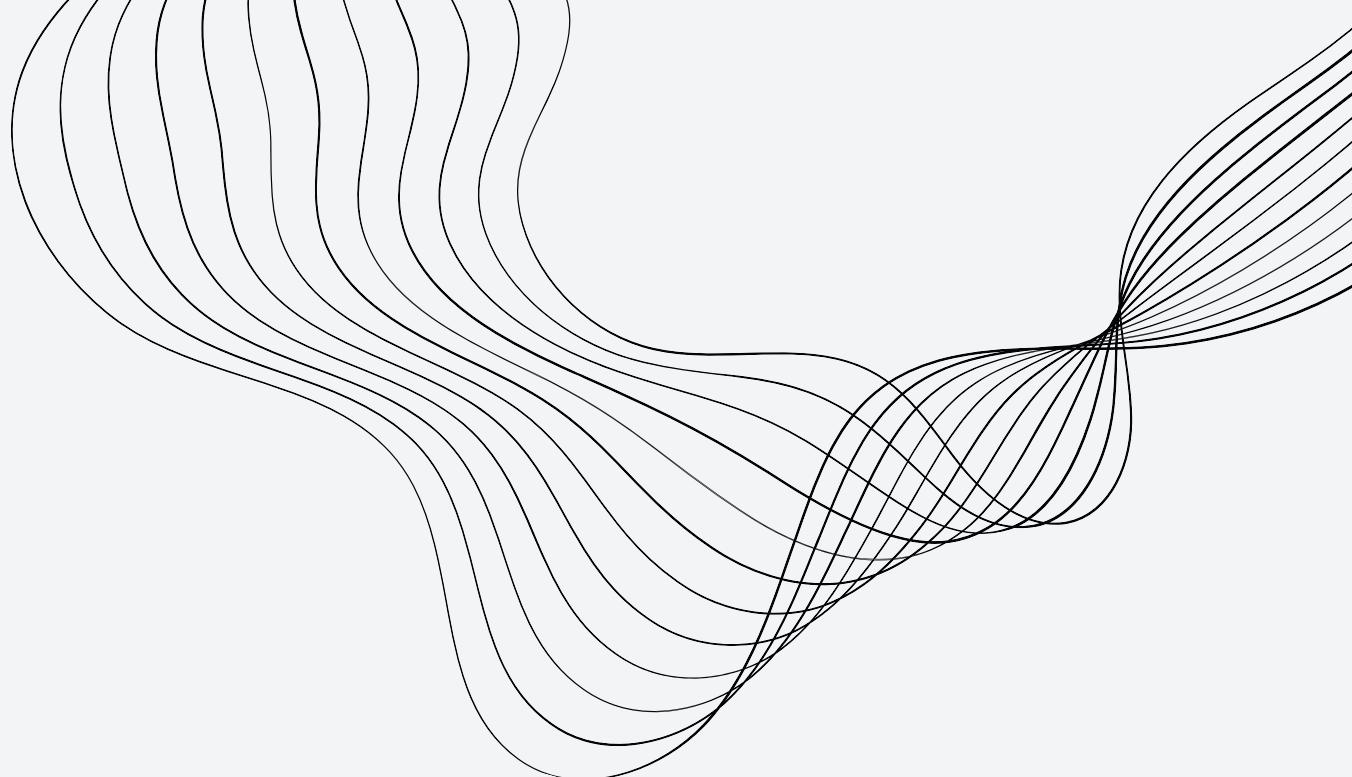
04 Secure and safe storage of sensitive information

```
OPEN SYMMETRIC KEY Financial_EncryptionKey DECRYPTION BY CERTIFICATE BankingEncryptionCert;

UPDATE Credit_Card
SET credit_limit_encrypted = EncryptByKey(Key_GUID('Financial_EncryptionKey'),
                                             CONVERT(VARCHAR(20), credit_limit),
                                             1,
                                             CONVERT(VARBINARY, credit_card_id));

CLOSE SYMMETRIC KEY Financial_EncryptionKey;
```

GUI FOR CRUD



Web Application: Spring Boot

ORM framework: Hibernate

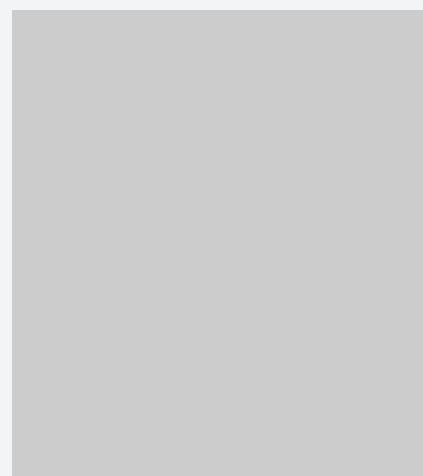
```
# Server and Application Configuration
server.port=8080
server.servlet.context-path=/banking
spring.application.name=BankingSystemDB

# DataSource Configuration
spring.datasource.url=jdbc:sqlserver://localhost:1433;databaseName=BankingSystemDB;encrypt=true;trustServerCertificate=true
spring.datasource.username=sa
spring.datasource.password=Aa@8573547512
spring.datasource.driver-class-name=com.microsoft.sqlserver.jdbc.SQLServerDriver

# Hibernate Configuration
spring.jpa.properties.hibernate.dialect=org.hibernate.dialect.SQLServerDialect
spring.jpa.hibernate.ddl-auto=update
spring.jpa.hibernate.naming.physical-strategy=org.hibernate.boot.model.naming.PhysicalNamingStrategyStandardImpl
spring.jpa.show-sql=true
spring.jpa.properties.hibernate.format_sql=true

# JSP Configuration
spring.mvc.view.prefix=/WEB-INF/views/
spring.mvc.view.suffix=.jsp

# Logging Configuration
logging.level.org.hibernate.SQL=DEBUG
logging.level.org.hibernate.type.descriptor.sql.BasicBinder=TRACE
```



SCREENSHOTS & DEMO

This screenshot shows the 'Customer List' page of the Banking System. At the top, there's a navigation bar with links to Home, Customers, Accounts, Loans, and Transactions. Below the navigation is a section titled 'Customer List' with a link to 'Add New Customer'. A 'Search Customers' section includes a search bar and a table for filtering by last name. The main area displays a table of customer records with columns for ID, Name, Email, Phone, Customer Type, Branch, and Actions (View, Edit, Delete). The table contains 11 entries, each with a unique ID and corresponding details.

ID	Name	Email	Phone	Customer Type	Branch	Actions
1	Alice Brown	alice@example.com	5551234567	Individual	Main Branch	View Edit Delete
2	Bob Smith	bob@example.com	5559876543	Individual	Downtown Branch	View Edit Delete
3	Jane Doe	jane@example.com	5551112222	Individual	Uptown Branch	View Edit Delete
4	Tom Harris	tom@example.com	5554443333	Business	Westside Branch	View Edit Delete
5	Mary Clarkson	mary@example.com	5557778888	Individual	Eastside Branch	View Edit Delete
6	Steve Adams	steve@example.com	5552221111	Business	Northside Branch	View Edit Delete
7	Nancy Whitehead	nancy@example.com	5556667777	Individual	Southside Branch	View Edit Delete
8	Pauline Greenfield	pauline@example.com	5558889999	Business	Central Branch	View Edit Delete
9	George Blackwell	george@example.com	5550001111	Individual	Lakeside Branch	View Edit Delete
10	Linda Stone	linda@example.com	5553334444	Individual	Riverside Branch	View Edit Delete
11	Hanson Chen	hanson@gmail.com	8578578578	Individual	Riverside Branch	View Edit Delete

Banking System Database © 2025

This screenshot shows the 'Customer Details' page for a specific customer. The top navigation bar and links are identical to the previous screenshot. The main content starts with a 'Customer Details' section containing a 'Back to List' link and an 'Edit Customer' link. Below this is a 'Personal Information' section with a table showing details for Customer ID 1: Alice Brown. The table includes fields for Full Name, Date of Birth, Email, Phone, SSN, Customer Type, Address, and Branch. Following this is an 'Accounts' section with a table listing two accounts: a Savings account with account number 9876543288 and balance 13800.00, and another Savings account with account number 9876543281 and balance 13100.00. Both accounts are marked as Active. There are also 'View All Accounts' and 'Edit Account' links. Below the accounts is a 'Loans' section with a 'View All Loans' link. At the bottom is a 'Recent Transactions' section with a 'View All Transactions' link. The footer again states 'Banking System Database © 2025'.

Customer ID:	1
Full Name:	Alice Brown
Date of Birth:	01/01/1990
Email:	alice@example.com
Phone:	5551234567
SSN:	123456789
Customer Type:	Individual
Address:	789 Oak St, 12345
Branch:	Main Branch (ID: 1)

Account Type	Account Number	Balance	Status	Actions
Savings	9876543288	13800.00	Active	View
Savings	9876543281	13100.00	Active	View

This screenshot shows the 'Create New Customer' page. The top navigation bar and links are identical. The main content begins with a 'Create New Customer' heading and a 'Back to List' link. It features a form with various input fields: 'Branch' (dropdown), 'Customer Type' (dropdown), 'First Name' (text), 'Last Name' (text), 'Date of Birth' (text), 'SSN' (text), 'Email' (text), 'Phone Number' (text), 'Address Line 1' (text), 'Address Line 2' (text), and 'Zip Code' (text). At the bottom are 'Create Customer' and 'Cancel' buttons. The footer again states 'Banking System Database © 2025'.

[Demo Link](#)

**Thank
you!**