Banking System with Advanced Fraud Detection

GitHub: peedaluk/Banking-system-with-Advanced-Fraud-detection

1. Project Overview

The Banking System with Advanced Fraud Detection is a secure, web-based application designed to deliver essential banking services while integrating advanced machine learning techniques for fraud detection. The system provides users with a seamless interface for managing accounts and transactions, while backend analytics monitor and flag suspicious activities in real time.

2. Features

- User Registration and Login
- Account Management
- Transaction Processing
- Real-time Fraud Detection
- Secure Password Handling
- User-friendly Web Interface

3. Technologies Used

Component	**Technology**
Backend	Python (Flask)
Frontend	HTML, CSS, JS
ML Models	Python (scikit-learn, etc.)

Templates	Jinja2
Passwords	Custom module

4. Project Structure

Folder/File	Purpose
`app.py`	Main Flask application
`models/`	Machine learning models for fraud detection
`routes/`	Flask route handlers
`templates/`	HTML templates for web pages
`static/`	Static assets (CSS, JS, images)
`screenshots/`	Project screenshots
`password.py`	Password management utilities

`requirements.txt`	Python dependencies
`README.md`	Project documentation

5. Setup Instructions

1. Clone the repository:
2. `bash`

```
git clone
https://github.com/peedaluk/Banking-system-with-Advanced-Fraud-d
etection.git
```

```
cd Banking-system-with-Advanced-Fraud-detection
```

3.
4. Install dependencies:
5. `bash`

```
pip install -r requirements.txt
```

6.
7. Run the application:
8. `bash`

```
python app.py
```

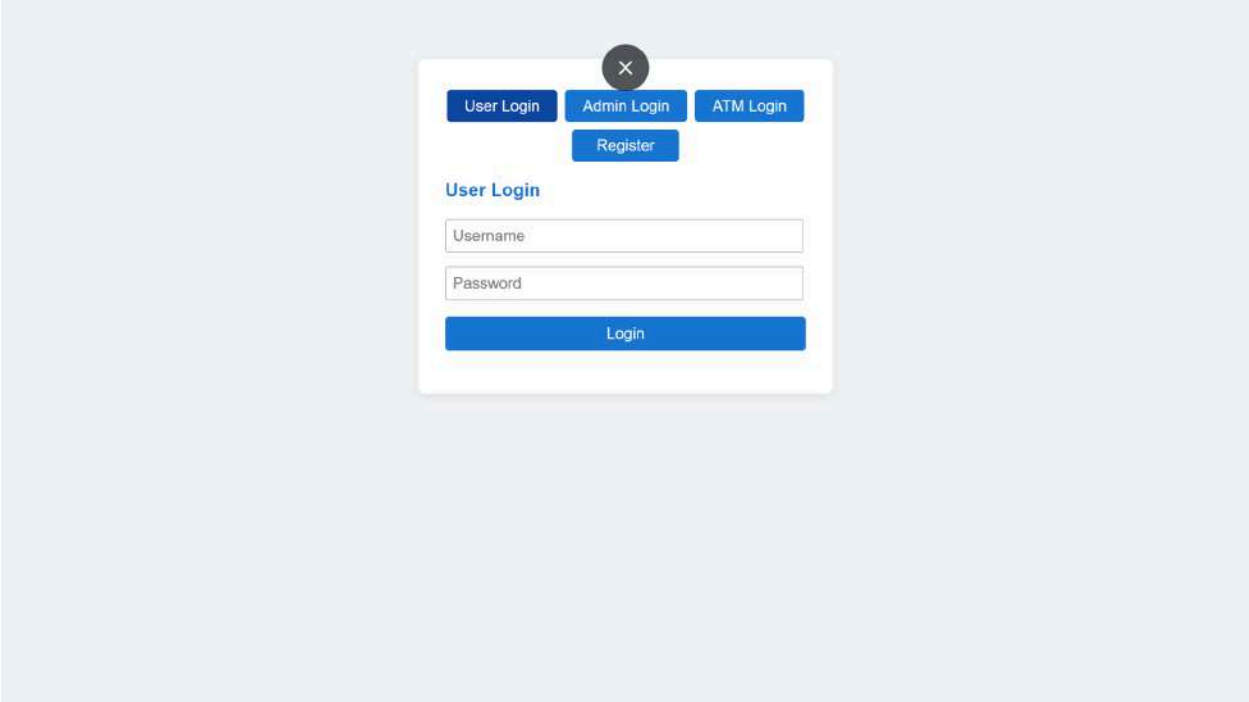
9.
10. Access the app:
    Open your browser and go to `http://localhost:5000`

6. Screenshots

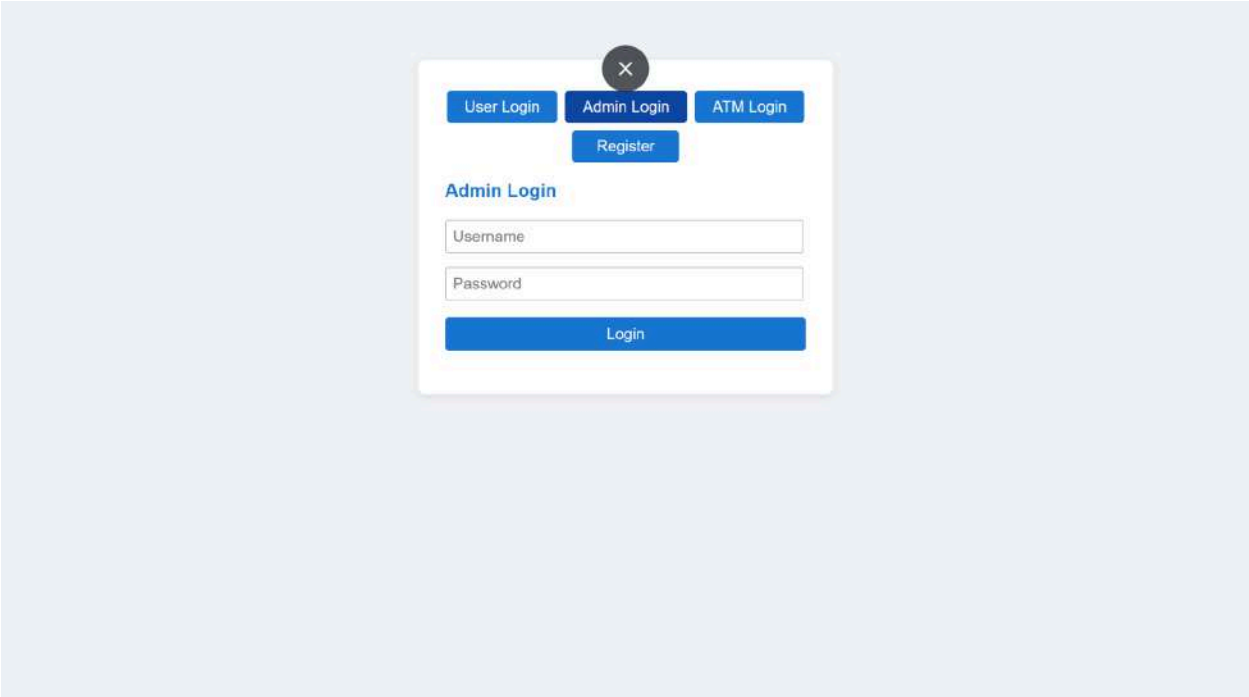
Login Pages

User Login

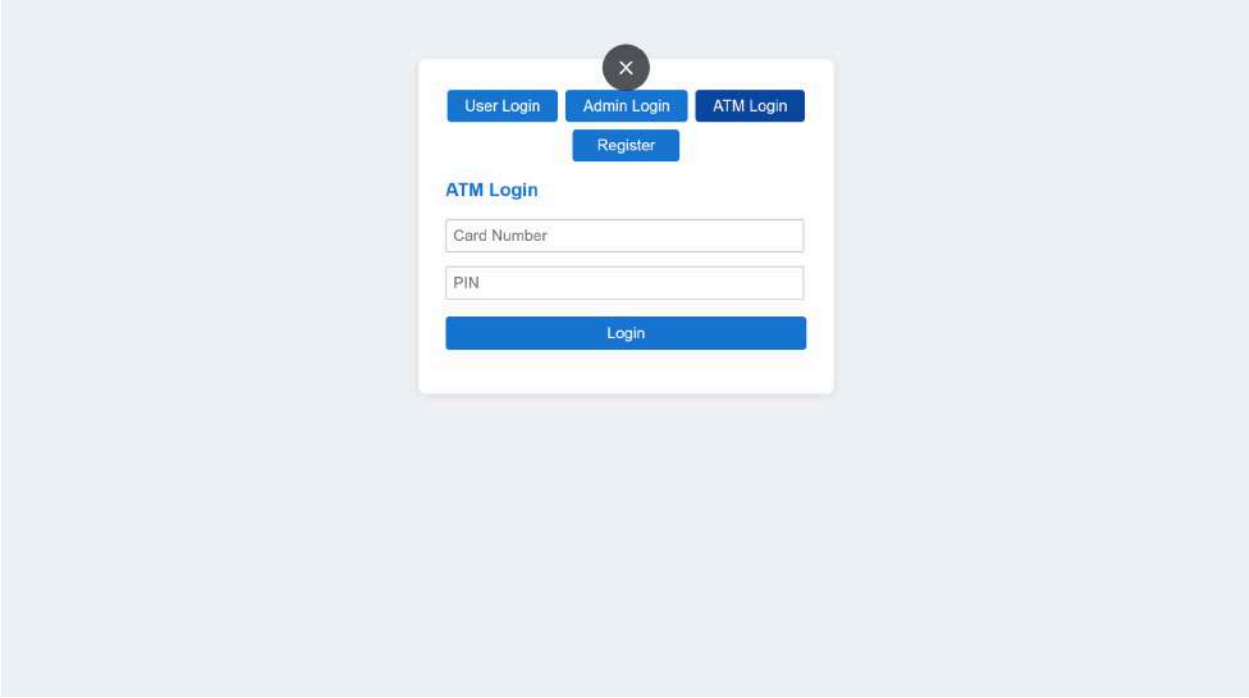
![login.png]



![admin_login.png]

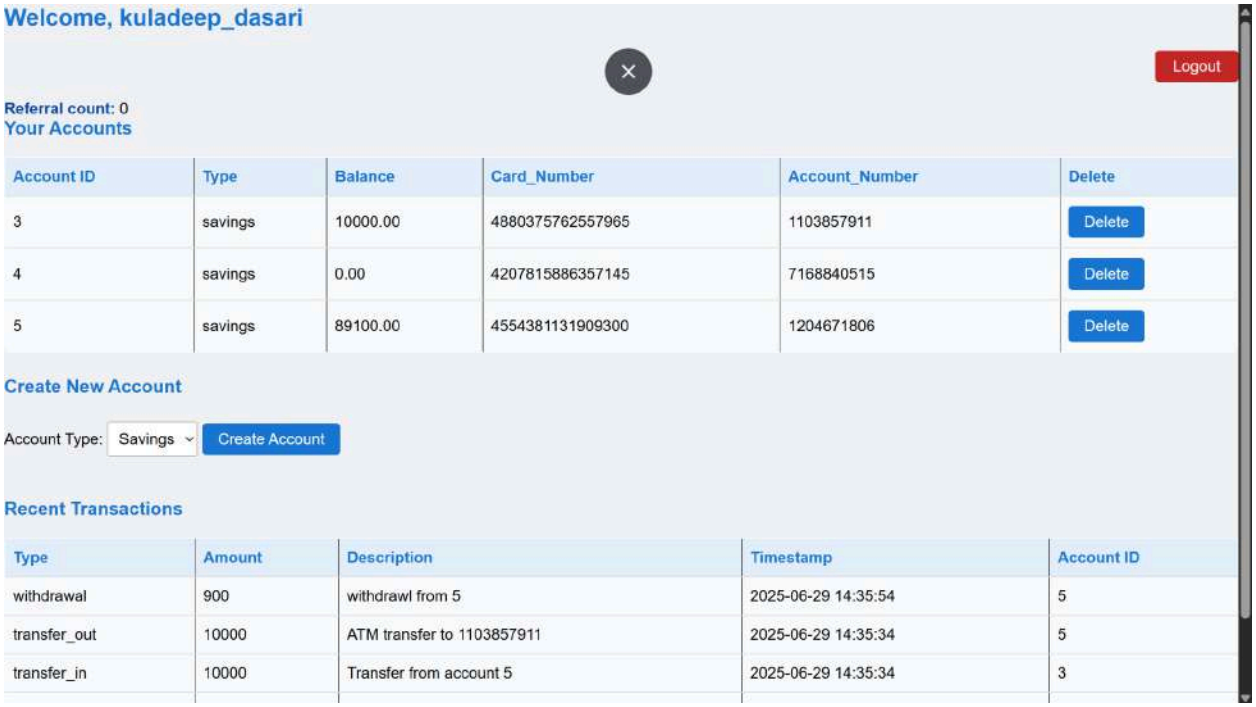


![atm_login.png]

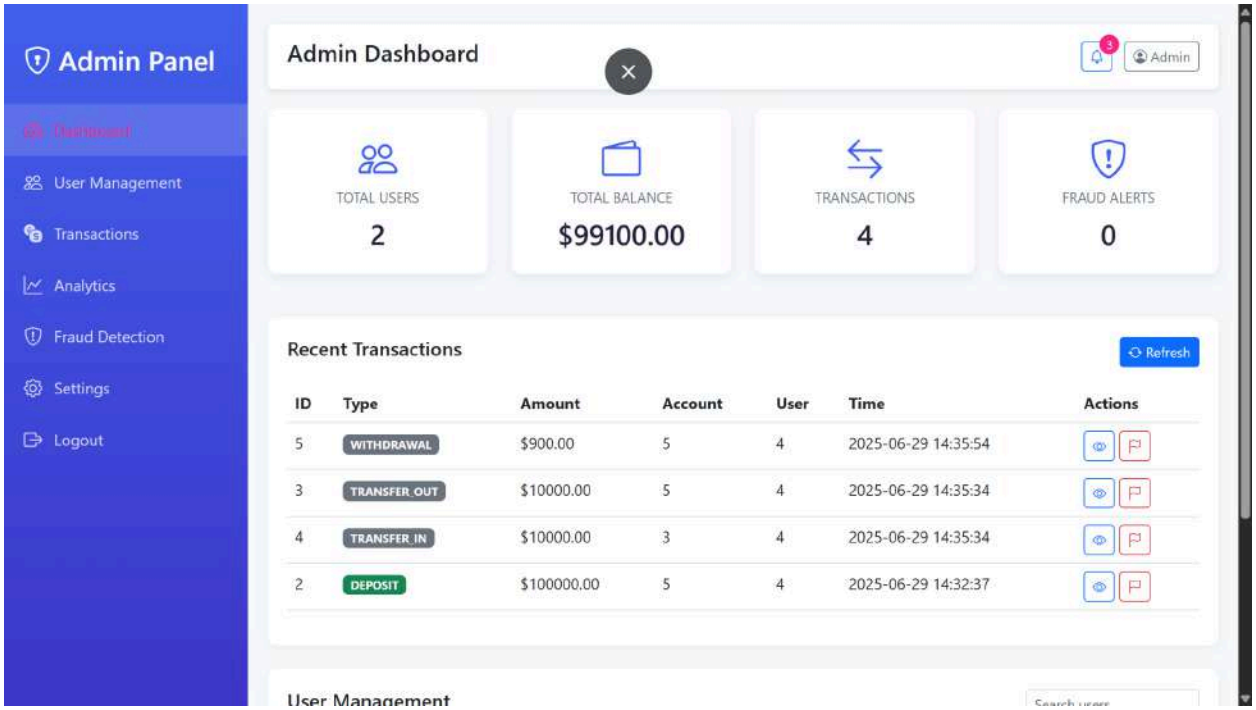


User Dashboard

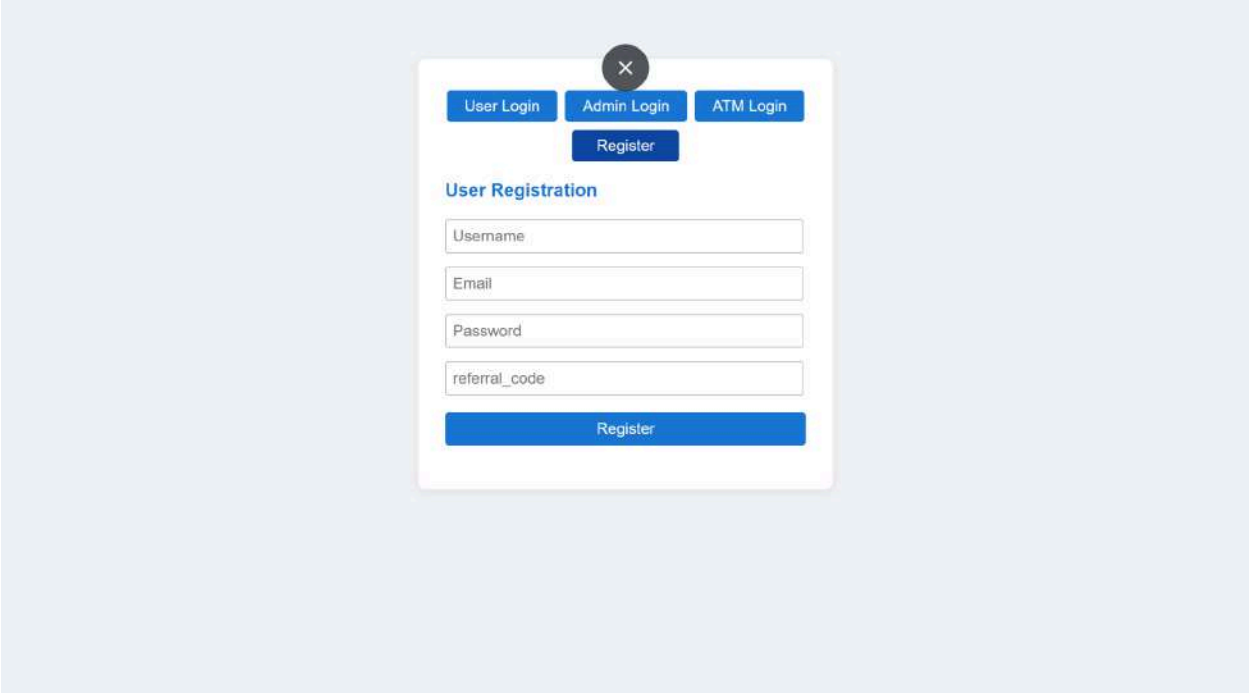
![user_dashboard.png]



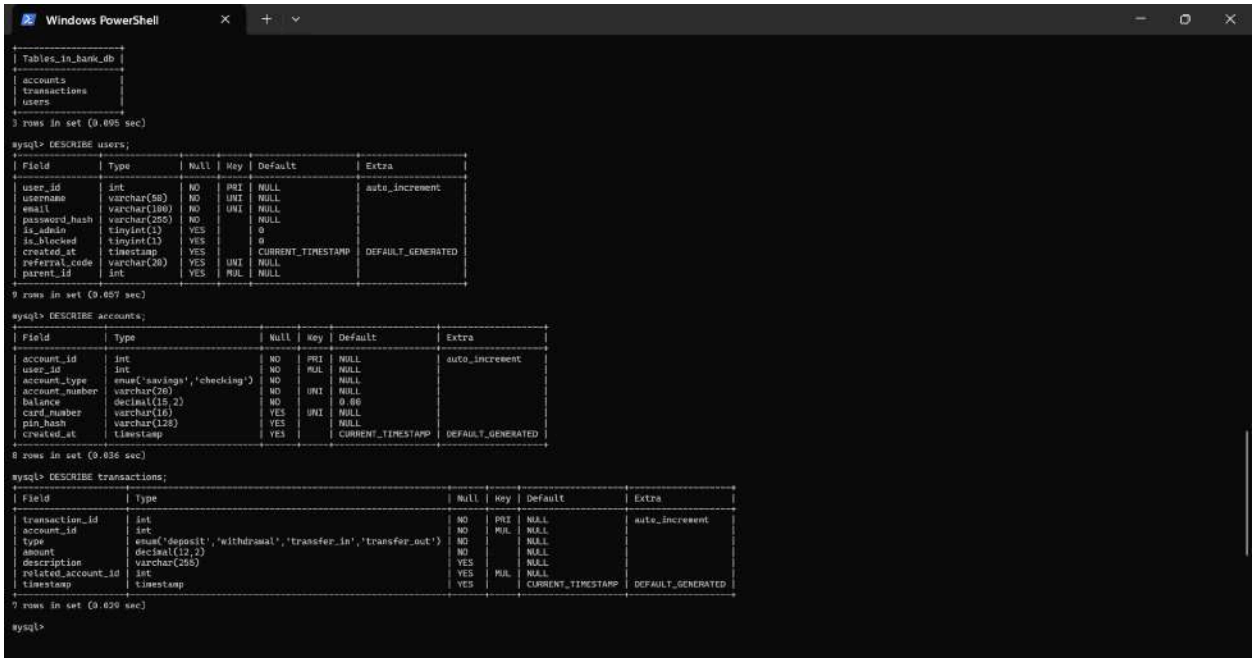
![admin_dashboard.png]



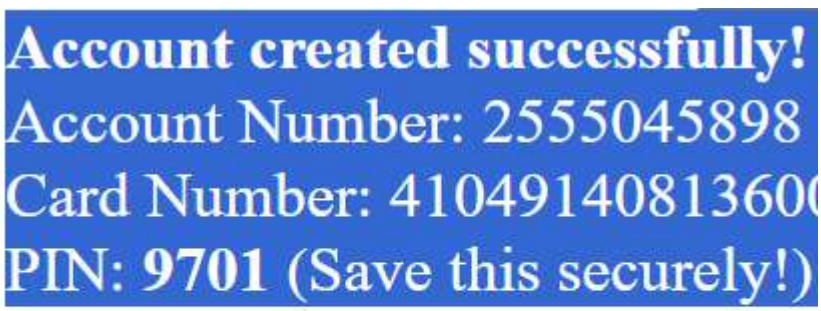
Registration Page
![register.png]



![database.png]



```
Windows PowerShell

+--------------------+
| Tables_in_bank_db |
+--------------------+
| accounts           |
| transactions       |
| users              |
+--------------------+
3 rows in set (0.095 sec)

mysql> DESCRIBE users;
+----------------+--------------+------+-----+--------------------+-------------------+
| Field          | Type         | Null | Key | Default            | Extra             |
+----------------+--------------+------+-----+--------------------+-------------------+
| user_id        | int          | NO   | PRI | NULL               | auto_increment    |
| username       | varchar(50)  | NO   | UNI | NULL               |                   |
| email          | varchar(100) | NO   | UNI | NULL               |                   |
| password_hash  | varchar(255) | NO   |     | NULL               |                   |
| is_admin       | tinyint(1)   | YES  |     | 0                  |                   |
| is_blocked     | tinyint(1)   | YES  |     | 0                  |                   |
| created_at     | timestamp    | YES  |     | CURRENT_TIMESTAMP  | DEFAULT_GENERATED |
| referral_code  | varchar(20)  | YES  | UNI | NULL               |                   |
| parent_id      | int          | YES  | MUL | NULL               |                   |
+----------------+--------------+------+-----+--------------------+-------------------+
9 rows in set (0.057 sec)

mysql> DESCRIBE accounts;
+----------------+-----------------------------+------+-----+--------------------+-------------------+
| Field          | Type                        | Null | Key | Default            | Extra             |
+----------------+-----------------------------+------+-----+--------------------+-------------------+
| account_id     | int                         | NO   | PRI | NULL               | auto_increment    |
| user_id        | int                         | NO   | MUL | NULL               |                   |
| account_type   | enum('savings','checking')  | NO   |     | NULL               |                   |
| account_number | varchar(20)                 | NO   | UNI | NULL               |                   |
| balance        | decimal(15,2)               | NO   |     | 0.00               |                   |
| card_number    | varchar(16)                 | YES  | UNI | NULL               |                   |
| pin_hash       | varchar(128)                | YES  |     | NULL               |                   |
| created_at     | timestamp                   | YES  |     | CURRENT_TIMESTAMP  | DEFAULT_GENERATED |
+----------------+-----------------------------+------+-----+--------------------+-------------------+
8 rows in set (0.036 sec)

mysql> DESCRIBE transactions;
+-----------------+-------------------------------------------------------------+------+-----+--------------------+-------------------+
| Field           | Type                                                        | Null | Key | Default            | Extra             |
+-----------------+-------------------------------------------------------------+------+-----+--------------------+-------------------+
| transaction_id  | int                                                         | NO   | PRI | NULL               | auto_increment    |
| account_id      | int                                                         | NO   | MUL | NULL               |                   |
| type            | enum('deposit','withdrawal','transfer_in','transfer_out')   | NO   |     | NULL               |                   |
| amount          | decimal(12,2)                                               | NO   |     | NULL               |                   |
| description     | varchar(255)                                                | YES  |     | NULL               |                   |
| related_account_id | int                                                       | YES  | MUL | NULL               |                   |
| timestamp       | timestamp                                                   | YES  |     | CURRENT_TIMESTAMP  | DEFAULT_GENERATED |
+-----------------+-------------------------------------------------------------+------+-----+--------------------+-------------------+
7 rows in set (0.029 sec)

mysql>
```



![screenshot.png]

7. Fraud Detection Logic

- Model Training: Machine learning models are trained on transaction data to distinguish between legitimate and fraudulent activities.
- Real-time Prediction: Every transaction is evaluated by the model before processing. If flagged as suspicious, the user is alerted and the transaction may be blocked or require further verification.

Sample Code:

```python
# app.py (snippet)
```

```python
from models.fraud_model import predict_fraud


@app.route('/transaction', methods=['POST'])
def transaction():
    data = request.form
    is_fraud = predict_fraud(data)
    if is_fraud:
        flash('Fraudulent transaction detected!', 'danger')
        return redirect(url_for('dashboard'))
    # Process transaction if not fraud
```

8. Conclusion & Future Work

This project demonstrates a secure, user-friendly banking system with integrated fraud detection.
Future enhancements could include:

- Transaction visualization dashboards
- Multi-factor authentication
- Integration with real banking APIs

9. References

- Project GitHub Repository
- Flask Documentation
- Hajdu, L., & Krész, M. (2020). Temporal Network Analytics for Fraud Detection in the Banking Sector. In L. Bellatreche et al. (Eds.), ADBIS/TPDL/EDA 2020 Workshops and Doctoral Consortium, CCIS 1260, pp. 145–157. Springer Nature Switzerland AG. ResearchGate Link
  This paper introduces a temporal network-based methodology for fraud detection

in banking, focusing on detecting cycles in transaction networks, which can reveal hidden fraudulent patterns not easily found with traditional client-centric approaches.

Instructions: