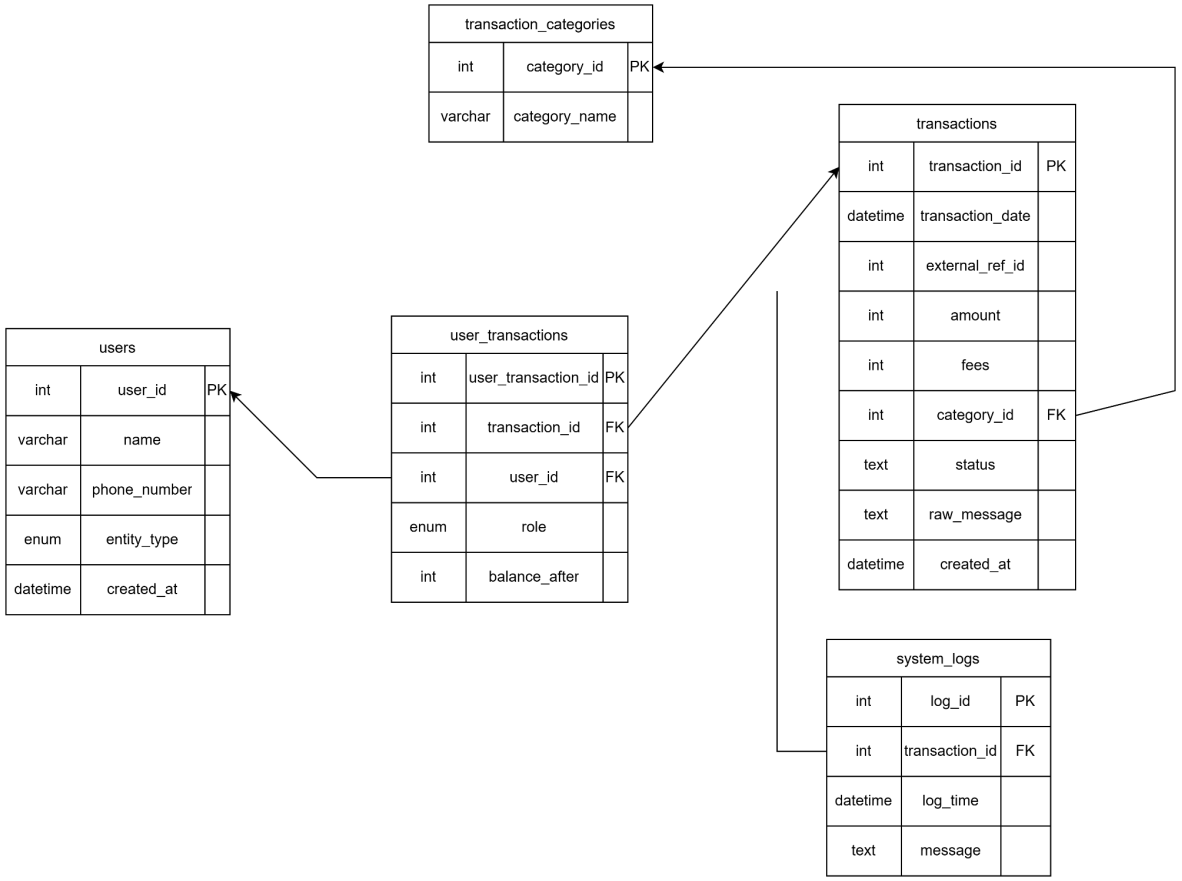
Entity Relationship Diagram (ERD)



Explanation

The entity Relationship Diagram was designed after analyzing the structure of the MoMo XML transactions data structure which has data about the transaction details, the users both sender and receiver , transaction types and system processing logs. Based on our analysis, we identified five main tables(entities) which are;

- **Users** table describes the participants and keeps records such as user_id, name and phone number which varies from one user to another to avoid errors and duplication.

- **Transactions** table records the details of transactions that happen and contains attributes such as transaction date , amount , fees which is the amount charged for transferring money, status where it is completed or failed and the raw sms message.

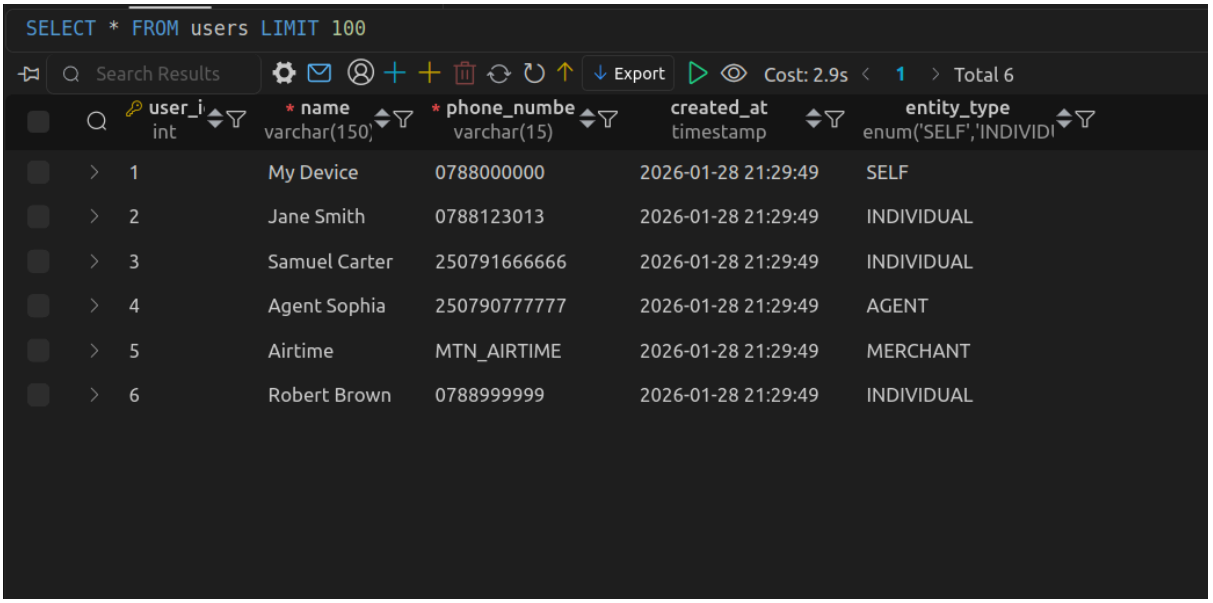
- **User_transaction** table links users and transactions table to track roles between sender and receiver.

- **Transaction_categories** table acts as a reference to classify payments.

- **System logs** table that stores tracking information and progress for each transaction.

The there are relationships between the tables where there is a many to many relationship Between users and transactions where a user can make multiple transactions and each transaction can involve multiple users meaning the person sending the money and the person who is receiving the money. This relationship is resolved using the user_transaction table which stores the users role in the transaction whether the sender or the receiver and also shows the balance after the transaction for each user.

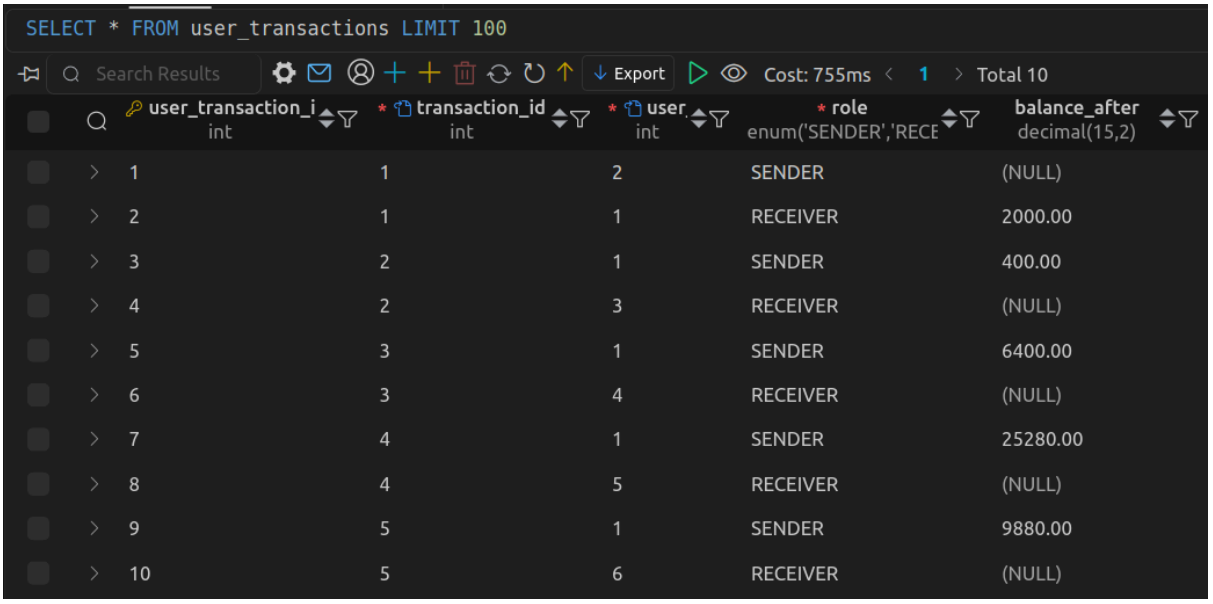
Data dictionary (screenshoots)



```
SELECT * FROM users LIMIT 100
```

Search Results | Export | Cost: 2.9s | 1 | Total 6

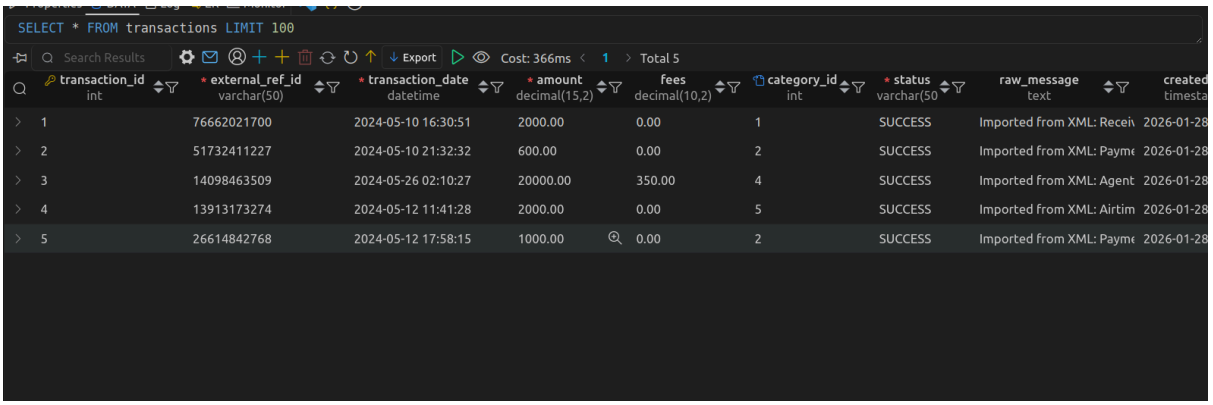
user_i int	* name varchar(150)	* phone_numbe varchar(15)	created_at timestamp	entity_type enum('SELF','INDIVIDI
1	My Device	0788000000	2026-01-28 21:29:49	SELF
2	Jane Smith	0788123013	2026-01-28 21:29:49	INDIVIDUAL
3	Samuel Carter	250791666666	2026-01-28 21:29:49	INDIVIDUAL
4	Agent Sophia	250790777777	2026-01-28 21:29:49	AGENT
5	Airtime	MTN_AIRTIME	2026-01-28 21:29:49	MERCHANT
6	Robert Brown	0788999999	2026-01-28 21:29:49	INDIVIDUAL



```
SELECT * FROM user_transactions LIMIT 100
```

Search Results | Export | Cost: 755ms | 1 | Total 10

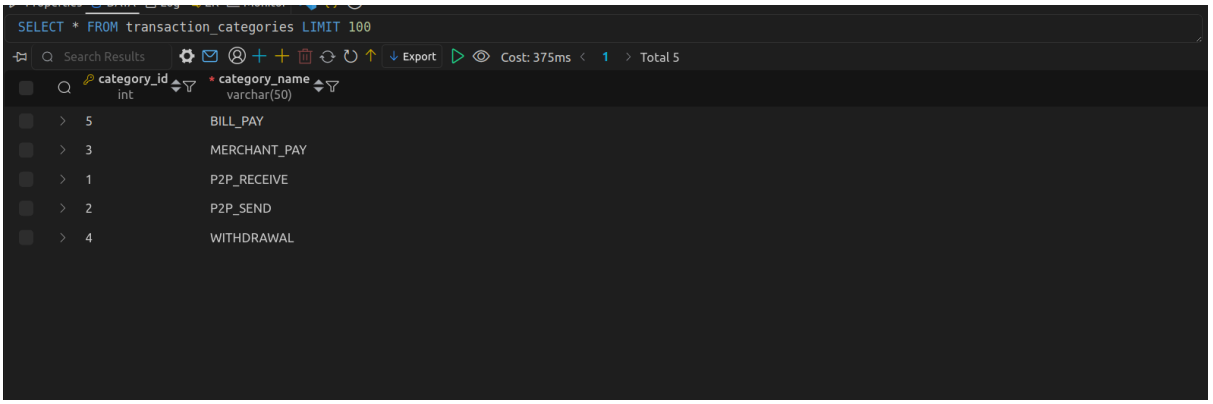
user_transaction_i int	* transaction_id int	* user int	* role enum('SENDER','RECE	balance_after decimal(15,2)
1	1	2	SENDER	(NULL)
2	1	1	RECEIVER	2000.00
3	2	1	SENDER	400.00
4	2	3	RECEIVER	(NULL)
5	3	1	SENDER	6400.00
6	3	4	RECEIVER	(NULL)
7	4	1	SENDER	25280.00
8	4	5	RECEIVER	(NULL)
9	5	1	SENDER	9880.00
10	5	6	RECEIVER	(NULL)



```
SELECT * FROM transactions LIMIT 100
```

Search Results | Export | Cost: 366ms | 1 | Total 5

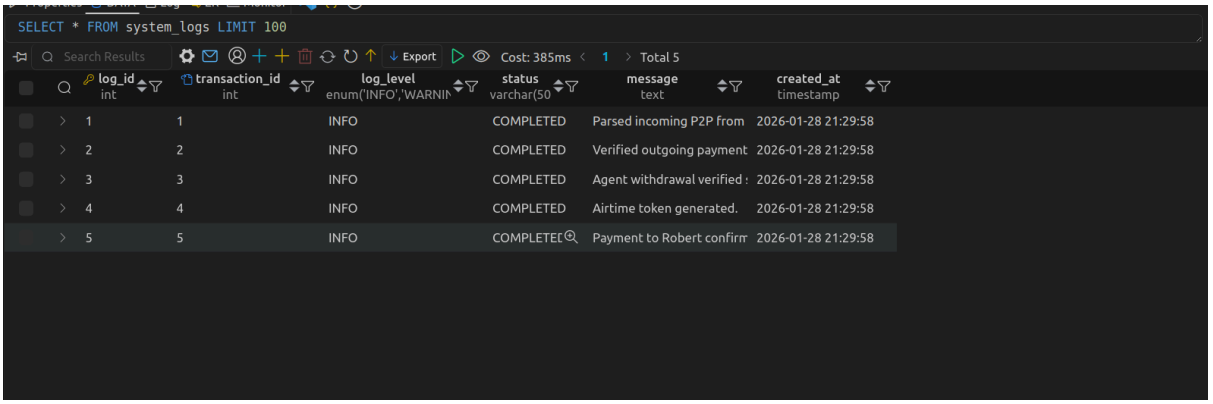
transaction_id int	* external_ref_id varchar(50)	* transaction_date datetime	* amount decimal(15,2)	fees decimal(10,2)	category_id int	* status varchar(50	raw_message text	created timesta
1	76662021700	2024-05-10 16:30:51	2000.00	0.00	1	SUCCESS	Imported from XML: Recei	2026-01-28
2	51732411227	2024-05-10 21:32:32	600.00	0.00	2	SUCCESS	Imported from XML: Payme	2026-01-28
3	14098463509	2024-05-26 02:10:27	20000.00	350.00	4	SUCCESS	Imported from XML: Agent	2026-01-28
4	13913173274	2024-05-12 11:41:28	2000.00	0.00	5	SUCCESS	Imported from XML: Airtim	2026-01-28
5	26614842768	2024-05-12 17:58:15	1000.00	0.00	2	SUCCESS	Imported from XML: Payme	2026-01-28



```
SELECT * FROM transaction_categories LIMIT 100
```

Search Results | Export | Cost: 375ms | 1 | Total 5

category_id int	* category_name varchar(50)
5	BILL_PAY
3	MERCHANT_PAY
1	P2P_RECEIVE
2	P2P_SEND
4	WITHDRAWAL



```
SELECT * FROM system_logs LIMIT 100
```

Search Results | Export | Cost: 385ms | 1 | Total 5

log_id int	transaction_id int	log_level enum('INFO','WARNIN	status varchar(50	message text	created_at timestamp
1	1	INFO	COMPLETED	Parsed incoming P2P from	2026-01-28 21:29:58
2	2	INFO	COMPLETED	Verified outgoing payment	2026-01-28 21:29:58
3	3	INFO	COMPLETED	Agent withdrawal verified :	2026-01-28 21:29:58
4	4	INFO	COMPLETED	Airtime token generated.	2026-01-28 21:29:58
5	5	INFO	COMPLETEI	Payment to Robert confirm	2026-01-28 21:29:58

SQL Database implementation

Explanation

Based on the ERD, we transformed our design into a mysql database using a script named database_Setup.sql.
DDL statements were used to create all the tables with suitable data types , for instance we used decimal for amount and fees to ensure financial accuracy and avoid errors

We implemented constraints in order to prevent input of invalid data like duplicate records or even missing values thus making sure that the database continues to be reliable without any errors. The constraints include

- **Primary key** which is implemented on entities like user_id and transaction_id to provide unique indexing.
- **Foreign key constraint** which is used to map the relationship between the user_transactions table, user and transactions ensuring consistent data linkage.
- **ENUM constraint** was used to enforce specific values for user roles sender or receiver and user entity type which is to specify if a user is an individual, agent or merchant.
- **Unique constraints** to ensure that each user has one phone number which is different from each user

JSON DATA MODELING

Explanation

JSON was used to show how the data in the database can be shared with other systems such as a website using an API. each main table has a matching Json structure so that the data can be easily sent and received

Json objects were created for users, transactions, transaction categories and system logs where they contain important information such user details, translation type, system messages. Hence this makes it for applications to display transaction information.
This design shows how data stored in different tables can be organized in one clear json structure.

AI usage

From the permitted ai usage it was about checking grammar the link below show the chat
https://gemini.google.com/share/88471cfed97a