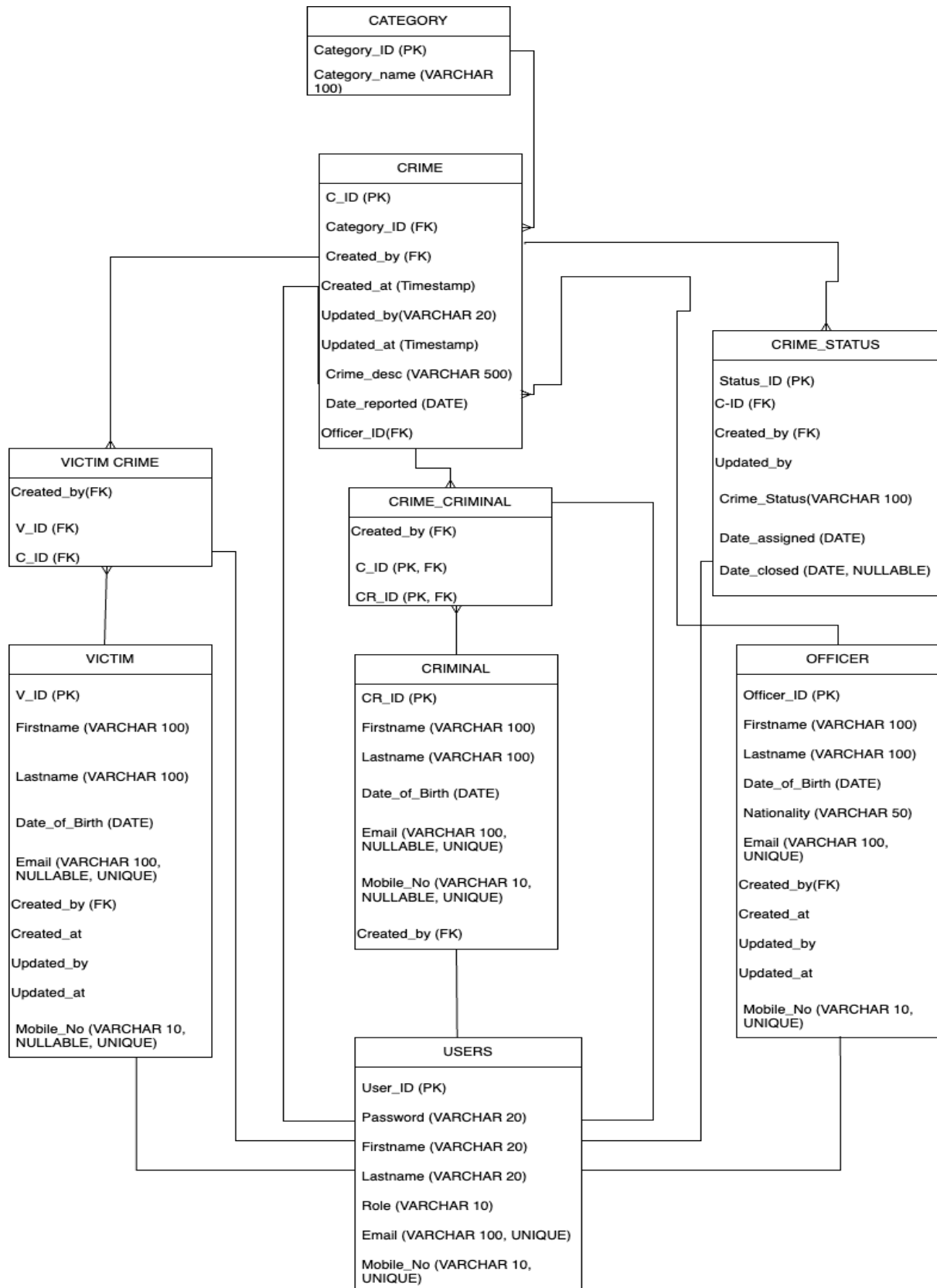


Crime Rate Management System (CRMS)

The Crime Rate Management System (CRMS) is designed as a relational database to support law enforcement agencies in managing crime data, investigations, and related entities. The diagram shows a well-structured system with the following main entities:

1. **USERS** - Central entity managing all system users and their roles
2. **OFFICER** - Stores information about law enforcement officers
3. **VICTIM** - Contains details of crime victims
4. **CRIMINAL** - Maintains records of individuals with criminal activity
5. **CRIME** - Records of reported criminal incidents
6. **CATEGORY** - Classification of crime types
7. **CRIME_STATUS** - Tracks the status and progress of crime investigations
8. **VICTIM_CRIME** - Associative entity linking victims to crimes
9. **CRIME_CRIMINAL** - Associative entity linking criminals to crimes

Entity-Relationship Analysis



Primary Entities

USERS

- Primary entity controlling access to the system
- Contains authentication information (Password) and basic user details
- Enforces role-based access control via the Role attribute
- All other entities have relationships with USERS for tracking creation/modification

CRIME

- Core entity recording reported incidents
- Linked to CATEGORY for classification
- Connected to OFFICER for assignment
- Contains tracking fields for auditing (Created_at, Updated_by, Updated_at)
- Associated with both VICTIM (via VICTIM_CRIME) and CRIMINAL (via CRIME_CRIMINAL)

CRIMINAL

- Stores personal information about individuals with criminal records
- Linked to specific crimes through the CRIME_CRIMINAL relationship
- Maintains creation and modification tracking

VICTIM

- Records details of crime victims
- Connected to specific crimes through VICTIM_CRIME relationship
- Includes contact information and audit fields

OFFICER

- Contains information about law enforcement personnel
- Additional attributes like Nationality for officer identification
- Associated with crimes they are investigating

CRIME_STATUS

- Tracks the progress of crime investigations
- Records assignment and closure dates
- Links the crime to assigned officers
- Provides status categorization of ongoing investigations

Associative Entities

VICTIM_CRIME

- Many-to-many relationship between VICTIM and CRIME
- Records which victims are associated with which crimes
- Includes creation tracking via USER reference

CRIME_CRIMINAL

- Many-to-many relationship between CRIME and CRIMINAL
- Records which criminals are associated with which crimes
- Includes creation tracking via USER reference

Categories and Classifications

CATEGORY

- Provides classification for crime types
- Referenced by CRIME for categorization
- Unique category names enforced

Normalization Analysis

The database appears to be in Third Normal Form (3NF) with some elements of Boyce-Codd Normal Form (BCNF). Here's the normalization process that has been applied:

First Normal Form (1NF)

- All tables have a primary key
- All attributes contain atomic values (no multi-valued attributes)
- No repeating groups within entities

Second Normal Form (2NF)

- The database is in 1NF
- All non-key attributes are fully functionally dependent on the primary key
- Appropriate use of composite keys in junction tables (VICTIM_CRIME, CRIME_CRIMINAL)
- No partial dependencies observed

Third Normal Form (3NF)

- The database is in 2NF
- Non-key attributes do not depend on other non-key attributes
- Separated entities for USERS, OFFICER, VICTIM, CRIMINAL, etc. to eliminate transitive dependencies
- Appropriate use of foreign keys to maintain relationships

BCNF Considerations

- Most relations appear to be in BCNF as every determinant is a candidate key
- The careful separation of entities ensures minimal redundancy

Business Rules and Constraints for CRMS

1. Role-Based Access Control:

- The Users table enforces role-based access, where each user has a defined role (e.g., Officer, Admin).

2. Non-Nullable Fields:

- Essential fields such as Firstname, Lastname, Email, and Role in the Users, Victim, Criminal, and Officer tables cannot be null.
- Crime_desc and Date_reported are mandatory in the Crime table.

3. Unique Constraints:

- Email is unique across Users, Victim, and Criminal tables.
- Mobile_No is unique across Users, Officer, and Criminal tables.

4. Foreign Key Constraints:

- Officer_ID, Category_ID, and C_ID in various tables (e.g., Crime, Category, Crime_Status) ensure referential integrity.
- The Crime_Criminal and Victim_Crime tables maintain many-to-many relationships between crimes, criminals, and victims.

5. Composite Primary Keys:

- The Victim_Crime and Crime_Criminal tables use composite primary keys (V_ID, C_ID and C_ID, CR_ID respectively) to ensure unique pairings.

6. Audit Trail:

- Fields like Created_by, Created_at, Updated_by, and Updated_at are included in most tables to track record creation and updates.

7. Crime Status Tracking:

- The Crime_Status table tracks the progress of each crime, including Date_assigned, Date_closed, and Crime_Status.

8. Data Integrity:

- The database design follows First, Second, and Third Normal Forms (1NF, 2NF, 3NF) to minimize redundancy and maintain data integrity.
- BCNF: The design also respects Boyce-Codd Normal Form by ensuring that all determinants are candidate keys.

9. Security and Validation:

- Role-based constraints in the Users table prevent unauthorized access.
- Email validation ensures proper email format and uniqueness.

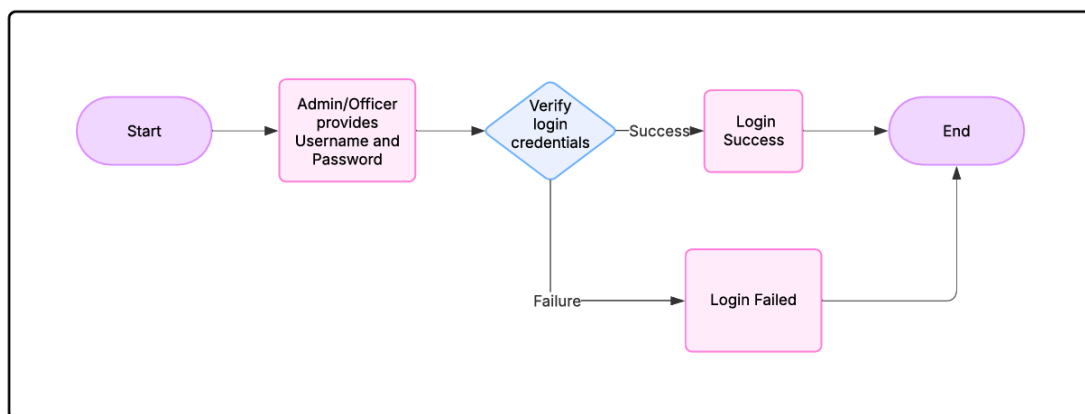
10. Temporal Data Management:

- Timestamp fields (Created_at, Updated_at) and date fields (Date_reported, Date_closed) manage the temporal aspect of crime reporting and investigation.

DFD(Data Flow Diagram)

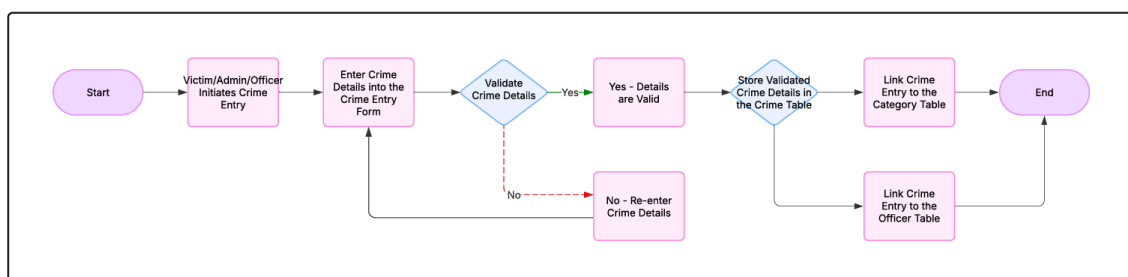
1. User Management

DFD 1: User Registration and Authentication



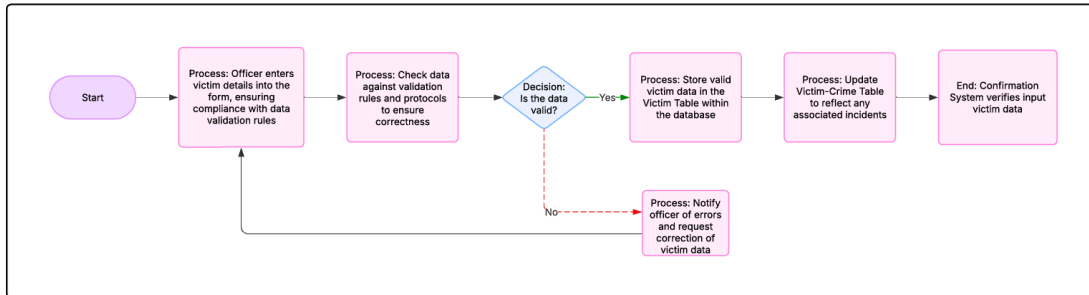
2. Crime Management

DFD 2: Crime Entry and Management



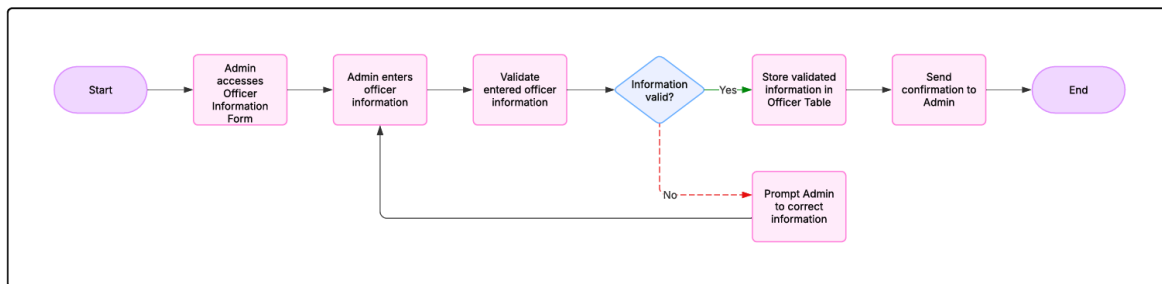
3. Victim and Criminal Management

DFD 3: Victim Information Entry and Management



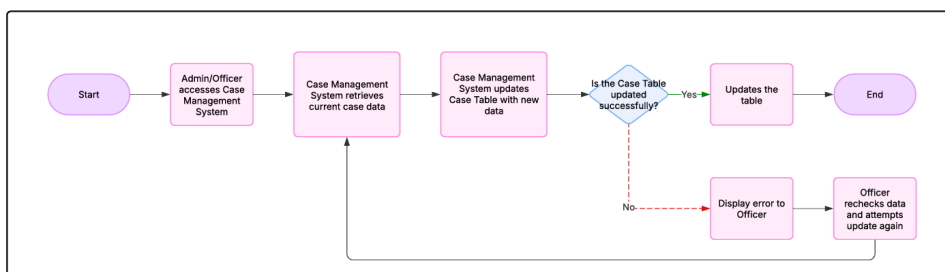
4. Officer Management

DFD 4: Officer Information Entry and Management



5. Case Management and Tracking

DFD 5: Case Assignment and Tracking



6. Category Management

DFD 6: Crime Category Entry and Management

