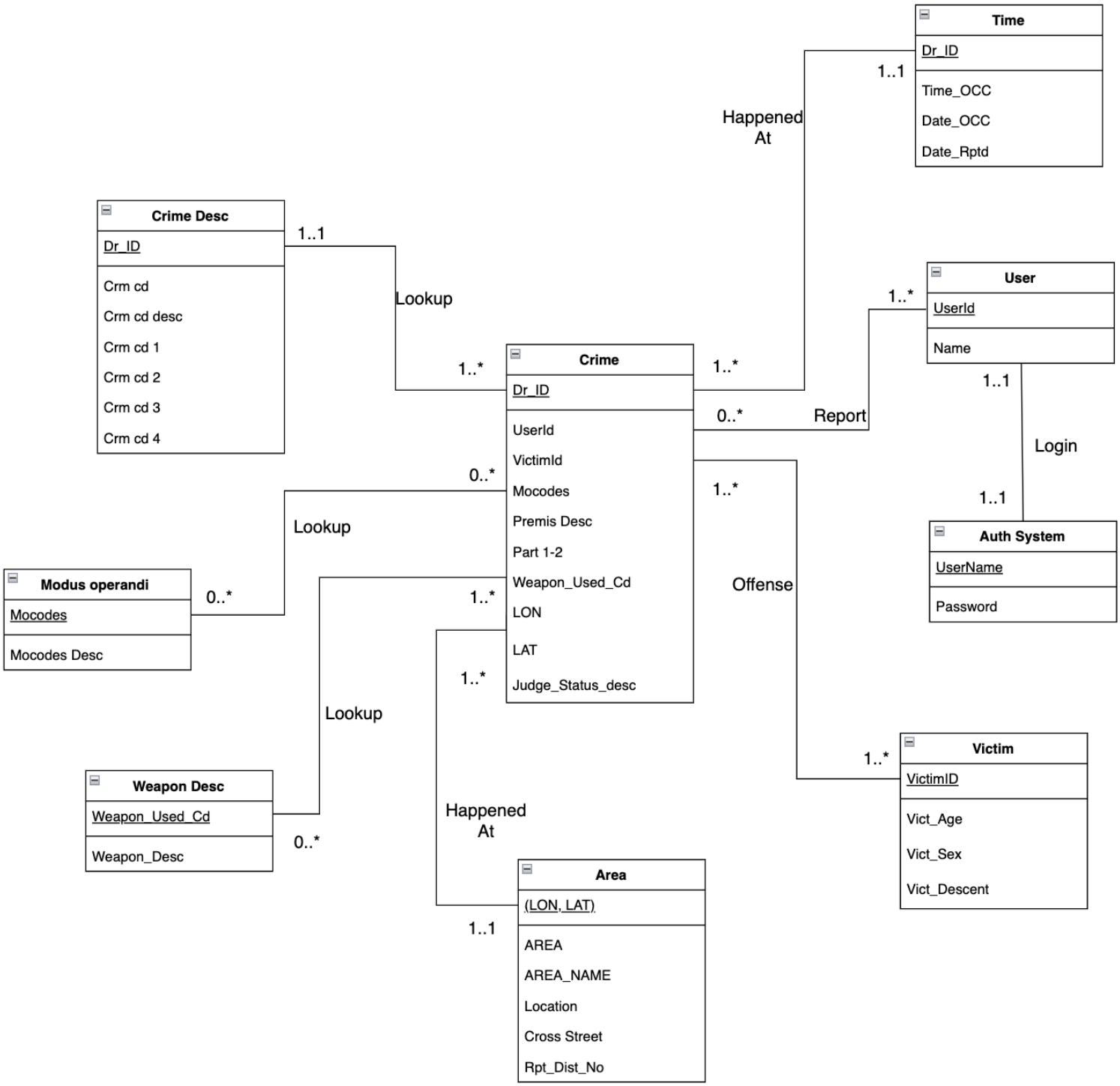
The database conforms to the Third Normal Format (3NF), ensuring optimal performance, data integrity, and minimal redundancy. The structure of each table, including crime, time, user, victim, and region, conforms to the basic standards of 3NF. Each table has a 1NF structure with each row uniquely identified by a primary key to ensure atomicity of data. The schema evolves to 2NF, where all non-primary key attributes are functionally fully dependent on the primary key, eliminating partial dependencies. For example, in the Crime table, attributes such as UserId and Mocodes are directly dependent on the primary key Dr_ID.

The elegance of this design is that it follows the 3NF principle, eliminating passing dependencies and ensuring that non-primary key attributes do not depend on other non-primary key attributes. This structure ensures that each piece of information is stored in its logical location, which improves data consistency and reduces the risk of anomalies during data manipulation. Foreign keys create well-defined relationships between tables, enhancing referential integrity and providing a robust foundation for complex queries. In essence, this 3NF-rooted model is a harmonious blend of efficiency, integrity, and flexibility, enabling it to handle diverse data sets while ensuring smooth operations and reliable data retrieval, a perfect fit for the complex requirements and specifications of the project.

Functional Dependency

1. Dr_ID -> {VictimId, Mocodes, UserId, Premis Desc, Part1-2, Weapon_Used_Cd, LON, LAT, Judge_Status_desc}
2. Dr_ID -> {Crm cd, Crm cd desc, crm cd1, crm cd2, crm cd3, crm cd4}
3. Dr_ID -> {Time_OCC, Date_OCC, Date_Rptd}
4. Mocodes -> Mocode Desc
5. Weapon_Used_Cd -> Weapon Desc
6. UserId -> Name
7. UserName -> Password
8. VictimId -> {Vict_Age, Vict_Sex, Vict_Descent}
9. {LON, LAT} -> {Area, Area_Name, Location, Cross Street, Rpt_Dist_No}

There is no redundancy among those dependencies. Every nontrivial FD listed above satisfies “the left hand side of the arrow is a superkey for the relation” so the database schema is normalized after creation.


Time
Dr_ID
Time_OCC
Date_OCC
Date_Rptd
1..1
Happened At
Crime Desc
Dr_ID
Crm cd
Crm cd desc
Crm cd 1
Crm cd 2
Crm cd 3
Crm cd 4
1..1
Lookup
1..*
Crime
Dr_ID
UserId
VictimId
Mocodes
Premis Desc
Part 1-2
Weapon_Used_Cd
LON
LAT
Judge_Status_desc
1..*
0..*
Report
1..*
User
UserId
Name
1..1
Login
1..1
Auth System
UserName
Password
0..*
Lookup
Modus operandi
Mocodes
Mocodes Desc
0..*
1..*
Offense
1..*
Victim
VictimID
Vict_Age
Vict_Sex
Vict_Descent
Lookup
Weapon Desc
Weapon_Used_Cd
Weapon_Desc
0..*
1..*
Happened At
Area
(LON, LAT)
AREA
AREA_NAME
Location
Cross Street
Rpt_Dist_No
1..1

Relational Schema

Crime Table:
Schema:
Crime(Dr_ID:VARCHAR(255) [PK], UserId:VARCHAR(255) [FK to User.UserId], VictimId: VARCHAR(255) [FK to Victim.VictimID], Mocodes:VARCHAR(255) [FK to ModusOperandi.Mocodes], PremisDesc:VARCHAR(255), Part1-2:VARCHAR(255), Weapon_Used_Cd:VARCHAR(255) [FK to WeaponDesc.WeaponUsedCd], LON: INT, LAT: INT, Judge_Status_desc: VARCHAR(255))
Description:
Stores information about crimes, including details about the crime, location, and associated user and victim. Each crime is uniquely identified by Dr_ID.

Time Table:
Schema:
Time(Dr_ID:VARCHAR(255) [PK] [FK to Crime.Dr_ID], Time_OCC:VARCHAR(255), Date_OCC:VARCHAR(255), Date_Rptd:VARCHAR(255))
Description:
Contains time-related information for each crime. Each entry is associated with a specific crime record.

User Table:
Schema:
User(UserId:VARCHAR(255) [PK], Name:VARCHAR(255))
Description:
Holds information about users who report crimes. Each user is uniquely identified by UserId.

Victim Table:
Schema:
Victim(VictimID:VARCHAR(255) [PK], Vict_Age:INT, Vict_Sex:VARCHAR(255), Vict_Descent:VARCHAR(255))
Description:
Contains information about crime victims, including age, sex, and descent. Each victim is uniquely identified by VictimID.

Area Table:
Schema:
Area(LON:INT, LAT:INT [PK], AREA:VARCHAR(255), Area_NAME:VARCHAR(255), Location:VARCHAR(255), CrossStreet:VARCHAR(255), Rpt_Dist_No:VARCHAR(255))
Description:
Stores information about different areas where crimes occurred, including specific location details and reporting district numbers.

WeaponDesc Table:

Schema:
WeaponDesc(WeaponUsedCd:VARCHAR(255) [PK], Weapon_Desc:VARCHAR(255))
Description:
Contains descriptions of weapons used in crimes, indexed by a unique weapon code.

ModusOperandi Table:
Schema:
ModusOperandi(Mocodes:VARCHAR(255) [PK], MocodesDesc:VARCHAR(255))
Description:
Holds information about the modus operandi of crimes, each uniquely identified by a code.

CrimeDesc Table:
Schema:
CrimeDesc(Dr_ID:VARCHAR(255) [PK] [FK to Crime.Dr_ID], CrmCd:VARCHAR(255), CrmCdDesc:VARCHAR(255), CrmCd1:VARCHAR(255), CrmCd2:VARCHAR(255), CrmCd3:VARCHAR(255), CrmCd4:VARCHAR(255))
Description:
Contains detailed descriptions of crimes, each associated with a specific crime record.

AuthSystem Table:
Schema:
AuthSystem(UserName:VARCHAR(255) [PK], Password:VARCHAR(255))
Description:
Holds authentication information about users' login. Each user is uniquely identified by UserName.

Relationship Description / Assumption

1. Each crime **happens at** a specific time and there could be some other crimes going on at the same time. Each crime **happens at** a specific area and there could be multiple crimes going on at the same place.
2. Weapon Used Id, as an attribute in the crime table should always **look up** Weapon Desc for description. A crime can involve zero to many weapons while the same weapon might appear in different crimes.
3. A crime can have zero to many modus operandi while each modus operandi in the table may appear in crime zero to many times. A crime needs to use Modus code to **look up** the Modus Operandi table for description.
4. A crime should **look up** the crime description. The same description may appear in multiple crimes.
5. Users can **report** a crime. A crime can be reported by one or multiple users. And a user can report zero to many crimes.
6. Users can **login** to the system by going through the authentication process. User login to his/her account is one to one relationship.
7. A crime could **offend** one or multiple victims, and each victim may suffer from one to many crimes.