**Semester Project Details**

**Project Member (Tayyab Tahir & Muhammad Umar)**

**Roll Numbers: 110844 & 110845**

**Project Statement:**

Bike Rental App with Damage Logs and Geo Fencing Bikes are rented via mobile app and unlocked using QR codes. Customers upload license verification. GPS restricts bikes within operational zones. Damaged or abandoned bikes are reported by users and scheduled for pickup. Discounts apply for users who park at designated zones. Late return fines apply.

**Entities:**

**User: Represents individuals who rent bikes.**

**Attributes:**

* User-ID (Primary Key, unique identifier)
* First-Name
* Last-Name
* Email
* Phone-Number
* License-Image-URL (Link to uploaded license verification)
* Registration-Date
* Payment-Information (Potentially a separate entity or stored securely)
* Rental-History (Potentially a link to a list of past rentals)

**Bike: Represents the physical bicycles available for rent**.

**Attributes:**

* Bike-ID (Primary Key, unique identifier, e.g., serial number)
* QR-Code (Unique identifier for unlocking)
* Status (e.g., Available, Rented, Damaged, Out of Service)
* Location (GPS coordinates - Latitude, Longitude)
* Model
* Date-Added

**Rental: Represents a single instance of a bike being rented by a user.**

**Attributes:**

* Rental-ID (Primary Key, unique identifier)
* User-ID (Foreign Key, links to the User entity)
* Bike-ID (Foreign Key, links to the Bike entity)
* Start-Time (Timestamp of when the rental began)
* End-Time (Timestamp of when the rental ended)
* Start-Location (GPS coordinates)
* End-Location (GPS coordinates)
* Rental-Fee
* Late-Return-Fee (If applicable)
* Discount-Applied (Boolean or amount, if applicable)
* Designated-Parking-Used (Boolean, indicates if parked in a designated zone)

**Damage Report: Represents reports submitted by users about damaged or abandoned bikes.**

**Attributes:**

* Report-ID (Primary Key, unique identifier)
* Bike-ID (Foreign Key, links to the Bike entity)
* Reporter-User-ID (Foreign Key, links to the User entity who reported it)
* Report-Time (Timestamp of when the report was submitted)
* Description (Details of the damage or abandonment)
* Location-Reported (GPS coordinates of the reported location)
* Status (e.g., Pending Pickup, Scheduled Pickup, Resolved)

**Operational Zone: Represents the geographically defined areas where bike rentals are allowed.**

**Attributes:**

* Zone-ID (Primary Key, unique identifier)
* Name (e.g., "City Center Zone", "University Area")
* Polygon Coordinates (Defines the boundaries of the zone - a list of GPS coordinates)

**Designated Parking Zone: Represents specific locations where users can park to receive discounts.**

**Attributes:**

* Parking Zone-ID (Primary Key, unique identifier)
* Name (e.g., "Main Street Parking", "Park Entrance")
* Coordinates (GPS coordinates of the parking zone)
* Discount-Percentage (The percentage discount offered for parking here)

**Pickup Schedule: Represents scheduled pickups for damaged or abandoned bikes.**

**Attributes:**

* Schedule-ID (Primary Key, unique identifier)
* Report-ID (Foreign Key, links to the Damage Report entity)
* Scheduled-Time (Date and time for pickup)
* Pickup-Location (GPS coordinates)
* Assigned-Personnel (Optional, identifier for the staff assigned for pickup)
* Status (e.g., Scheduled, In Progress, Completed)

**Relationships:**

**User rents Bike:** (One-to-Many) A user can rent multiple bikes over time, and a bike can be rented by multiple users over time (through different rental instances). This is mediated by the Rental entity.

**Rental belongs to User:** (Many-to-One) Each rental is associated with one user.

**Rental uses Bike:** (Many-to-One) Each rental uses one specific bike.

**User reports Damage Report:** (One-to-Many) A user can submit multiple damage reports.

**Damage Report is reported by User:** (Many-to-One) Each damage report is submitted by one user.

**Bike is subject of Damage Report:** (One-to-Many) A bike can be the subject of multiple damage reports over its lifetime.

**Damage Report concerns Bike:** (Many-to-One) Each damage report concerns one specific bike.

**Bike is within Operational Zone:** (Many-to-Many) A bike can potentially be within multiple operational zones (though at any given time, its location will fall within one or none). Operational zones contain many bikes.

**Rental ends at Designated Parking Zone:** (Many-to-One, Optional) A rental might end at a designated parking zone.

**Designated Parking Zone is used by Rental:** (One-to-Many) A designated parking zone can be the end point for multiple rentals.

**Damage Report is scheduled for Pickup Schedule:** (One-to-One) Each damage report that requires pickup will have one corresponding pickup schedule.

**Pickup Schedule is for Damage Report:** (One-to-One) Each pickup schedule is for one specific damage report.

**Data Model Considerations:**

You might consider adding an entity for Payment Transactions to track payments for rentals and fines.

User Authentication and Authorization would be crucial but might be considered separate modules rather than core entities.

The Location attribute for Bike will be frequently updated via GPS.

The Polygon Coordinates for Operational Zone would likely be stored as a data structure that allows for efficient point-in-polygon checks.

This breakdown provides a foundational understanding of the entities, their key attributes, and the relationships between them for your bike rental app. A more detailed design would involve specifying data types, constraints, and further refining the relationships.