PES UNIVERSITY
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Department of Computer Science and Engineering
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UE23CS351A
DATABASE MANAGEMENT SYSTEMS (DBMS)

PROJECT REPORT on

<RedLens>

Submitted by: Team Code: _____005-055_____

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Introduction

1. **Problem Statement -**

   RedLens - A GIS-powered database designed to store, analyse, and visualise crime data for hotspot detection and safety scoring.

2. **Short Description**

   RedLens is a database-driven system designed to enhance public safety by utilising geospatial intelligence and crime data analytics. The project integrates a GIS-powered database that stores detailed information about crimes, criminals, police stations, officers, and affected locations. Using this data, the database identifies crime hotspots, calculates area-based safety scores, and provides interactive visualisations on maps to facilitate a better understanding of crime patterns.

User Requirements Specification

1. General Requirements

- The system should allow users to log in with role-based access (admin, analyst, public user)
- The system should allow only “public” users to sign up
- The system should provide an interface that includes:
  - For public users - GIS-powered hotspot maps and safety scores, tab to search for crime rates area-wise, section to report crimes, submit reports, and manage their account
  - For admin - an interface that allows the admin to check and verify citizen reports, upload them onto the database, and manage all user accounts
  - For the analyst - interface to access all verified records, and filter records based on location
- The system should ensure security and allow only admins to modify data

2. Role Specific Requirements

Analyst

- Directly interact with and query the database for verified crime records.
- Generate and visualise hotspots & safety scores on a map.
- Generate reports and calculate safety scores using the hotspot maps generated previously

Admin

- Should be able to verify/discard citizen reports before officially storing (add, update, delete) in the crime records
- Should be able to manage user accounts
- Should be able to manage locations (add/update latitude, longitude, area names)

Public User / Citizen

Should be able to:

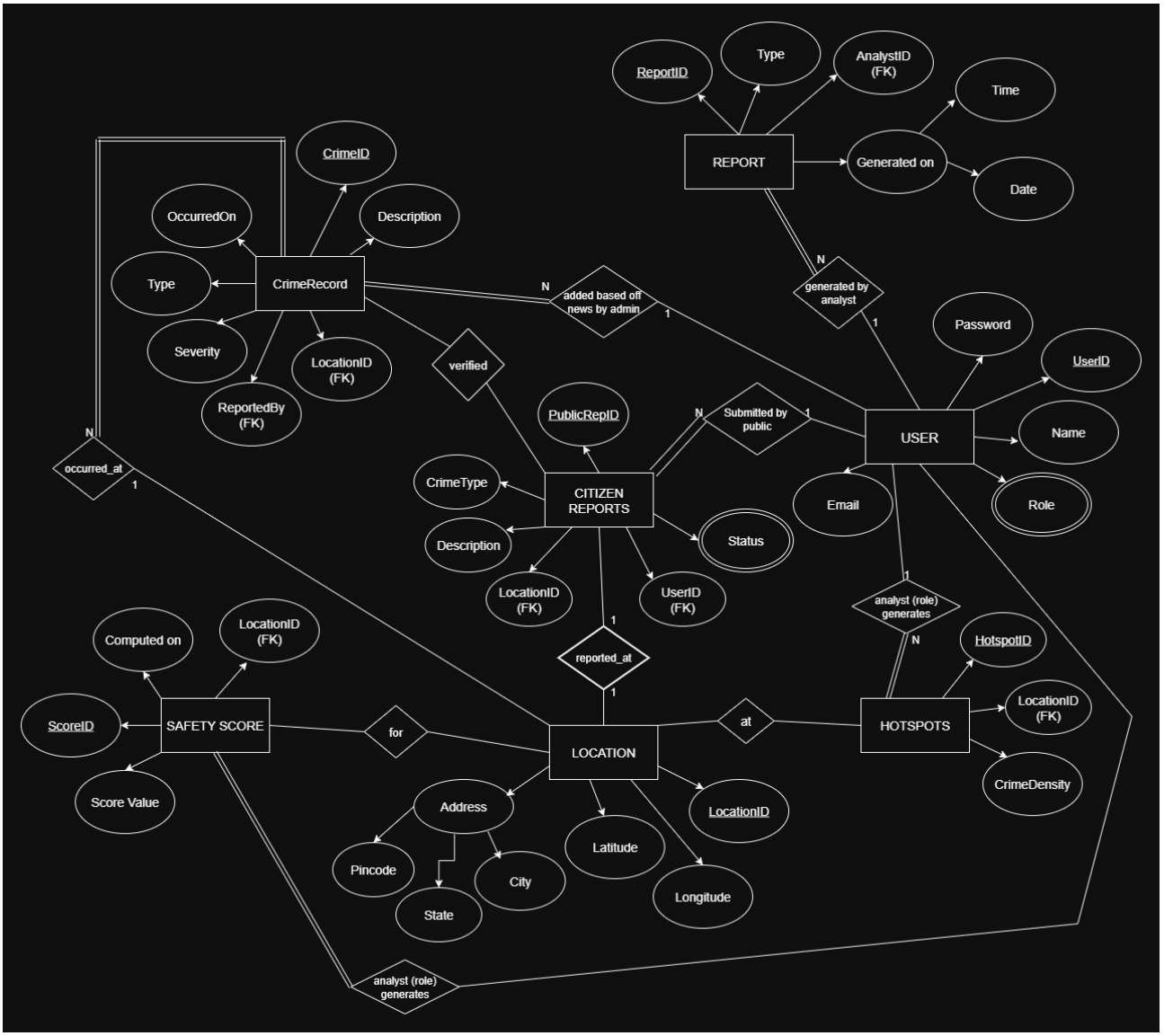
- View safety scores and hotspot maps of neighbourhoods.
- Search/filter area-wise crime rates based on area, type or severity.
- Report crimes in a certain area through forms (verified by admin later)
- View profile, logout, or delete account

3. System Requirements

- There should be no redundancy in crime entries.
- The hotspot map should be rendering within due time
- The system should ensure data security and prevent unauthorised access to admin privileges.
- The system should integrate GIS well with at least 6 decimal precision
- The system should have a good response time.

E-R Model

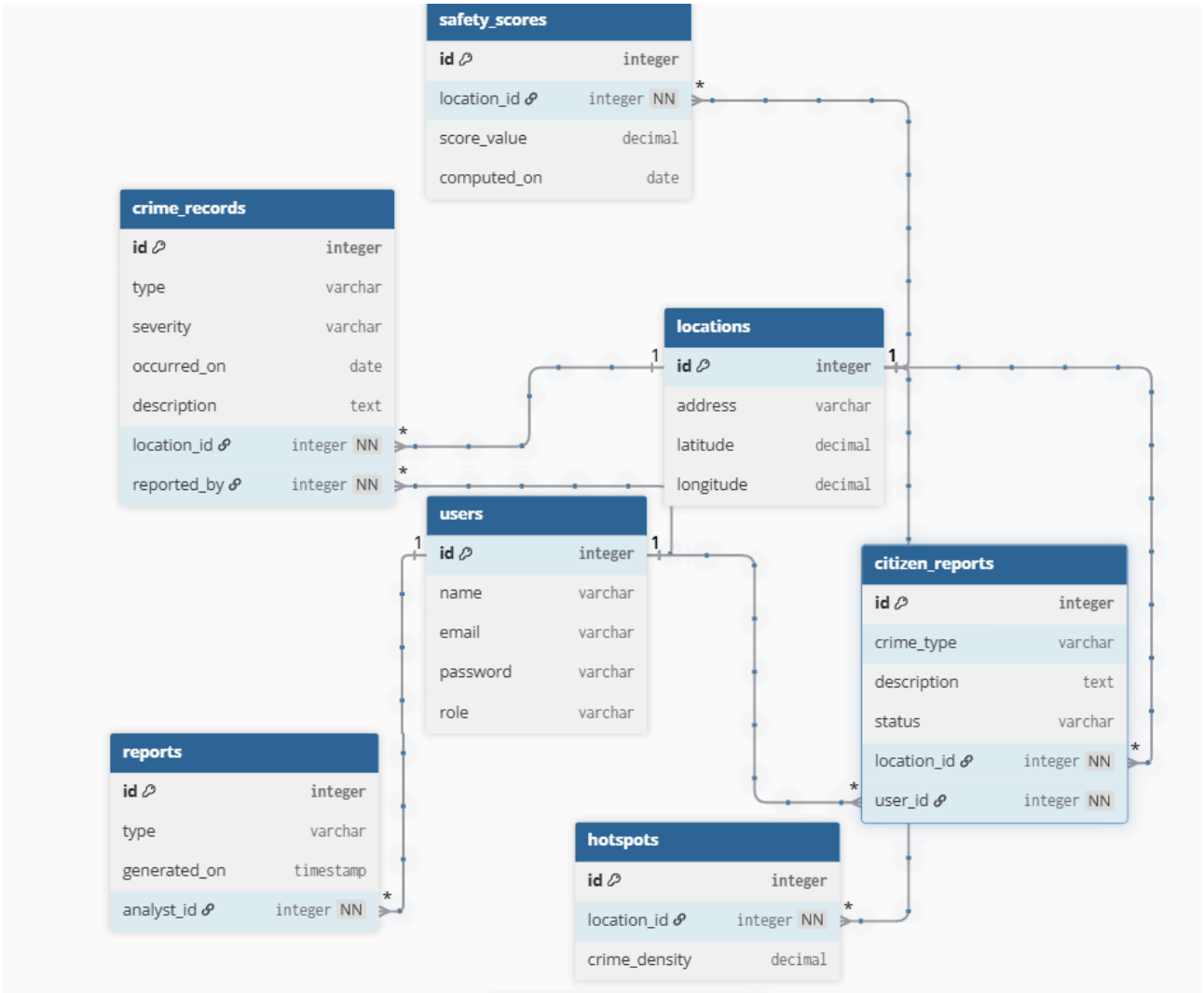
- **List of Entities {highlight Weak ones}**
  Safety scores, hotspots, reports
- **ERD from a tool like draw.io**



Relational Model

- **List of Relations** {label those that are not Entities in ER Model}
  User->CrimeRecord (verified and reported by), User->CrimeRecord (Reviewedby), User->Safetyscore (computedby), User->Hotspots (computedby), User->Reports (generatedby), location->crimerecord, location->safetyscores, location->hotspots, CrimeRecord → CitizenReports (derived) , CrimeRecord → Hotspots (derived), CrimeRecord → SafetyScore (derived)

- **Schema Diagram**



SQL DDL Statements

```
        -- ============================================
-- RedLens Database - Enhanced DDL Statements
-- GIS-powered crime analysis with hotspot detection
-- ============================================

DROP DATABASE IF EXISTS RedLens;
CREATE DATABASE RedLens;
USE RedLens;

-- ============================================
-- TABLE: User (Role-based access control)
-- ============================================
CREATE TABLE User (
    UserID VARCHAR(10) PRIMARY KEY,
    Name VARCHAR(100) NOT NULL,
    Role VARCHAR(20) NOT NULL CHECK (Role IN ('Admin', 'Analyst', 'Public')),
    Email VARCHAR(100) UNIQUE NOT NULL,
    Password VARCHAR(255) NOT NULL,  -- For hashed passwords
    PhoneNumber VARCHAR(15),
    IsActive BOOLEAN DEFAULT TRUE,
    CreatedAt TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    LastLogin TIMESTAMP NULL,
    UpdatedAt TIMESTAMP DEFAULT CURRENT_TIMESTAMP ON UPDATE
CURRENT_TIMESTAMP,
    INDEX idx_user_email (Email),
    INDEX idx_user_role (Role),
    INDEX idx_user_active (IsActive)
);

-- ============================================
-- TABLE: CrimeCategory
-- ============================================
CREATE TABLE CrimeCategory (
    CategoryID INT AUTO_INCREMENT PRIMARY KEY,
    CategoryName VARCHAR(50) UNIQUE NOT NULL,
    Description TEXT,
    SeverityWeight DECIMAL(3,2) DEFAULT 1.0,  -- Weight for safety score calculation
    CreatedAt TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    INDEX idx_category_name (CategoryName)
```

```
);

-- ============================================
-- TABLE: Location (GIS-powered with 6 decimal precision)
-- ============================================
CREATE TABLE Location (
    LocationID INT AUTO_INCREMENT PRIMARY KEY,
    Address VARCHAR(200),
    AreaName VARCHAR(100) NOT NULL,  -- For neighborhood grouping (required)
    Landmark VARCHAR(100),  -- NEW: Nearby landmark for better identification
    City VARCHAR(100) DEFAULT 'Bengaluru',
    State VARCHAR(100) DEFAULT 'Karnataka',
    Pincode VARCHAR(10),
    Latitude DECIMAL(9, 6) NOT NULL,  -- 6 decimal precision as per requirements
    Longitude DECIMAL(9, 6) NOT NULL,  -- 6 decimal precision
    IsVerified BOOLEAN DEFAULT FALSE,  -- Admin verification flag
    Status VARCHAR(20) DEFAULT 'Active' CHECK (Status IN ('Active', 'Inactive', 'Under
Review')),  -- NEW
    CreatedAt TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    UpdatedAt TIMESTAMP DEFAULT CURRENT_TIMESTAMP ON UPDATE
CURRENT_TIMESTAMP,
    INDEX idx_location_area (AreaName),
    INDEX idx_location_pincode (Pincode),
    INDEX idx_location_coords (Latitude, Longitude),
    INDEX idx_location_verified (IsVerified),
    INDEX idx_location_status (Status),  -- NEW
    -- Ensure unique coordinates to avoid redundancy
    UNIQUE KEY unique_coords (Latitude, Longitude)
);

-- ============================================
-- TABLE: CrimeRecord (Verified crimes only)
-- ============================================
CREATE TABLE CrimeRecord (
    CrimeID INT AUTO_INCREMENT PRIMARY KEY,
    Type VARCHAR(50) NOT NULL,
    CategoryID INT NOT NULL,
    Severity VARCHAR(20) NOT NULL CHECK (Severity IN ('Low', 'Medium', 'High')),
    Description TEXT,
    OccurredOn DATE NOT NULL,
    OccurredTime TIME,  -- NEW: Time of crime occurrence
    ReportedBy VARCHAR(10),  -- User who reported (can be null for system-generated)
    VerifiedBy VARCHAR(10),  -- NEW: Admin who verified this record
```

```
    VerifiedOn TIMESTAMP,  -- NEW: When it was verified
    LocationID INT NOT NULL,
    Status VARCHAR(20) DEFAULT 'Active' CHECK (Status IN ('Active', 'Resolved', 'Under
Investigation')),
    CreatedAt TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    UpdatedAt TIMESTAMP DEFAULT CURRENT_TIMESTAMP ON UPDATE
CURRENT_TIMESTAMP,
    FOREIGN KEY (ReportedBy) REFERENCES User(UserID) ON DELETE SET NULL,
    FOREIGN KEY (VerifiedBy) REFERENCES User(UserID) ON DELETE SET NULL,
    FOREIGN KEY (LocationID) REFERENCES Location(LocationID) ON DELETE
CASCADE,
    FOREIGN KEY (CategoryID) REFERENCES CrimeCategory(CategoryID) ON DELETE
RESTRICT,
    INDEX idx_crime_date (OccurredOn),
    INDEX idx_crime_location (LocationID),
    INDEX idx_crime_severity (Severity),
    INDEX idx_crime_type (Type),
    INDEX idx_crime_category (CategoryID),
    INDEX idx_crime_status (Status),
    INDEX idx_crime_verified (VerifiedBy, VerifiedOn)
);

-- ============================================
-- TABLE: CitizenReports (Unverified reports from public)
-- ============================================
CREATE TABLE CitizenReports (
    PublicReportID INT AUTO_INCREMENT PRIMARY KEY,
    CrimeType VARCHAR(50) NOT NULL,
    CategoryID INT,  -- NEW: Link to crime category
    Severity VARCHAR(20) CHECK (Severity IN ('Low', 'Medium', 'High')),
    Description TEXT NOT NULL,
    IncidentDate DATE,  -- NEW: When the crime occurred
    IncidentTime TIME,  -- NEW: Time of incident
    Status VARCHAR(20) DEFAULT 'Pending' CHECK (Status IN ('Pending', 'Verified',
'Rejected')),
    SubmittedOn TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    ReviewedBy VARCHAR(10),  -- Admin who reviewed
    ReviewedOn TIMESTAMP,
    RejectionReason TEXT,
    LinkedCrimeID INT,  -- NEW: Reference to CrimeRecord if verified
    UserID VARCHAR(10) NOT NULL,
    LocationID INT NOT NULL,
    AttachmentURL VARCHAR(500),  -- NEW: Optional evidence/photo
```

```
    FOREIGN KEY (UserID) REFERENCES User(UserID) ON DELETE CASCADE,
    FOREIGN KEY (ReviewedBy) REFERENCES User(UserID) ON DELETE SET NULL,
    FOREIGN KEY (LocationID) REFERENCES Location(LocationID) ON DELETE
CASCADE,
    FOREIGN KEY (CategoryID) REFERENCES CrimeCategory(CategoryID) ON DELETE
SET NULL,
    FOREIGN KEY (LinkedCrimeID) REFERENCES CrimeRecord(CrimeID) ON DELETE
SET NULL,
    INDEX idx_citizen_status (Status),
    INDEX idx_citizen_user (UserID),
    INDEX idx_citizen_location (LocationID),
    INDEX idx_citizen_submitted (SubmittedOn),
    INDEX idx_citizen_reviewed (ReviewedBy),
    INDEX idx_citizen_pending (Status, SubmittedOn)
);

-- ============================================
-- TABLE: SafetyScore (Area-based safety scoring)
-- ============================================
CREATE TABLE SafetyScore (
    ScoreID INT AUTO_INCREMENT PRIMARY KEY,
    LocationID INT NOT NULL,
    AreaName VARCHAR(100) NOT NULL,  -- Denormalized for quick area-based queries
    ScoreValue INT NOT NULL CHECK (ScoreValue BETWEEN 0 AND 100),
    CrimeCount INT DEFAULT 0,  -- NEW: Total crimes used in calculation
    HighSeverityCount INT DEFAULT 0,  -- NEW: Count of high severity crimes
    ComputedOn DATE NOT NULL,
    ComputedBy VARCHAR(10),  -- NEW: Analyst who computed
    Algorithm VARCHAR(50) DEFAULT 'Weighted Density',  -- NEW: Algorithm used
    CreatedAt TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    UpdatedAt TIMESTAMP DEFAULT CURRENT_TIMESTAMP ON UPDATE
CURRENT_TIMESTAMP,
    FOREIGN KEY (LocationID) REFERENCES Location(LocationID) ON DELETE
CASCADE,
    FOREIGN KEY (ComputedBy) REFERENCES User(UserID) ON DELETE SET NULL,
    INDEX idx_safety_location (LocationID),
    INDEX idx_safety_area (AreaName),
    INDEX idx_safety_computed (ComputedOn),
    INDEX idx_safety_value (ScoreValue),
    -- Prevent duplicate scores per location per day
    UNIQUE KEY unique_location_date (LocationID, ComputedOn)
);
```

```
-- ============================================
-- TABLE: Hotspots (Crime density mapping)
-- ============================================
CREATE TABLE Hotspots (
    HotspotID INT AUTO_INCREMENT PRIMARY KEY,
    LocationID INT NOT NULL,
    AreaName VARCHAR(100) NOT NULL,  -- Denormalized for quick filtering
    CrimeDensity DECIMAL(5, 2) NOT NULL,  -- Crimes per sq km or similar metric
    CrimeCount INT DEFAULT 0,  -- NEW: Actual crime count
    RadiusMeters INT DEFAULT 500,  -- NEW: Radius considered for hotspot
    RiskLevel VARCHAR(20) CHECK (RiskLevel IN ('Low', 'Medium', 'High', 'Critical')),
    ComputedOn DATE NOT NULL,
    ComputedBy VARCHAR(10),  -- NEW: Analyst who generated
    CreatedAt TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    FOREIGN KEY (LocationID) REFERENCES Location(LocationID) ON DELETE
CASCADE,
    FOREIGN KEY (ComputedBy) REFERENCES User(UserID) ON DELETE SET NULL,
    INDEX idx_hotspot_location (LocationID),
    INDEX idx_hotspot_area (AreaName),
    INDEX idx_hotspot_density (CrimeDensity),
    INDEX idx_hotspot_risk (RiskLevel),
    INDEX idx_hotspot_computed (ComputedOn),
    -- Ensure unique hotspot per location per day
    UNIQUE KEY unique_hotspot_date (LocationID, ComputedOn)
);

-- ============================================
-- TABLE: Reports (Analyst-generated reports)
-- ============================================
CREATE TABLE Reports (
    ReportID INT AUTO_INCREMENT PRIMARY KEY,
    Title VARCHAR(200) NOT NULL,
    Type VARCHAR(50) NOT NULL CHECK (Type IN ('Hotspot Analysis', 'Safety Trend',
'Crime Summary', 'Area Report', 'Custom')),
    Description TEXT,
    StartDate DATE,  -- NEW: Report period start
    EndDate DATE,  -- NEW: Report period end
    FilterArea VARCHAR(100),  -- NEW: Area filter applied
    FilterCrimeType VARCHAR(50),  -- NEW: Crime type filter
    FilterSeverity VARCHAR(20),  -- NEW: Severity filter
    FilterParams JSON,  -- Additional filter criteria
    TotalCrimes INT DEFAULT 0,  -- NEW: Summary stat
    AverageSafetyScore DECIMAL(5,2),  -- NEW: Summary stat
```

```
    GeneratedAt TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    AnalystID VARCHAR(10) NOT NULL,
    ReportFileURL VARCHAR(500),  -- NEW: Path to generated report file
    FOREIGN KEY (AnalystID) REFERENCES User(UserID) ON DELETE CASCADE,
    INDEX idx_report_analyst (AnalystID),
    INDEX idx_report_generated (GeneratedAt),
    INDEX idx_report_type (Type),
    INDEX idx_report_area (FilterArea)
);

-- ============================================
-- TABLE: CrimeAuditLog (Audit trail for data changes)
-- ============================================
CREATE TABLE CrimeAuditLog (
    LogID INT AUTO_INCREMENT PRIMARY KEY,
    EntityType VARCHAR(50) NOT NULL,  -- 'CrimeRecord', 'CitizenReport', 'User', etc.
    EntityID INT NOT NULL,
    Action VARCHAR(20) NOT NULL CHECK (Action IN ('INSERT', 'UPDATE', 'DELETE',
'VERIFY', 'REJECT')),
    PerformedBy VARCHAR(10) NOT NULL,
    PerformedAt TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    OldData JSON,
    NewData JSON,
    ChangeReason TEXT,
    FOREIGN KEY (PerformedBy) REFERENCES User(UserID) ON DELETE CASCADE,
    INDEX idx_audit_entity (EntityType, EntityID),
    INDEX idx_audit_user (PerformedBy),
    INDEX idx_audit_date (PerformedAt),
    INDEX idx_audit_action (Action)
);

-- ============================================
-- TABLE: AreaStatistics (Pre-computed area stats for performance)
-- ============================================
CREATE TABLE AreaStatistics (
    StatID INT AUTO_INCREMENT PRIMARY KEY,
    AreaName VARCHAR(100) NOT NULL UNIQUE,
    TotalCrimes INT DEFAULT 0,
    CrimesLastMonth INT DEFAULT 0,
    CrimesLastYear INT DEFAULT 0,
    HighSeverityCrimes INT DEFAULT 0,
    MostCommonCrimeType VARCHAR(50),
    CurrentSafetyScore INT,
```

```
    LastUpdated TIMESTAMP DEFAULT CURRENT_TIMESTAMP ON UPDATE
CURRENT_TIMESTAMP,
    INDEX idx_area_name (AreaName),
    INDEX idx_area_score (CurrentSafetyScore)
);




-- ============================================
-- VIEWS for Common Queries
-- ============================================

-- View: Active Crimes by Area
CREATE VIEW v_ActiveCrimesByArea AS
SELECT
    l.AreaName,
    l.City,
    COUNT(c.CrimeID) AS CrimeCount,
    SUM(CASE WHEN c.Severity = 'High' THEN 1 ELSE 0 END) AS HighSeverityCount,
    AVG(CASE
        WHEN c.Severity = 'High' THEN 3
        WHEN c.Severity = 'Medium' THEN 2
        ELSE 1
    END) AS AvgSeverityLevel
FROM Location l
LEFT JOIN CrimeRecord c ON l.LocationID = c.LocationID AND c.Status = 'Active'
GROUP BY l.AreaName, l.City;

-- View: Latest Safety Scores by Area
CREATE VIEW v_LatestSafetyScores AS
SELECT
    ss.AreaName,
    ss.ScoreValue,
    ss.CrimeCount,
    ss.ComputedOn,
    CASE
        WHEN ss.ScoreValue >= 80 THEN 'Safe'
        WHEN ss.ScoreValue >= 60 THEN 'Moderate'
        WHEN ss.ScoreValue >= 40 THEN 'Risky'
```

```
        ELSE 'Dangerous'
    END AS RiskCategory
FROM SafetyScore ss
INNER JOIN (
    SELECT AreaName, MAX(ComputedOn) AS MaxDate
    FROM SafetyScore
    GROUP BY AreaName
) latest ON ss.AreaName = latest.AreaName AND ss.ComputedOn = latest.MaxDate;

-- View: Pending Citizen Reports
CREATE VIEW v_PendingReports AS
SELECT
    cr.PublicReportID,
    cr.CrimeType,
    cr.Severity,
    cr.SubmittedOn,
    u.Name AS ReporterName,
    u.Email AS ReporterEmail,
    l.AreaName,
    l.Address,
    DATEDIFF(CURRENT_DATE, cr.SubmittedOn) AS DaysPending
FROM CitizenReports cr
JOIN User u ON cr.UserID = u.UserID
JOIN Location l ON cr.LocationID = l.LocationID
WHERE cr.Status = 'Pending'
ORDER BY cr.SubmittedOn ASC;

-- View: Current Hotspots
CREATE VIEW v_CurrentHotspots AS
SELECT
    h.HotspotID,
    h.AreaName,
    h.CrimeDensity,
    h.CrimeCount,
    h.RiskLevel,
    l.Latitude,
    l.Longitude,
    h.ComputedOn
FROM Hotspots h
JOIN Location l ON h.LocationID = l.LocationID
INNER JOIN (
    SELECT AreaName, MAX(ComputedOn) AS MaxDate
    FROM Hotspots
```

```
    GROUP BY AreaName
) latest ON h.AreaName = latest.AreaName AND h.ComputedOn = latest.MaxDate
WHERE h.RiskLevel IN ('High', 'Critical');

-- ============================================
-- STORED PROCEDURES
-- ============================================

DELIMITER //

-- Procedure: Verify Citizen Report and Create Crime Record
CREATE PROCEDURE sp_VerifyCitizenReport(
    IN p_ReportID INT,
    IN p_AdminID VARCHAR(10),
    IN p_Action VARCHAR(20),  -- 'VERIFY' or 'REJECT'
    IN p_RejectionReason TEXT
)
BEGIN
    DECLARE v_CrimeID INT;
    DECLARE v_UserID VARCHAR(10);
    DECLARE v_LocationID INT;
    DECLARE v_CrimeType VARCHAR(50);
    DECLARE v_CategoryID INT;
    DECLARE v_Severity VARCHAR(20);
    DECLARE v_Description TEXT;
    DECLARE v_IncidentDate DATE;
    DECLARE v_IncidentTime TIME;

    START TRANSACTION;

    IF p_Action = 'VERIFY' THEN
        -- Get report details
        SELECT UserID, LocationID, CrimeType, CategoryID, Severity, Description,
IncidentDate, IncidentTime
        INTO v_UserID, v_LocationID, v_CrimeType, v_CategoryID, v_Severity,
v_Description, v_IncidentDate, v_IncidentTime
        FROM CitizenReports
        WHERE PublicReportID = p_ReportID AND Status = 'Pending';

        -- Create crime record
        INSERT INTO CrimeRecord (Type, CategoryID, Severity, Description, OccurredOn,
OccurredTime,
                                 ReportedBy, VerifiedBy, VerifiedOn, LocationID, Status)
```

```
        VALUES (v_CrimeType, v_CategoryID, v_Severity, v_Description, v_IncidentDate,
v_IncidentTime,
                v_UserID, p_AdminID, CURRENT_TIMESTAMP, v_LocationID, 'Active');

        SET v_CrimeID = LAST_INSERT_ID();

        -- Update citizen report
        UPDATE CitizenReports
        SET Status = 'Verified', ReviewedBy = p_AdminID, ReviewedOn =
CURRENT_TIMESTAMP, LinkedCrimeID = v_CrimeID
        WHERE PublicReportID = p_ReportID;

        -- Log the action
        INSERT INTO CrimeAuditLog (EntityType, EntityID, Action, PerformedBy,
ChangeReason)
        VALUES ('CitizenReport', p_ReportID, 'VERIFY', p_AdminID, 'Report verified and
converted to CrimeRecord');

    ELSE  -- REJECT
        UPDATE CitizenReports
        SET Status = 'Rejected', ReviewedBy = p_AdminID, ReviewedOn =
CURRENT_TIMESTAMP, RejectionReason = p_RejectionReason
        WHERE PublicReportID = p_ReportID;

        -- Log the action
        INSERT INTO CrimeAuditLog (EntityType, EntityID, Action, PerformedBy,
ChangeReason)
        VALUES ('CitizenReport', p_ReportID, 'REJECT', p_AdminID, p_RejectionReason);
    END IF;

    COMMIT;
END //

DELIMITER //
-- Calulate Safety Score
DELIMITER //

DROP PROCEDURE IF EXISTS sp_CalculateSafetyScore //

CREATE PROCEDURE sp_CalculateSafetyScore(
    IN p_AreaName VARCHAR(100),
    IN p_AnalystID VARCHAR(10),
    IN p_DaysBack INT
```

```
)
BEGIN
    DECLARE v_LocationID INT;
    DECLARE v_TotalCrimes INT DEFAULT 0;
    DECLARE v_HighSeverity INT DEFAULT 0;
    DECLARE v_WeightedScore DECIMAL(10,2) DEFAULT 0;
    DECLARE v_SafetyScore INT DEFAULT 50;

    SELECT LocationID INTO v_LocationID
    FROM Location
    WHERE AreaName = p_AreaName
    LIMIT 1;

    IF v_LocationID IS NULL THEN
        SIGNAL SQLSTATE '45000' SET MESSAGE_TEXT = 'Area not found';
    END IF;

    SELECT
        COALESCE(COUNT(*), 0) AS TotalCrimes,
        COALESCE(SUM(CASE WHEN Severity = 'High' THEN 1 ELSE 0 END), 0) AS
HighSeverity
    INTO v_TotalCrimes, v_HighSeverity
    FROM CrimeRecord cr
    JOIN Location l ON cr.LocationID = l.LocationID
    WHERE l.AreaName = p_AreaName
    AND cr.OccurredOn >= DATE_SUB(CURRENT_DATE, INTERVAL p_DaysBack DAY);

    SET v_WeightedScore = v_HighSeverity * 15;
    SET v_SafetyScore = GREATEST(0, LEAST(100, 100 - v_WeightedScore));

    INSERT INTO SafetyScore (LocationID, AreaName, ScoreValue, CrimeCount,
HighSeverityCount,
                             ComputedOn, ComputedBy)
    VALUES (v_LocationID, p_AreaName, v_SafetyScore, v_TotalCrimes, v_HighSeverity,
            CURRENT_DATE, p_AnalystID)
    ON DUPLICATE KEY UPDATE
        ScoreValue = v_SafetyScore,
        CrimeCount = v_TotalCrimes,
        HighSeverityCount = v_HighSeverity,
        ComputedBy = p_AnalystID,
        UpdatedAt = CURRENT_TIMESTAMP;

END //
```

```
DELIMITER ;


-- ============================================
-- TRIGGERS
-- ============================================

DELIMITER //

-- Trigger: Auto-log crime record changes
CREATE TRIGGER trg_CrimeRecord_AfterInsert
AFTER INSERT ON CrimeRecord
FOR EACH ROW
BEGIN
    INSERT INTO CrimeAuditLog (EntityType, EntityID, Action, PerformedBy, NewData)
    VALUES ('CrimeRecord', NEW.CrimeID, 'INSERT', NEW.VerifiedBy,
            JSON_OBJECT('Type', NEW.Type, 'Severity', NEW.Severity, 'LocationID',
NEW.LocationID));
END //

CREATE TRIGGER trg_CrimeRecord_AfterUpdate
AFTER UPDATE ON CrimeRecord
FOR EACH ROW
BEGIN
    INSERT INTO CrimeAuditLog (EntityType, EntityID, Action, PerformedBy, OldData,
NewData)
    VALUES ('CrimeRecord', NEW.CrimeID, 'UPDATE', NEW.VerifiedBy,
            JSON_OBJECT('Type', OLD.Type, 'Severity', OLD.Severity, 'Status', OLD.Status),
            JSON_OBJECT('Type', NEW.Type, 'Severity', NEW.Severity, 'Status',
NEW.Status));
END //

CREATE TRIGGER trg_CrimeRecord_AfterDelete
AFTER DELETE ON CrimeRecord
FOR EACH ROW
BEGIN
    INSERT INTO CrimeAuditLog (EntityType, EntityID, Action, PerformedBy, OldData)
    VALUES ('CrimeRecord', OLD.CrimeID, 'DELETE', OLD.VerifiedBy,
            JSON_OBJECT('Type', OLD.Type, 'Severity', OLD.Severity, 'LocationID',
OLD.LocationID));
END //
```

```
-- Trigger: Update AreaStatistics when crime record is added
CREATE TRIGGER trg_UpdateAreaStats_AfterCrimeInsert
AFTER INSERT ON CrimeRecord
FOR EACH ROW
BEGIN
   DECLARE v_AreaName VARCHAR(100);

   SELECT AreaName INTO v_AreaName
   FROM Location WHERE LocationID = NEW.LocationID;

   INSERT INTO AreaStatistics (AreaName, TotalCrimes, HighSeverityCrimes,
LastUpdated)
   VALUES (v_AreaName, 1, IF(NEW.Severity = 'High', 1, 0), CURRENT_TIMESTAMP)
   ON DUPLICATE KEY UPDATE
      TotalCrimes = TotalCrimes + 1,
      HighSeverityCrimes = HighSeverityCrimes + IF(NEW.Severity = 'High', 1, 0),
      LastUpdated = CURRENT_TIMESTAMP;
END //

-- Trigger: Prevent deletion of verified crime records (soft delete only)
CREATE TRIGGER trg_PreventCrimeDeletion
BEFORE DELETE ON CrimeRecord
FOR EACH ROW
BEGIN
   SIGNAL SQLSTATE '45000'
   SET MESSAGE_TEXT = 'Cannot delete verified crime records. Update status to
Resolved instead.';
END //

-- Trigger: Validate location coordinates are within Karnataka bounds
CREATE TRIGGER trg_ValidateLocationCoordinates
BEFORE INSERT ON Location
FOR EACH ROW
BEGIN
   -- Karnataka approximate bounds: Lat 11.5-18.5, Long 74-78.5
   IF NEW.Latitude < 11.5 OR NEW.Latitude > 18.5 OR
      NEW.Longitude < 74.0 OR NEW.Longitude > 78.5 THEN
      SIGNAL SQLSTATE '45000'
      SET MESSAGE_TEXT = 'Coordinates must be within Karnataka bounds';
   END IF;
END //

-- Trigger: Auto-reject old pending reports (30+ days)
```

```
CREATE TRIGGER trg_AutoRejectOldReports
BEFORE UPDATE ON CitizenReports
FOR EACH ROW
BEGIN
    IF OLD.Status = 'Pending' AND
       DATEDIFF(CURRENT_DATE, OLD.SubmittedOn) > 30 AND
       NEW.Status = 'Pending' THEN
        SET NEW.Status = 'Rejected';
        SET NEW.RejectionReason = 'Auto-rejected: Report older than 30 days';
        SET NEW.ReviewedOn = CURRENT_TIMESTAMP;
    END IF;
END //

-- Trigger: Prevent public users from creating admin/analyst accounts
CREATE TRIGGER trg_ValidateUserRole
BEFORE INSERT ON User
FOR EACH ROW
BEGIN
    IF NEW.Role IN ('Admin', 'Analyst') AND NEW.UserID NOT LIKE 'ADM%' AND
NEW.UserID NOT LIKE 'ANL%' THEN
        SIGNAL SQLSTATE '45000'
        SET MESSAGE_TEXT = 'Invalid UserID format for Admin/Analyst role';
    END IF;
END //

-- Trigger: Update LastLogin on authentication (simulated)
CREATE TRIGGER trg_UpdateLastLogin
BEFORE UPDATE ON User
FOR EACH ROW
BEGIN
    IF NEW.Password != OLD.Password THEN
        SET NEW.LastLogin = CURRENT_TIMESTAMP;
    END IF;
END //

DELIMITER ;

-- ============================================
-- ADDITIONAL STORED PROCEDURES
-- ============================================

DELIMITER //
```

```
-- Procedure: Get Crime Statistics for Area
CREATE PROCEDURE sp_GetAreaCrimeStats(
    IN p_AreaName VARCHAR(100),
    IN p_StartDate DATE,
    IN p_EndDate DATE
)
BEGIN
    SELECT
        cc.CategoryName,
        COUNT(*) AS CrimeCount,
        SUM(CASE WHEN cr.Severity = 'High' THEN 1 ELSE 0 END) AS HighSeverityCount,
        SUM(CASE WHEN cr.Severity = 'Medium' THEN 1 ELSE 0 END) AS
MediumSeverityCount,
        SUM(CASE WHEN cr.Severity = 'Low' THEN 1 ELSE 0 END) AS LowSeverityCount
    FROM CrimeRecord cr
    JOIN Location l ON cr.LocationID = l.LocationID
    JOIN CrimeCategory cc ON cr.CategoryID = cc.CategoryID
    WHERE l.AreaName = p_AreaName
    AND cr.OccurredOn BETWEEN p_StartDate AND p_EndDate
    GROUP BY cc.CategoryName
    ORDER BY CrimeCount DESC;
END //

-- Procedure: Identify Crime Hotspots
CREATE PROCEDURE sp_IdentifyHotspots(
    IN p_AnalystID VARCHAR(10),
    IN p_DaysBack INT,
    IN p_RadiusMeters INT
)
BEGIN
    -- This is a simplified version. Real implementation would use spatial functions
    INSERT INTO Hotspots (LocationID, AreaName, CrimeDensity, CrimeCount,
RadiusMeters,
                          RiskLevel, ComputedOn, ComputedBy)
    SELECT
        l.LocationID,
        l.AreaName,
        COUNT(cr.CrimeID) / p_RadiusMeters * 1000 AS CrimeDensity,
        COUNT(cr.CrimeID) AS CrimeCount,
        p_RadiusMeters,
        CASE
            WHEN COUNT(cr.CrimeID) >= 20 THEN 'Critical'
            WHEN COUNT(cr.CrimeID) >= 10 THEN 'High'
```

```
            WHEN COUNT(cr.CrimeID) >= 5 THEN 'Medium'
            ELSE 'Low'
        END AS RiskLevel,
        CURRENT_DATE,
        p_AnalystID
    FROM Location l
    LEFT JOIN CrimeRecord cr ON l.LocationID = cr.LocationID
        AND cr.OccurredOn >= DATE_SUB(CURRENT_DATE, INTERVAL p_DaysBack
DAY)
    GROUP BY l.LocationID, l.AreaName
    HAVING CrimeCount > 0
    ON DUPLICATE KEY UPDATE
        CrimeDensity = VALUES(CrimeDensity),
        CrimeCount = VALUES(CrimeCount),
        RiskLevel = VALUES(RiskLevel),
        ComputedBy = VALUES(ComputedBy);
END //

-- Procedure: Generate Crime Report
CREATE PROCEDURE sp_GenerateCrimeReport(
    IN p_AnalystID VARCHAR(10),
    IN p_ReportType VARCHAR(50),
    IN p_Title VARCHAR(200),
    IN p_StartDate DATE,
    IN p_EndDate DATE,
    IN p_FilterArea VARCHAR(100),
    IN p_FilterSeverity VARCHAR(20)
)
BEGIN
    DECLARE v_TotalCrimes INT;
    DECLARE v_AvgSafety DECIMAL(5,2);

    -- Count total crimes matching filters
    SELECT COUNT(*), COALESCE(AVG(ss.ScoreValue), 0)
    INTO v_TotalCrimes, v_AvgSafety
    FROM CrimeRecord cr
    JOIN Location l ON cr.LocationID = l.LocationID
    LEFT JOIN SafetyScore ss ON l.AreaName = ss.AreaName
        AND ss.ComputedOn = (SELECT MAX(ComputedOn) FROM SafetyScore WHERE
AreaName = l.AreaName)
    WHERE cr.OccurredOn BETWEEN p_StartDate AND p_EndDate
    AND (p_FilterArea IS NULL OR l.AreaName = p_FilterArea)
    AND (p_FilterSeverity IS NULL OR cr.Severity = p_FilterSeverity);
```

```
    -- Insert report record
    INSERT INTO Reports (Title, Type, StartDate, EndDate, FilterArea, FilterSeverity,
                         TotalCrimes, AverageSafetyScore, AnalystID)
    VALUES (p_Title, p_ReportType, p_StartDate, p_EndDate, p_FilterArea,
p_FilterSeverity,
            v_TotalCrimes, v_AvgSafety, p_AnalystID);

    SELECT LAST_INSERT_ID() AS ReportID, v_TotalCrimes AS TotalCrimes,
v_AvgSafety AS AvgSafetyScore;
END //

-- Procedure: Search Crimes with Filters
CREATE PROCEDURE sp_SearchCrimes(
    IN p_AreaName VARCHAR(100),
    IN p_CrimeType VARCHAR(50),
    IN p_Severity VARCHAR(20),
    IN p_StartDate DATE,
    IN p_EndDate DATE,
    IN p_Limit INT
)
BEGIN
    SELECT
        cr.CrimeID,
        cr.Type,
        cr.Severity,
        cr.Description,
        cr.OccurredOn,
        cr.OccurredTime,
        l.AreaName,
        l.Address,
        l.Latitude,
        l.Longitude,
        cc.CategoryName,
        u.Name AS ReportedByName
    FROM CrimeRecord cr
    JOIN Location l ON cr.LocationID = l.LocationID
    JOIN CrimeCategory cc ON cr.CategoryID = cc.CategoryID
    LEFT JOIN User u ON cr.ReportedBy = u.UserID
    WHERE (p_AreaName IS NULL OR l.AreaName = p_AreaName)
    AND (p_CrimeType IS NULL OR cr.Type LIKE CONCAT('%', p_CrimeType, '%'))
    AND (p_Severity IS NULL OR cr.Severity = p_Severity)
    AND (p_StartDate IS NULL OR cr.OccurredOn >= p_StartDate)
```

```
    AND (p_EndDate IS NULL OR cr.OccurredOn <= p_EndDate)
    AND cr.Status = 'Active'
    ORDER BY cr.OccurredOn DESC
    LIMIT p_Limit;
END //

-- Procedure: Get Safety Score Trend for Area
CREATE PROCEDURE sp_GetSafetyTrend(
    IN p_AreaName VARCHAR(100),
    IN p_DaysBack INT
)
BEGIN
    SELECT
        ComputedOn,
        ScoreValue,
        CrimeCount,
        HighSeverityCount,
        CASE
            WHEN ScoreValue >= 80 THEN 'Safe'
            WHEN ScoreValue >= 60 THEN 'Moderate'
            WHEN ScoreValue >= 40 THEN 'Risky'
            ELSE 'Dangerous'
        END AS RiskCategory
    FROM SafetyScore
    WHERE AreaName = p_AreaName
    AND ComputedOn >= DATE_SUB(CURRENT_DATE, INTERVAL p_DaysBack DAY)
    ORDER BY ComputedOn ASC;
END //

-- Procedure: Batch Update Area Statistics
CREATE PROCEDURE sp_RefreshAllAreaStats()
BEGIN
    TRUNCATE TABLE AreaStatistics;

    INSERT INTO AreaStatistics (AreaName, TotalCrimes, CrimesLastMonth,
CrimesLastYear,
                                HighSeverityCrimes, MostCommonCrimeType, CurrentSafetyScore)
    SELECT
        l.AreaName,
        COUNT(cr.CrimeID) AS TotalCrimes,
        SUM(CASE WHEN cr.OccurredOn >= DATE_SUB(CURRENT_DATE, INTERVAL 30
DAY) THEN 1 ELSE 0 END) AS CrimesLastMonth,
```

```
        SUM(CASE WHEN cr.OccurredOn >= DATE_SUB(CURRENT_DATE, INTERVAL
365 DAY) THEN 1 ELSE 0 END) AS CrimesLastYear,
        SUM(CASE WHEN cr.Severity = 'High' THEN 1 ELSE 0 END) AS
HighSeverityCrimes,
        (SELECT Type FROM CrimeRecord cr2
         JOIN Location l2 ON cr2.LocationID = l2.LocationID
         WHERE l2.AreaName = l.AreaName
         GROUP BY Type ORDER BY COUNT(*) DESC LIMIT 1) AS
MostCommonCrimeType,
        (SELECT ScoreValue FROM SafetyScore ss
         WHERE ss.AreaName = l.AreaName
         ORDER BY ComputedOn DESC LIMIT 1) AS CurrentSafetyScore
    FROM Location l
    LEFT JOIN CrimeRecord cr ON l.LocationID = cr.LocationID
    GROUP BY l.AreaName;
END //

-- Procedure: Delete User Account (with cascading cleanup)
CREATE PROCEDURE sp_DeleteUserAccount(
    IN p_UserID VARCHAR(10),
    IN p_AdminID VARCHAR(10)
)
BEGIN
    DECLARE v_Role VARCHAR(20);

    START TRANSACTION;

    -- Check user role
    SELECT Role INTO v_Role FROM User WHERE UserID = p_UserID;

    IF v_Role IS NULL THEN
        SIGNAL SQLSTATE '45000' SET MESSAGE_TEXT = 'User not found';
    END IF;

    -- Log the deletion
    INSERT INTO CrimeAuditLog (EntityType, EntityID, Action, PerformedBy,
ChangeReason)
    VALUES ('User', p_UserID, 'DELETE', p_AdminID, CONCAT('User account deleted: ',
p_UserID));

    -- Soft delete: deactivate instead of hard delete
    UPDATE User SET IsActive = FALSE WHERE UserID = p_UserID;
```

```
    COMMIT;
END //

DELIMITER ;

-- ============================================
-- FUNCTIONS
-- ============================================

DELIMITER //

-- Function: Calculate distance between two coordinates (Haversine formula)
CREATE FUNCTION fn_CalculateDistance(
    lat1 DECIMAL(9,6), lon1 DECIMAL(9,6),
    lat2 DECIMAL(9,6), lon2 DECIMAL(9,6)
)
RETURNS DECIMAL(10,2)
DETERMINISTIC
BEGIN
    DECLARE R INT DEFAULT 6371; -- Earth radius in km
    DECLARE dLat DECIMAL(10,8);
    DECLARE dLon DECIMAL(10,8);
    DECLARE a DECIMAL(10,8);
    DECLARE c DECIMAL(10,8);

    SET dLat = RADIANS(lat2 - lat1);
    SET dLon = RADIANS(lon2 - lon1);

    SET a = SIN(dLat/2) * SIN(dLat/2) +
            COS(RADIANS(lat1)) * COS(RADIANS(lat2)) *
            SIN(dLon/2) * SIN(dLon/2);

    SET c = 2 * ATAN2(SQRT(a), SQRT(1-a));

    RETURN R * c; -- Distance in km
END //

-- Function: Get Risk Level from Safety Score
CREATE FUNCTION fn_GetRiskLevel(p_SafetyScore INT)
RETURNS VARCHAR(20)
DETERMINISTIC
BEGIN
    RETURN CASE
```

```
        WHEN p_SafetyScore >= 80 THEN 'Safe'
        WHEN p_SafetyScore >= 60 THEN 'Moderate'
        WHEN p_SafetyScore >= 40 THEN 'Risky'
        ELSE 'Dangerous'
    END;
END //

-- Function: Get Crime Count in Radius
CREATE FUNCTION fn_GetCrimeCountInRadius(
    p_Latitude DECIMAL(9,6),
    p_Longitude DECIMAL(9,6),
    p_RadiusKm DECIMAL(5,2),
    p_DaysBack INT
)
RETURNS INT
READS SQL DATA
BEGIN
    DECLARE v_Count INT;

    SELECT COUNT(*) INTO v_Count
    FROM CrimeRecord cr
    JOIN Location l ON cr.LocationID = l.LocationID
    WHERE fn_CalculateDistance(p_Latitude, p_Longitude, l.Latitude, l.Longitude) <=
p_RadiusKm
    AND cr.OccurredOn >= DATE_SUB(CURRENT_DATE, INTERVAL p_DaysBack DAY)
    AND cr.Status = 'Active';

    RETURN v_Count;
END //

-- Function: Check if User is Admin
CREATE FUNCTION fn_IsAdmin(p_UserID VARCHAR(10))
RETURNS BOOLEAN
READS SQL DATA
BEGIN
    DECLARE v_Role VARCHAR(20);
    SELECT Role INTO v_Role FROM User WHERE UserID = p_UserID AND IsActive =
TRUE;
    RETURN v_Role = 'Admin';
END //

-- Function: Get Latest Safety Score for Area
CREATE FUNCTION fn_GetLatestSafetyScore(p_AreaName VARCHAR(100))
```

```
RETURNS INT
READS SQL DATA
BEGIN
    DECLARE v_Score INT;

    SELECT ScoreValue INTO v_Score
    FROM SafetyScore
    WHERE AreaName = p_AreaName
    ORDER BY ComputedOn DESC
    LIMIT 1;

    RETURN COALESCE(v_Score, 50); -- Default to 50 if no score exists
END //

DELIMITER ;

-- ============================================
-- ADDITIONAL CONSTRAINTS
-- ============================================

-- Remove the problematic CHECK constraints
-- ALTER TABLE CrimeRecord DROP CONSTRAINT chk_crime_date_not_future;
-- ALTER TABLE CitizenReports DROP CONSTRAINT chk_report_date_not_future;
-- ALTER TABLE SafetyScore DROP CONSTRAINT chk_score_date_not_future;

-- Create triggers instead
DELIMITER //

CREATE TRIGGER trg_ValidateCrimeDate
BEFORE INSERT ON CrimeRecord
FOR EACH ROW
BEGIN
    IF NEW.OccurredOn > CURRENT_DATE THEN
        SIGNAL SQLSTATE '45000'
        SET MESSAGE_TEXT = 'Crime occurrence date cannot be in the future';
    END IF;
END //

CREATE TRIGGER trg_ValidateCrimeDateUpdate
BEFORE UPDATE ON CrimeRecord
FOR EACH ROW
BEGIN
    IF NEW.OccurredOn > CURRENT_DATE THEN
```

```
        SIGNAL SQLSTATE '45000'
        SET MESSAGE_TEXT = 'Crime occurrence date cannot be in the future';
    END IF;
END //

CREATE TRIGGER trg_ValidateReportDate
BEFORE INSERT ON CitizenReports
FOR EACH ROW
BEGIN
    IF NEW.IncidentDate IS NOT NULL AND NEW.IncidentDate > CURRENT_DATE THEN
        SIGNAL SQLSTATE '45000'
        SET MESSAGE_TEXT = 'Incident date cannot be in the future';
    END IF;
END //

CREATE TRIGGER trg_ValidateReportDateUpdate
BEFORE UPDATE ON CitizenReports
FOR EACH ROW
BEGIN
    IF NEW.IncidentDate IS NOT NULL AND NEW.IncidentDate > CURRENT_DATE THEN
        SIGNAL SQLSTATE '45000'
        SET MESSAGE_TEXT = 'Incident date cannot be in the future';
    END IF;
END //

CREATE TRIGGER trg_ValidateSafetyScoreDate
BEFORE INSERT ON SafetyScore
FOR EACH ROW
BEGIN
    IF NEW.ComputedOn > CURRENT_DATE THEN
        SIGNAL SQLSTATE '45000'
        SET MESSAGE_TEXT = 'Safety score computation date cannot be in the future';
    END IF;
END //

DELIMITER ;


-- Ensure report date range is valid
ALTER TABLE Reports
ADD CONSTRAINT chk_report_date_range
CHECK (StartDate IS NULL OR EndDate IS NULL OR StartDate <= EndDate);
```

```
-- Ensure crime density is non-negative
ALTER TABLE Hotspots
ADD CONSTRAINT chk_crime_density_positive
CHECK (CrimeDensity >= 0);

-- ============================================
-- EVENTS (Scheduled Tasks)
-- ============================================

-- Enable event scheduler
SET GLOBAL event_scheduler = ON;

-- Event: Auto-refresh area statistics daily at midnight
CREATE EVENT evt_RefreshAreaStats
ON SCHEDULE EVERY 1 DAY
STARTS CURRENT_DATE + INTERVAL 1 DAY
DO
    CALL sp_RefreshAllAreaStats();

-- Event: Auto-reject old pending reports weekly
CREATE EVENT evt_CleanupOldReports
ON SCHEDULE EVERY 1 WEEK
STARTS CURRENT_DATE + INTERVAL 1 DAY
DO
    UPDATE CitizenReports
    SET Status = 'Rejected',
        RejectionReason = 'Auto-rejected: Report older than 30 days',
        ReviewedOn = CURRENT_TIMESTAMP
    WHERE Status = 'Pending'
    AND DATEDIFF(CURRENT_DATE, SubmittedOn) > 30;

-- ============================================
-- END OF DDL
```

SQL DML Statements

```
-- ========================================
-- Sample Data for CrimeCategory
-- ========================================
INSERT INTO CrimeCategory (CategoryName, Description, SeverityWeight) VALUES
('Theft', 'Unlawful taking of property', 0.6),
('Assault', 'Physical attack or threat of attack', 0.9),
('Burglary', 'Breaking and entering with intent to commit crime', 0.8),
('Robbery', 'Theft involving force or threat', 1.0),
('Vandalism', 'Willful destruction of property', 0.4),
('Fraud', 'Wrongful deception for financial gain', 0.5),
('Drug-related', 'Possession, distribution, or use of illegal drugs', 0.7),
('Vehicle Crime', 'Theft or damage to vehicles', 0.6),
('Cyber Crime', 'Computer or internet-based crimes', 0.5),
('Domestic Violence', 'Violence within domestic settings', 0.9),
('Murder', 'Unlawful killing of another person', 1.0),
('Sexual Assault', 'Non-consensual sexual contact', 1.0),
('Kidnapping', 'Unlawful abduction of a person', 1.0),
('Arson', 'Willful fire-setting', 0.8),
('Other', 'Crimes not fitting other categories', 0.3);

-- ========================================
-- ============================================================
-- DATA SEED START - RedLens City Crime Intelligence Dataset
-- ============================================================

-- 1 USERS
INSERT INTO User (UserID, Name, Role, Email, Password, PhoneNumber) VALUES
('ADM001', 'Priya Menon', 'Admin', 'priya.admin@redlens.in', 'hashed_pass_1',
'9876543210'),
('ADM002', 'Ravi Sharma', 'Admin', 'ravi.admin@redlens.in', 'hashed_pass_2',
'9812345678'),
('ANL001', 'Sneha Iyer', 'Analyst', 'sneha.analyst@redlens.in', 'hashed_pass_3',
'9823456789'),
('ANL002', 'Arjun Patel', 'Analyst', 'arjun.analyst@redlens.in', 'hashed_pass_4',
'9867891234'),
('ANL003', 'Deepa Rao', 'Analyst', 'deepa.analyst@redlens.in', 'hashed_pass_5',
'9876111222'),
```

('PUB001', 'Aarav Nair', 'Public', 'aarav.public@redlens.in', 'hashed_pass_6',
'9845123456'),
('PUB002', 'Isha Verma', 'Public', 'isha.public@redlens.in', 'hashed_pass_7',
'9822123456'),
('PUB003', 'Karan Das', 'Public', 'karan.public@redlens.in', 'hashed_pass_8',
'9833344556'),
('PUB004', 'Divya Rao', 'Public', 'divya.public@redlens.in', 'hashed_pass_9',
'9812347777'),
('PUB005', 'Rahul Jain', 'Public', 'rahul.public@redlens.in', 'hashed_pass_10',
'9876123456'),
('PUB006', 'Meera Joshi', 'Public', 'meera.public@redlens.in', 'hashed_pass_11',
'9812233445'),
('PUB007', 'Aditya Singh', 'Public', 'aditya.public@redlens.in', 'hashed_pass_12',
'9823450987'),
('PUB008', 'Nisha Bhat', 'Public', 'nisha.public@redlens.in', 'hashed_pass_13',
'9832211987'),
('PUB009', 'Varun Pillai', 'Public', 'varun.public@redlens.in', 'hashed_pass_14',
'9810076543'),
('PUB010', 'Tanya Dey', 'Public', 'tanya.public@redlens.in', 'hashed_pass_15',
'9823098765');

-- 2 LOCATIONS (Bengaluru Neighborhoods)
INSERT INTO Location (Address, AreaName, Landmark, Latitude, Longitude, IsVerified)
VALUES
('100 Feet Road', 'Indiranagar', 'CMH Road', 12.971891, 77.641151, TRUE),
('Forum Mall', 'Koramangala', 'Forum Mall', 12.935223, 77.624482, TRUE),
('MG Road', 'Shivajinagar', 'MG Metro', 12.978142, 77.603292, TRUE),
('Whitefield Main Road', 'Whitefield', 'ITPL', 12.969800, 77.750000, TRUE),
('BTM 2nd Stage', 'BTM Layout', 'Udupi Garden', 12.916575, 77.610116, TRUE),
('Electronic City Phase 1', 'Electronic City', 'Infosys Campus', 12.845214, 77.660169,
TRUE),
('JP Nagar 7th Phase', 'JP Nagar', 'Ragigudda Temple', 12.906342, 77.585682, TRUE),
('Hebbal Flyover', 'Hebbal', 'Esteem Mall', 13.035838, 77.597023, TRUE),
('Yeshwanthpur', 'Yeshwanthpur', 'Orion Mall', 13.020690, 77.554462, TRUE),
('Marathahalli Bridge', 'Marathahalli', 'KLM Mall', 12.956963, 77.701793, TRUE),
('Rajajinagar', 'Rajajinagar', 'Navarang Theatre', 12.991800, 77.553800, TRUE),
('Basavanagudi', 'Basavanagudi', 'Bull Temple', 12.941650, 77.568710, TRUE),
('Malleshwaram', 'Malleshwaram', 'Mantri Mall', 13.001765, 77.570368, TRUE),
('KR Puram', 'KR Puram', 'Cable Bridge', 13.003700, 77.711800, TRUE),
('Banashankari', 'Banashankari', 'BSK Bus Depot', 12.918200, 77.573900, TRUE);

-- 3 CRIME RECORDS (Verified & Mixed)

```
INSERT INTO CrimeRecord (Type, CategoryID, Severity, Description, OccurredOn,
OccurredTime, ReportedBy, VerifiedBy, VerifiedOn, LocationID, Status)
VALUES
('Robbery', 4, 'High', 'Snatching near traffic signal', '2025-10-05', '21:30:00', 'PUB001',
'ADM001', CURRENT_TIMESTAMP, 2, 'Active'),
('Theft', 1, 'Medium', 'Bike stolen at MG Road', '2025-09-27', '19:00:00', 'PUB002',
'ADM002', CURRENT_TIMESTAMP, 3, 'Resolved'),
('Assault', 2, 'High', 'Street fight near pub area', '2025-10-11', '23:45:00', 'PUB003',
'ADM002', CURRENT_TIMESTAMP, 2, 'Under Investigation'),
('Burglary', 3, 'High', 'Break-in at Whitefield apartment', '2025-09-30', '02:00:00', 'PUB004',
'ADM001', CURRENT_TIMESTAMP, 4, 'Active'),
('Cyber Crime', 9, 'Medium', 'Instagram fraud profile scam', '2025-10-10', '16:00:00',
'PUB005', 'ADM001', CURRENT_TIMESTAMP, 1, 'Resolved'),
('Drug-related', 7, 'High', 'Drug bust near Koramangala Club', '2025-09-25', '20:30:00',
'PUB002', 'ADM002', CURRENT_TIMESTAMP, 2, 'Active'),
('Vandalism', 5, 'Low', 'Bus stop glass broken', '2025-10-12', '09:00:00', 'PUB006',
'ADM001', CURRENT_TIMESTAMP, 5, 'Resolved'),
('Fraud', 6, 'Medium', 'Fake UPI app incident', '2025-10-18', '14:30:00', 'PUB007',
'ADM002', CURRENT_TIMESTAMP, 10, 'Active'),
('Vehicle Crime', 8, 'Medium', 'Car parts stolen', '2025-10-03', '05:00:00', 'PUB008',
'ADM001', CURRENT_TIMESTAMP, 11, 'Active'),
('Domestic Violence', 10, 'High', 'Reported domestic abuse case', '2025-09-21', '22:00:00',
'PUB009', 'ADM002', CURRENT_TIMESTAMP, 12, 'Under Investigation'),
('Murder', 11, 'High', 'Suspicious death reported', '2025-10-15', '01:00:00', 'PUB010',
'ADM001', CURRENT_TIMESTAMP, 9, 'Active'),
('Sexual Assault', 12, 'High', 'Incident near bus terminal', '2025-10-08', '22:15:00',
'PUB003', 'ADM002', CURRENT_TIMESTAMP, 8, 'Active'),
('Arson', 14, 'High', 'Vehicle set ablaze in BTM Layout', '2025-10-17', '04:10:00', 'PUB001',
'ADM001', CURRENT_TIMESTAMP, 5, 'Active'),
('Robbery', 4, 'Medium', 'Chain snatching near Rajajinagar', '2025-09-25', '20:00:00',
'PUB004', 'ADM002', CURRENT_TIMESTAMP, 11, 'Resolved'),
('Theft', 1, 'Low', 'Petty theft reported in Malleshwaram market', '2025-10-20', '12:30:00',
'PUB005', 'ADM001', CURRENT_TIMESTAMP, 13, 'Active'),
('Fraud', 6, 'Medium', 'Online loan scam complaint', '2025-09-18', '13:00:00', 'PUB007',
'ADM001', CURRENT_TIMESTAMP, 14, 'Resolved'),
('Kidnapping', 13, 'High', 'Attempted abduction case in KR Puram', '2025-09-29', '18:00:00',
'PUB009', 'ADM002', CURRENT_TIMESTAMP, 14, 'Under Investigation'),
('Burglary', 3, 'Medium', 'Store robbery in Banashankari', '2025-10-01', '03:15:00',
'PUB010', 'ADM002', CURRENT_TIMESTAMP, 15, 'Resolved'),
('Cyber Crime', 9, 'Medium', 'Credit card phishing site detected', '2025-09-22', '15:30:00',
'PUB002', 'ADM001', CURRENT_TIMESTAMP, 4, 'Active'),
('Vandalism', 5, 'Low', 'School wall vandalized', '2025-09-23', '10:45:00', 'PUB003',
'ADM002', CURRENT_TIMESTAMP, 7, 'Active');
```

```
-- 4 CITIZEN REPORTS (Pending + Verified + Rejected)
INSERT INTO CitizenReports (CrimeType, CategoryID, Severity, Description,
IncidentDate, IncidentTime, Status, UserID, LocationID)
VALUES
('Theft', 1, 'Medium', 'Wallet stolen near BTM bus stop', '2025-10-30', '19:00:00', 'Pending',
'PUB001', 5),
('Vandalism', 5, 'Low', 'Graffiti on metro pillar', '2025-10-25', '11:00:00', 'Pending', 'PUB002',
3),
('Assault', 2, 'High', 'Fight at Koramangala 4th block', '2025-10-15', '22:30:00', 'Verified',
'PUB003', 2),
('Fraud', 6, 'Medium', 'Scam call regarding fake KYC', '2025-10-12', '15:20:00', 'Verified',
'PUB004', 1),
('Cyber Crime', 9, 'Medium', 'Instagram hacking attempt', '2025-10-17', '14:45:00',
'Pending', 'PUB005', 10),
('Drug-related', 7, 'High', 'Suspicious activity near park', '2025-10-05', '18:00:00', 'Verified',
'PUB006', 6),
('Robbery', 4, 'High', 'Two men robbed a local store', '2025-10-02', '21:00:00', 'Rejected',
'PUB007', 11),
('Burglary', 3, 'Medium', 'Attempted break-in', '2025-09-30', '03:10:00', 'Verified', 'PUB008',
12),
('Assault', 2, 'Medium', 'Verbal harassment reported', '2025-10-28', '20:15:00', 'Pending',
'PUB009', 9),
('Theft', 1, 'Low', 'Lost bicycle', '2025-10-26', '17:00:00', 'Pending', 'PUB010', 13);

-- 5 SAFETY SCORES
INSERT INTO SafetyScore (LocationID, AreaName, ScoreValue, CrimeCount,
HighSeverityCount, ComputedOn, ComputedBy)
VALUES
(1, 'Indiranagar', 78, 5, 1, '2025-11-05', 'ANL001'),
(2, 'Koramangala', 58, 8, 3, '2025-11-05', 'ANL002'),
(3, 'Shivajinagar', 82, 4, 1, '2025-11-05', 'ANL003'),
(4, 'Whitefield', 73, 5, 2, '2025-11-05', 'ANL001'),
(5, 'BTM Layout', 65, 7, 3, '2025-11-05', 'ANL002'),
(6, 'Electronic City', 50, 9, 4, '2025-11-05', 'ANL003'),
(7, 'JP Nagar', 88, 3, 0, '2025-11-05', 'ANL002'),
(8, 'Hebbal', 76, 4, 1, '2025-11-05', 'ANL001'),
(9, 'Yeshwanthpur', 69, 6, 2, '2025-11-05', 'ANL003'),
(10, 'Marathahalli', 61, 7, 3, '2025-11-05', 'ANL001'),
(11, 'Rajajinagar', 67, 6, 2, '2025-11-05', 'ANL002'),
(12, 'Basavanagudi', 80, 4, 0, '2025-11-05', 'ANL003'),
(13, 'Malleshwaram', 77, 5, 1, '2025-11-05', 'ANL001'),
(14, 'KR Puram', 59, 8, 3, '2025-11-05', 'ANL002'),
```

```
(15, 'Banashankari', 84, 3, 0, '2025-11-05', 'ANL003');

-- 6 HOTSPOTS
INSERT INTO Hotspots (LocationID, AreaName, CrimeDensity, CrimeCount,
RadiusMeters, RiskLevel, ComputedOn, ComputedBy)
VALUES
(2, 'Koramangala', 16.2, 9, 500, 'High', '2025-11-05', 'ANL001'),
(4, 'Whitefield', 13.5, 7, 500, 'Medium', '2025-11-05', 'ANL002'),
(5, 'BTM Layout', 11.0, 6, 500, 'Medium', '2025-11-05', 'ANL002'),
(6, 'Electronic City', 18.9, 10, 500, 'Critical', '2025-11-05', 'ANL003'),
(9, 'Yeshwanthpur', 15.5, 8, 500, 'High', '2025-11-05', 'ANL002'),
(11, 'Rajajinagar', 14.2, 7, 500, 'High', '2025-11-05', 'ANL001'),
(14, 'KR Puram', 12.3, 7, 500, 'Medium', '2025-11-05', 'ANL003');

-- 7 REPORTS
INSERT INTO Reports (Title, Type, Description, StartDate, EndDate, FilterArea,
FilterSeverity, TotalCrimes, AverageSafetyScore, AnalystID)
VALUES
('Koramangala Crime Summary - Oct 2025', 'Crime Summary', 'Detailed crime activity
report for Koramangala.', '2025-10-01', '2025-10-31', 'Koramangala', NULL, 8, 58.0,
'ANL001'),
('BTM Layout Safety Report', 'Safety Trend', 'Safety trend for BTM area showing medium
risk levels.', '2025-09-01', '2025-10-31', 'BTM Layout', NULL, 7, 65.0, 'ANL002'),
('Citywide Crime Overview - Q4', 'Hotspot Analysis', 'Identified top 5 high-risk zones in
Bengaluru.', '2025-09-01', '2025-10-31', NULL, 'High', 35, 68.0, 'ANL003'),
('KR Puram Incident Summary', 'Area Report', 'Frequent medium severity crimes noted.',
'2025-10-01', '2025-10-31', 'KR Puram', 'Medium', 7, 59.0, 'ANL002'),
('Electronic City Critical Alert', 'Custom', 'Drug and assault-related spike noticed.',
'2025-09-15', '2025-10-31', 'Electronic City', 'High', 10, 50.0, 'ANL003');

-- 8 AREA STATISTICS (Auto Refresh Recommended)
CALL sp_RefreshAllAreaStats();

-- ============================================================
-- 🌇 DATA SEED END
-- ============================================================
```

SQL DCL Statements

```
-- ============================================
-- REDLENS ROLE-BASED ACCESS CONTROL (DCL SCRIPT)
-- ============================================

-- 1. Create Users (Run only once)
CREATE USER IF NOT EXISTS 'ADM001'@'%' IDENTIFIED BY 'AdminPass123!';
CREATE USER IF NOT EXISTS 'ANL001'@'%' IDENTIFIED BY 'AnalystPass123!';
CREATE USER IF NOT EXISTS 'PUB001'@'%' IDENTIFIED BY 'PublicPass123!';

-- ============================================
-- 2. ADMIN ROLE – Full Access to Everything
-- ============================================

GRANT ALL PRIVILEGES ON RedLens.* TO 'ADM001'@'%';

-- ============================================
-- 3. ANALYST ROLE – Limited Access
-- ============================================

-- Analysts can view everything
GRANT SELECT ON RedLens.* TO 'ANL001'@'%';

-- Analysts can modify crime records (insert/update only)
GRANT INSERT, UPDATE ON RedLens.CrimeRecord TO 'ANL001'@'%';

-- Analysts can insert reports they generate
GRANT INSERT ON RedLens.Reports TO 'ANL001'@'%';
```

```
-- Analysts can run ALL stored procedures & functions
GRANT EXECUTE ON FUNCTION RedLens.* TO 'ANL001'@'%';
GRANT EXECUTE ON PROCEDURE RedLens.* TO 'ANL001'@'%';

-- ============================================
-- 4. PUBLIC ROLE – Strictly Read-Only (Views Only)
-- ============================================

GRANT SELECT ON RedLens.v_ActiveCrimesByArea TO 'PUB001'@'%';
GRANT SELECT ON RedLens.v_CurrentHotspots TO 'PUB001'@'%';
GRANT SELECT ON RedLens.v_LatestSafetyScores TO 'PUB001'@'%';
GRANT SELECT ON RedLens.v_PendingReports TO 'PUB001'@'%';

-- DO NOT GIVE PUBLIC USERS ACCESS TO RAW TABLES
-- No direct SELECT on CrimeRecord, User, SafetyScore, CitizenReports, etc.

-- ============================================
-- REVOKE STATEMENTS
-- Use these if you need to correct permissions
-- ============================================

--  Remove Analyst's ability to insert crime records
REVOKE INSERT, UPDATE ON RedLens.CrimeRecord FROM 'ANL001'@'%';

-- Remove Public user's access to hotspots
 REVOKE SELECT ON RedLens.v_CurrentHotspots FROM 'PUB001'@'%';

-- ============================================
-- APPLY CHANGES
-- ============================================

FLUSH PRIVILEGES;

-- ============================================
-- END OF DCL SCRIPT
-- ============================================
```

Results:

```
mysql> SELECT * FROM areastatistics LIMIT 20;
+--------+----------------+-------------+----------------+---------------+-------------------+--------------------+-------------------+---------------
------+
| StatID | AreaName       | TotalCrimes | CrimesLastMonth | CrimesLastYear | HighSeverityCrimes | MostCommonCrimeType | CurrentSafetyScore | LastUpdated
     |
+--------+----------------+-------------+----------------+---------------+-------------------+--------------------+-------------------+---------------
------+
|      1 | Banashankari   |           1 |              0 |             1 |                 0 | Burglary           |                84 | 2025-11-19 00:
00:01 |
|      2 | Basavanagudi   |           1 |              0 |             1 |                 1 | Domestic Violence  |                80 | 2025-11-19 00:
00:01 |
|      3 | BTM Layout     |           6 |              0 |             6 |                 2 | Vandalism          |                86 | 2025-11-19 00:
00:01 |
|      4 | Electronic City |           4 |              1 |             4 |                 1 | Robbery            |                90 | 2025-11-19 00:
00:01 |
|      5 | Hebbal         |           2 |              1 |             2 |                 1 | Sexual Assault     |                96 | 2025-11-19 00:
00:01 |
|      6 | Indiranagar    |           5 |              1 |             5 |                 1 | Cyber Crime        |               100 | 2025-11-19 00:
00:01 |
|      7 | JP Nagar       |           3 |              0 |             3 |                 0 | Vandalism          |               100 | 2025-11-19 00:
00:01 |
|      8 | Koramangala    |           7 |              1 |             7 |                 4 | Assault            |                98 | 2025-11-19 00:
00:01 |
|      9 | KR Puram       |           2 |              0 |             2 |                 1 | Fraud              |                59 | 2025-11-19 00:
00:01 |
|     10 | Malleshwaram   |           1 |              1 |             1 |                 0 | Theft              |                98 | 2025-11-19 00:
00:01 |
|     11 | Marathahalli   |           5 |              1 |             5 |                 1 | Fraud              |                92 | 2025-11-19 00:
00:01 |
|     12 | Rajajinagar    |           2 |              0 |             2 |                 0 | Vehicle Crime      |                67 | 2025-11-19 00:
00:01 |
|     13 | Shivajinagar   |           4 |              0 |             4 |                 1 | Theft              |                96 | 2025-11-19 00:
00:01 |
|     14 | Whitefield     |           6 |              1 |             6 |                 2 | Cyber Crime        |                98 | 2025-11-19 00:
00:01 |
```

mysql> SELECT * FROM citizenreports LIMIT 20;

PublicReportID	CrimeType	CategoryID	Severity	Description	IncidentDate	IncidentTime	Status	SubmittedOn	ReviewedBy	ReviewedOn	RejectionReason	LinkedCrimeID	UserID	LocationID	AttachmentURL
1	Theft	1	Medium	Wallet stolen near BTM bus stop	2025-10-30	19:00:00	Verified	2025-11-09 11:05:59	NULL	2025-11-10 18:19:20	NULL	NULL	PUB001	5	NULL
2	Vandalism	5	Low	Graffiti on metro pillar	2025-10-25	11:00:00	Rejected	2025-11-09 11:05:59	ADM001	2025-11-13 11:30:23	Discarded by admin	NULL	PUB002	3	NULL
3	Assault	2	High	Fight at Koramangala 4th block	2025-10-15	22:30:00	Verified	2025-11-09 11:05:59	NULL	NULL	NULL	NULL	PUB003	2	NULL
4	Fraud	6	Medium	Scam call regarding fake KYC	2025-10-12	15:20:00	Rejected	2025-11-09 11:05:59	NULL	2025-11-10 18:20:10	NULL	NULL	PUB004	1	NULL
5	Cyber Crime	9	Medium	Instagram hacking attempt	2025-10-17	14:45:00	Verified	2025-11-09 11:05:59	NULL	2025-11-10 18:19:41	NULL	NULL	PUB005	10	NULL
6	Drug-related	7	High	Suspicious activity near park	2025-10-05	18:00:00	Verified	2025-11-09 11:05:59	NULL	NULL	NULL	NULL	PUB006	6	NULL
7	Robbery	4	High	Two men robbed a local store	2025-10-02	21:00:00	Rejected	2025-11-09 11:05:59	NULL	NULL	NULL	NULL	PUB007	11	NULL
8	Burglary	3	Medium	Attempted break-in	2025-09-30	03:10:00	Verified	2025-11-09 11:05:59	NULL	NULL	NULL	NULL	PUB008	12	NULL
9	Assault	2	Medium	Verbal harassment reported	2025-10-28	20:15:									

mysql> SELECT * FROM crimecategory LIMIT 20;

CategoryID	CategoryName	Description	SeverityWeight	CreatedAt
1	Theft	Unlawful taking of property	0.60	2025-11-09 11:05:08
2	Assault	Physical attack or threat of attack	0.90	2025-11-09 11:05:08
3	Burglary	Breaking and entering with intent to commit crime	0.80	2025-11-09 11:05:08
4	Robbery	Theft involving force or threat	1.00	2025-11-09 11:05:08
5	Vandalism	Willful destruction of property	0.40	2025-11-09 11:05:08
6	Fraud	Wrongful deception for financial gain	0.50	2025-11-09 11:05:08
7	Drug-related	Possession, distribution, or use of illegal drugs	0.70	2025-11-09 11:05:08
8	Vehicle Crime	Theft or damage to vehicles	0.60	2025-11-09 11:05:08
9	Cyber Crime	Computer or internet-based crimes	0.50	2025-11-09 11:05:08
10	Domestic Violence	Violence within domestic settings	0.90	2025-11-09 11:05:08
11	Murder	Unlawful killing of another person	1.00	2025-11-09 11:05:08
12	Sexual Assault	Non-consensual sexual contact	1.00	2025-11-09 11:05:08
13	Kidnapping	Unlawful abduction of a person	1.00	2025-11-09 11:05:08
14	Arson	Willful fire-setting	0.80	2025-11-09 11:05:08
15	Other	Crimes not fitting other categories	0.30	2025-11-09 11:05:08

15 rows in set (0.00 sec)

mysql> SELECT * FROM crimerecord LIMIT 20;

CrimeID	Type	CategoryID	Severity	Description	OccurredOn	OccurredTime	ReportedBy	VerifiedBy	VerifiedOn	LocationID	Status	CreatedAt	UpdatedAt
1	Robbery	4	High	Snatching near traffic signal	2025-10-05	21:30:00	PUB001	ADM001	2025-11-09 11:05:59	2	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
2	Theft	1	Medium	Bike stolen at MG Road	2025-09-27	19:00:00	PUB002	ADM002	2025-11-09 11:05:59	3	Resolved	2025-11-09 11:05:59	2025-11-09 11:05:59
3	Assault	2	High	Street fight near pub area	2025-10-11	23:45:00	PUB003	ADM002	2025-11-09 11:05:59	2	Under Investigation	2025-11-09 11:05:59	2025-11-09 11:05:59
4	Burglary	3	High	Break-in at Whitefield apartment	2025-09-30	02:00:00	PUB004	ADM001	2025-11-09 11:05:59	4	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
5	Cyber Crime	9	Medium	Instagram fraud profile scam	2025-10-10	16:00:00	PUB005	ADM001	2025-11-09 11:05:59	1	Resolved	2025-11-09 11:05:59	2025-11-09 11:05:59
6	Drug-related	7	High	Drug bust near Koramangala Club	2025-09-25	20:30:00	PUB002	ADM002	2025-11-09 11:05:59	2	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
7	Vandalism	5	Low	Bus stop glass broken	2025-10-12	09:00:00	PUB006	ADM001	2025-11-09 11:05:59	5	Resolved	2025-11-09 11:05:59	2025-11-09 11:05:59
8	Fraud	6	Medium	Fake UPI app incident	2025-10-18	14:30:00	PUB007	ADM002	2025-11-09 11:05:59	10	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
9	Vehicle Crime	8	Medium	Car parts stolen	2025-10-03	05:00:00	PUB008	ADM001	2025-11-09 11:05:59	11	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
10	Domestic Violence	10	High	Reported domestic abuse case	2025-09-21	22:00:00	PUB009	ADM002	2025-11-09 11:05:59	12	Under Investigation	2025-11-09 11:05:59	2025-11-09 11:05:59
11	Murder	11	High	Suspicious death reported	2025-10-15	01:00:00	PUB010	ADM001	2025-11-09 11:05:59	9	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
12	Sexual Assault	12	High	Incident near bus terminal	2025-10-08	22:15:00	PUB003	ADM002	2025-11-09 11:05:59	8	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
13	Arson	14	High	Vehicle set ablaze in BTM Layout	2025-10-17	04:10:00	PUB001	ADM001	2025-11-09 11:05:59	5	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
14	Robbery	4	Medium	Chain snatching near Rajajinagar	2025-09-25	20:00:00	PUB004	ADM002	2025-11-09 11:05:59	11	Resolved	2025-11-09 11:05:59	2025-11-09 11:05:59
15	Theft	1	Low	Petty theft reported in Malleshwaram market	2025-10-20	12:30:00	PUB005	ADM001	2025-11-09 11:05:59	13	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
16	Fraud	6	Medium	Online loan scam complaint	2025-09-18	13:00:00	PUB007	ADM001	2025-11-09 11:05:59	14	Resolved	2025-11-09 11:05:59	2025-11-09 11:05:59

mysql> SELECT * FROM hotspots LIMIT 20;

HotspotID	LocationID	AreaName	CrimeDensity	CrimeCount	RadiusMeters	RiskLevel	ComputedOn	ComputedBy	CreatedAt
1	2	Koramangala	16.20	9	500	High	2025-11-05	ANL001	2025-11-09 11:05:59
2	4	Whitefield	13.50	7	500	Medium	2025-11-05	ANL002	2025-11-09 11:05:59
3	5	BTM Layout	11.00	6	500	Medium	2025-11-05	ANL002	2025-11-09 11:05:59
4	6	Electronic City	18.90	10	500	Critical	2025-11-05	ANL003	2025-11-09 11:05:59
5	9	Yeshwanthpur	15.50	8	500	High	2025-11-05	ANL002	2025-11-09 11:05:59
6	11	Rajajinagar	14.20	7	500	High	2025-11-05	ANL001	2025-11-09 11:05:59
7	14	KR Puram	12.30	7	500	Medium	2025-11-05	ANL003	2025-11-09 11:05:59

7 rows in set (0.01 sec)

mysql> SELECT * FROM location LIMIT 20;

LocationID	Address	AreaName	Landmark	City	State	Pincode	Latitude	Longitude	IsVerified	Status	CreatedAt	UpdatedAt
1	100 Feet Road	Indiranagar	CMH Road	Bengaluru	Karnataka	NULL	12.971891	77.641151	1	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
2	Forum Mall	Koramangala	Forum Mall	Bengaluru	Karnataka	NULL	12.935223	77.624482	1	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
3	MG Road	Shivajinagar	MG Metro	Bengaluru	Karnataka	NULL	12.978142	77.603292	1	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
4	Whitefield Main Road	Whitefield	ITPL	Bengaluru	Karnataka	NULL	12.969800	77.750000	1	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
5	BTM 2nd Stage	BTM Layout	Udupi Garden	Bengaluru	Karnataka	NULL	12.916575	77.610116	1	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
6	Electronic City Phase 1	Electronic City	Infosys Campus	Bengaluru	Karnataka	NULL	12.845214	77.660169	1	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
7	JP Nagar 7th Phase	JP Nagar	Ragigudda Temple	Bengaluru	Karnataka	NULL	12.906342	77.585682	1	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
8	Hebbal Flyover	Hebbal	Esteem Mall	Bengaluru	Karnataka	NULL	13.035838	77.597023	1	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
9	Yeshwanthpur	Yeshwanthpur	Orion Mall	Bengaluru	Karnataka	NULL	13.020690	77.554462	1	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
10	Marathahalli Bridge	Marathahalli	KLM Mall	Bengaluru	Karnataka	NULL	12.956963	77.701793	1	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
11	Rajajinagar	Rajajinagar	Navarang Theatre	Bengaluru	Karnataka	NULL	12.991800	77.553800	1	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
12	Basavanagudi	Basavanagudi	Bull Temple	Bengaluru	Karnataka	NULL	12.941650	77.568710	1	Active	2025-11-09 11:05:59	2025-11-09 11:05:59
13	Malleshwaram	Malleshwaram	Mantri Mall	Bengaluru	Karnataka	NULL	13.001765	77.570368	1	Active	2025-11-09 11:05:59	2025-11-09 11:05:59

ReportID	Title	Type	Description	StartDate	EndDate	FilterArea	FilterCrimeType	FilterSeverity	FilterParams	TotalCrimes	AverageSafetyScore	GeneratedAt	AnalystID	ReportFileURL
1	Koramangala Crime Summary - Oct 2025	Crime Summary	Detailed crime activity report for Koramangala.	2025-10-01	2025-10-31	Koramangala	NULL	NULL	NULL	8	58.00	2025-11-09 11:05:59	ANL001	NULL
2	BTM Layout Safety Report	Safety Trend	Safety trend for BTM area showing medium risk levels.	2025-09-01	2025-10-31	BTM Layout	NULL	NULL	NULL	7	65.00	2025-11-09 11:05:59	ANL002	NULL
3	Citywide Crime Overview - Q4	Hotspot Analysis	Identified top 5 high-risk zones in Bengaluru.	2025-09-01	2025-10-31	NULL	NULL	High	NULL	35	68.00	2025-11-09 11:05:59	ANL003	NULL
4	KR Puram Incident Summary	Area Report	Frequent medium severity crimes noted.	2025-10-01	2025-10-31	KR Puram	NULL	Medium	NULL	7	59.00	2025-11-09 11:05:59	ANL002	NULL
5	Electronic City Critical Alert	Custom	Drug and assault-related spike noticed.	2025-09-15	2025-10-31	Electronic City	NULL	High	NULL	10	50.00	2025-11-09 11:05:59	ANL003	NULL
7	Robbery	Crime Summary	NULL	2025-09-23	2025-10-23	Electronic City	NULL	NULL	NULL	3	90.00	2025-11-10 23:24:19	ANL6533	NULL

6 rows in set (0.00 sec)

mysql> SELECT * FROM safetyscore LIMIT 20;

ScoreID	LocationID	AreaName	ScoreValue	CrimeCount	HighSeverityCount	ComputedOn	ComputedBy	Algorithm	CreatedAt	UpdatedAt
1	1	Indiranagar	78	5	1	2025-11-05	ANL001	Weighted Density	2025-11-09 11:05:59	2025-11-09 11:05:59
2	2	Koramangala	58	8	3	2025-11-05	ANL002	Weighted Density	2025-11-09 11:05:59	2025-11-09 11:05:59
3	3	Shivajinagar	82	4	1	2025-11-05	ANL003	Weighted Density	2025-11-09 11:05:59	2025-11-09 11:05:59
4	4	Whitefield	73	5	2	2025-11-05	ANL001	Weighted Density	2025-11-09 11:05:59	2025-11-09 11:05:59
5	5	BTM Layout	65	7	3	2025-11-05	ANL002	Weighted Density	2025-11-09 11:05:59	2025-11-09 11:05:59
6	6	Electronic City	50	9	4	2025-11-05	ANL003	Weighted Density	2025-11-09 11:05:59	2025-11-09 11:05:59
7	7	JP Nagar	88	3	0	2025-11-05	ANL002	Weighted Density	2025-11-09 11:05:59	2025-11-09 11:05:59
8	8	Hebbal	76	4	1	2025-11-05	ANL001	Weighted Density	2025-11-09 11:05:59	2025-11-09 11:05:59

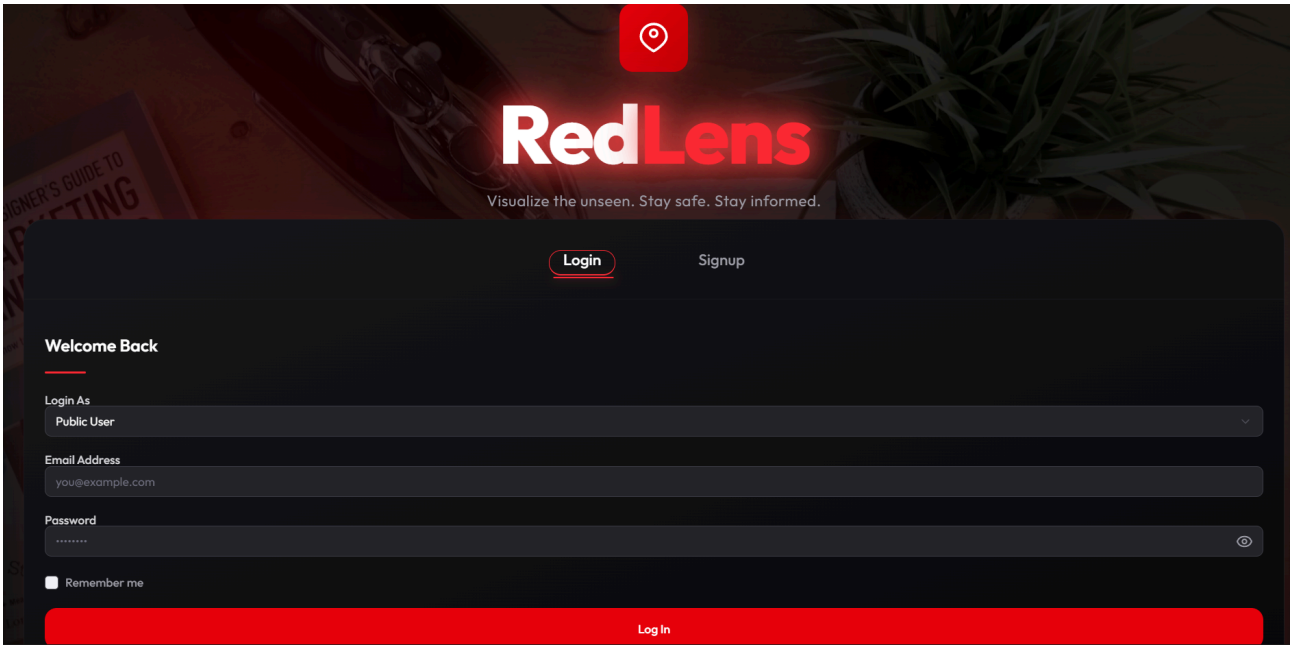
```
mysql> SELECT * FROM user LIMIT 20;
+---------+-------------+---------+-------------------------+--------------------------------------------------------------+-------------+----------+-----
---------------+---------------------+---------------------+
| UserID  | Name        | Role    | Email                   | Password                                                     | PhoneNumber | IsActive | Crea
tedAt          | LastLogin           | UpdatedAt           |
+---------+-------------+---------+-------------------------+--------------------------------------------------------------+-------------+----------+-----
---------------+---------------------+---------------------+
| ADM001  | Priya Menon | Admin   | priya.admin@redlens.in  | hashed_pass_1                                                | 9876543210  |        1 | 2025
-11-09 11:05:59 | NULL                | 2025-11-09 11:05:59 |
| ADM002  | Ravi Sharma | Admin   | ravi.admin@redlens.in   | hashed_pass_2                                                | 9812345678  |        1 | 2025
-11-09 11:05:59 | NULL                | 2025-11-09 11:05:59 |
| ADM7631 | Admin User  | Admin   | admin@example.com       | $2b$10$9VSqR4W4ECWNlykNCZFwN.HF29/3VkgOoj2TX9SrreRhwKrZv/MTe | NULL        |        1 | 2025
-11-09 13:28:16 | NULL                | 2025-11-09 13:28:16 |
| ADM8356 | admin user  | Admin   | ads2@gmail.com          | $2b$10$jTv2KaAMr56qfF0GjuiSCu51NloQyNrN.ous/bMpkQvFKkgfiON.2 | 9845403242  |        1 | 2025
-11-10 19:28:13 | 2025-11-20 23:17:15 | 2025-11-20 23:17:15 |
| ANL001  | Sneha Iyer  | Analyst | sneha.analyst@redlens.in | hashed_pass_3                                               | 9823456789  |        1 | 2025
-11-09 11:05:59 | NULL                | 2025-11-09 11:05:59 |
| ANL002  | Arjun Patel | Analyst | arjun.analyst@redlens.in | hashed_pass_4                                               | 9867891234  |        1 | 2025
-11-09 11:05:59 | NULL                | 2025-11-09 11:05:59 |
| ANL003  | Deepa Rao   | Analyst | deepa.analyst@redlens.in | hashed_pass_5                                               | 9876111222  |        1 | 2025
-11-09 11:05:59 | NULL                | 2025-11-09 11:05:59 |
| ANL3342 | Jane Analyst | Analyst | analyst@example.com     | $2b$10$ftIgGolXIfSEpsr5559ZHuEi1Pjvs5BhhiH1p/lYq/hi2ogT6Yr3O | NULL        |        1 | 2025
-11-09 13:27:27 | NULL                | 2025-11-09 13:27:27 |
| ANL6533 | as          | Analyst | ad2@gmail.com           | $2b$10$xTPnduymqDDsxrGUSy5T.u/HVWs0SlKDW0XO0W7apKSv.BcbyP8Be | 872441222   |        1 | 2025
-11-10 12:41:20 | 2025-11-20 23:14:44 | 2025-11-20 23:14:44 |
| PUB001  | Aarav Nair  | Public  | aarav.public@redlens.in | hashed_pass_6                                               | 9845123456  |        1 | 2025
-11-09 11:05:59 | NULL                | 2025-11-09 11:05:59 |
| PUB002  | Isha Verma  | Public  | isha.public@redlens.in  | hashed_pass_7                                               | 9822123456  |        1 | 2025
-11-09 11:05:59 | NULL                | 2025-11-09 11:05:59 |
| PUB003  | Karan Das   | Public  | karan.public@redlens.in | hashed_pass_8                                               | 9833344556  |        1 | 2025
-11-09 11:05:59 | NULL                | 2025-11-09 11:05:59 |
| PUB004  | Divya Rao   | Public  | divya.public@redlens.in | hashed_pass_9                                               | 9812347777  |        1 | 2025
-11-09 11:05:59 | NULL                | 2025-11-09 11:05:59 |
| PUB005  | Rahul Jain  | Public  | rahul.public@redlens.in | hashed_pass_10                                              | 9876123456  |        1 | 2025
-11-09 11:05:59 | NULL                | 2025-11-09 11:05:59 |
| PUB006  | Meera Joshi | Public  | meera.public@redlens.in | hashed_pass_11                                              | 9812233445  |        1 | 2025
-11-09 11:05:59 | NULL                | 2025-11-09 11:05:59 |
```

```
mysql> SELECT * FROM v_activecrimesbyarea LIMIT 20;
+-----------------+-----------+-------------+--------------------+-------------------+
| AreaName        | City      | CrimeCount | HighSeverityCount | AvgSeverityLevel |
+-----------------+-----------+-------------+--------------------+-------------------+
| Indiranagar     | Bengaluru |           1 |                  0 |            2.0000 |
| Koramangala     | Bengaluru |           4 |                  3 |            2.5000 |
| Shivajinagar    | Bengaluru |           1 |                  0 |            2.0000 |
| Whitefield      | Bengaluru |           4 |                  2 |            2.5000 |
| BTM Layout      | Bengaluru |           3 |                  2 |            2.6667 |
| Electronic City | Bengaluru |           2 |                  1 |            2.5000 |
| JP Nagar        | Bengaluru |           1 |                  0 |            1.0000 |
| Hebbal          | Bengaluru |           2 |                  1 |            2.5000 |
| Yeshwanthpur    | Bengaluru |           1 |                  1 |            3.0000 |
| Marathahalli    | Bengaluru |           3 |                  1 |            2.3333 |
| Rajajinagar     | Bengaluru |           1 |                  0 |            2.0000 |
| Basavanagudi    | Bengaluru |           0 |                  0 |            1.0000 |
| Malleshwaram    | Bengaluru |           1 |                  0 |            1.0000 |
| KR Puram        | Bengaluru |           0 |                  0 |            1.0000 |
| Banashankari    | Bengaluru |           0 |                  0 |            1.0000 |
+-----------------+-----------+-------------+--------------------+-------------------+
15 rows in set (0.01 sec)

mysql> SELECT * FROM v_currenthotspots LIMIT 20;
+-----------+-----------------+--------------+------------+-----------+-----------+-----------+------------+
| HotspotID | AreaName        | CrimeDensity | CrimeCount | RiskLevel | Latitude  | Longitude | ComputedOn |
+-----------+-----------------+--------------+------------+-----------+-----------+-----------+------------+
|         4 | Electronic City |        18.90 |         10 | Critical  | 12.845214 | 77.660169 | 2025-11-05 |
|         1 | Koramangala     |        16.20 |          9 | High      | 12.935223 | 77.624482 | 2025-11-05 |
|         5 | Yeshwanthpur    |        15.50 |          8 | High      | 13.020690 | 77.554462 | 2025-11-05 |
|         6 | Rajajinagar     |        14.20 |          7 | High      | 12.991800 | 77.553800 | 2025-11-05 |
+-----------+-----------------+--------------+------------+-----------+-----------+-----------+------------+
4 rows in set (0.00 sec)
```

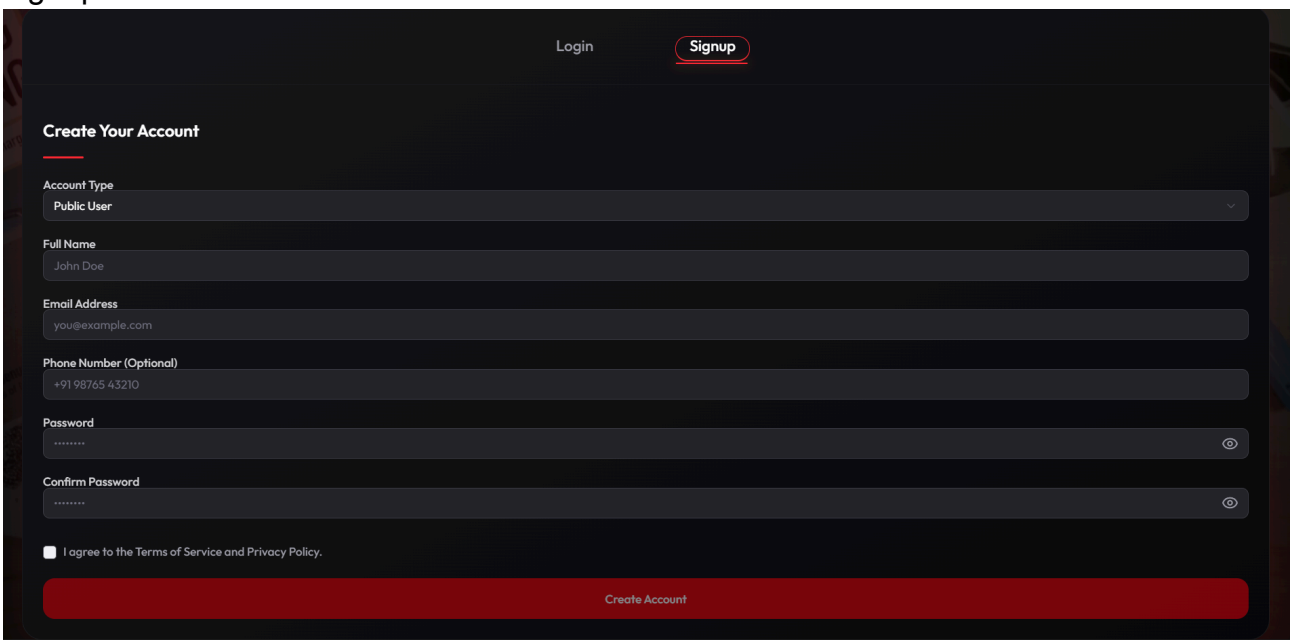
```
mysql> SELECT * FROM v_latestsafetyscores LIMIT 20;
+----------------+------------+------------+------------+--------------+
| AreaName       | ScoreValue | CrimeCount | ComputedOn | RiskCategory |
+----------------+------------+------------+------------+--------------+
| Banashankari   |         84 |          3 | 2025-11-05 | Safe         |
| Basavanagudi   |         80 |          4 | 2025-11-05 | Safe         |
| BTM Layout     |         86 |          2 | 2025-11-10 | Safe         |
| Electronic City |         90 |          1 | 2025-11-20 | Safe         |
| Hebbal         |         96 |          1 | 2025-11-10 | Safe         |
| Indiranagar    |        100 |          0 | 2025-11-10 | Safe         |
| JP Nagar       |        100 |          1 | 2025-11-10 | Safe         |
| Koramangala    |         98 |          1 | 2025-11-10 | Safe         |
| KR Puram       |         59 |          8 | 2025-11-05 | Risky        |
| Malleshwaram   |         98 |          1 | 2025-11-10 | Safe         |
| Marathahalli   |         92 |          2 | 2025-11-13 | Safe         |
| Rajajinagar    |         67 |          6 | 2025-11-05 | Moderate     |
| Shivajinagar   |         96 |          1 | 2025-11-10 | Safe         |
| Whitefield     |         98 |          1 | 2025-11-10 | Safe         |
| Yeshwanthpur   |         90 |          1 | 2025-11-10 | Safe         |
+----------------+------------+------------+------------+--------------+
15 rows in set (0.00 sec)

mysql> SELECT * FROM v_pendingreports LIMIT 20;
+----------------+-----------+----------+---------------------+--------------+------------------------+--------------+--------------+-------------+
| PublicReportID | CrimeType | Severity | SubmittedOn         | ReporterName | ReporterEmail          | AreaName     | Address      | DaysPending |
+----------------+-----------+----------+---------------------+--------------+------------------------+--------------+--------------+-------------+
|              9 | Assault   | Medium   | 2025-11-09 11:05:59 | Varun Pillai | varun.public@redlens.in | Yeshwanthpur | Yeshwanthpur |          11 |
|             10 | Theft     | Low      | 2025-11-09 11:05:59 | Tanya Dey    | tanya.public@redlens.in | Malleshwaram | Malleshwaram |          11 |
+----------------+-----------+----------+---------------------+--------------+------------------------+--------------+--------------+-------------+
2 rows in set (0.00 sec)
```

Frontend

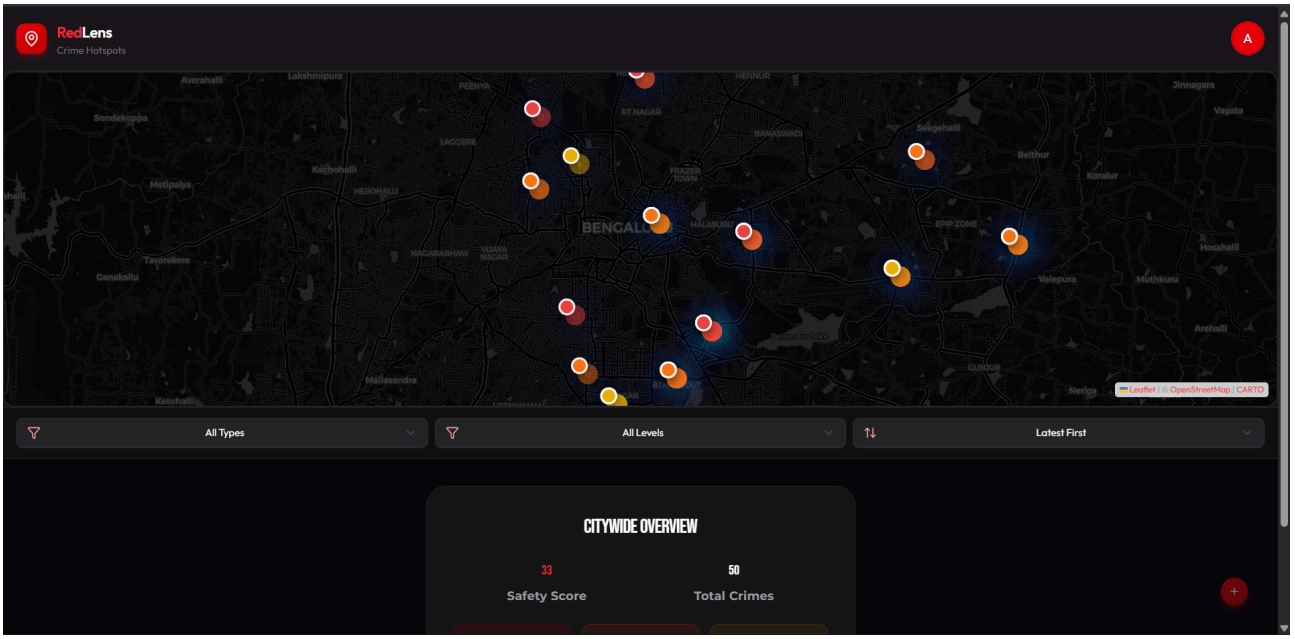
Login:



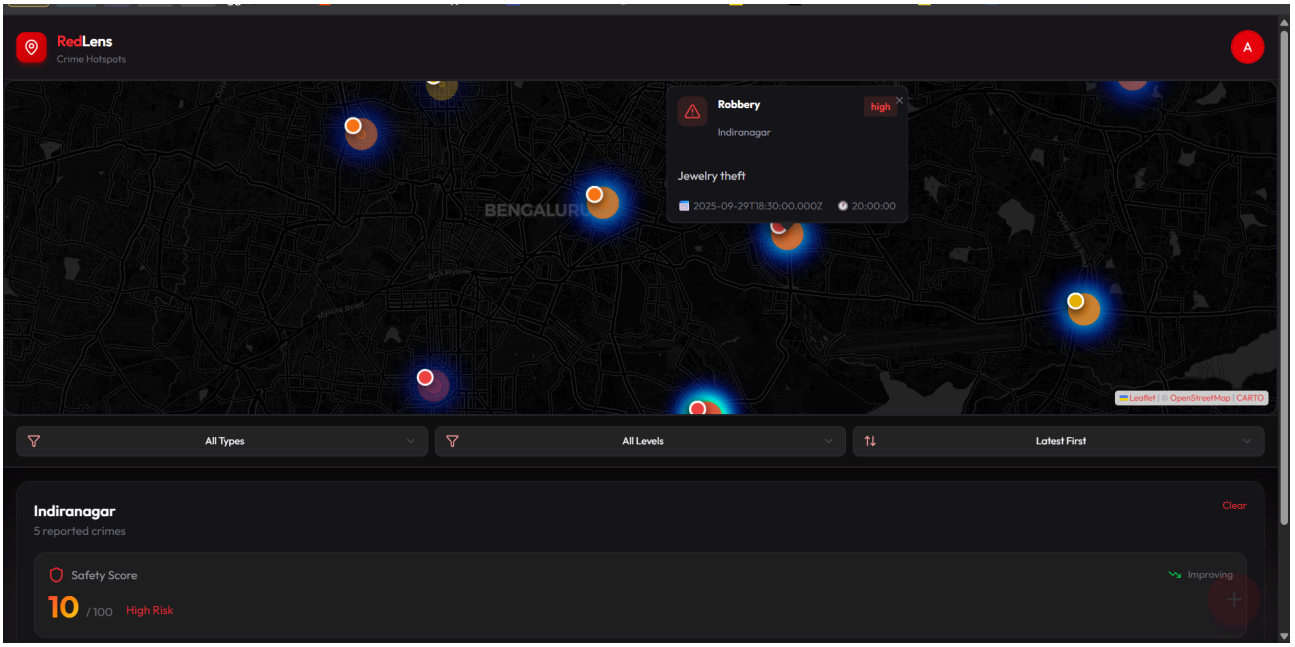
Signup:



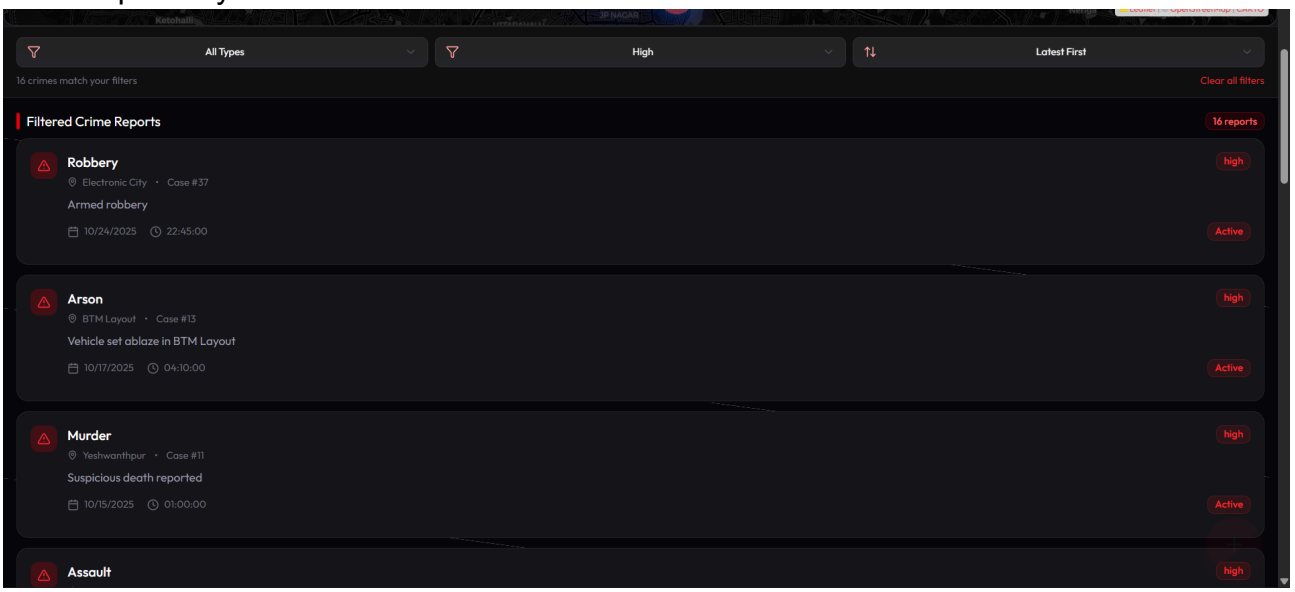
User Dashboard:



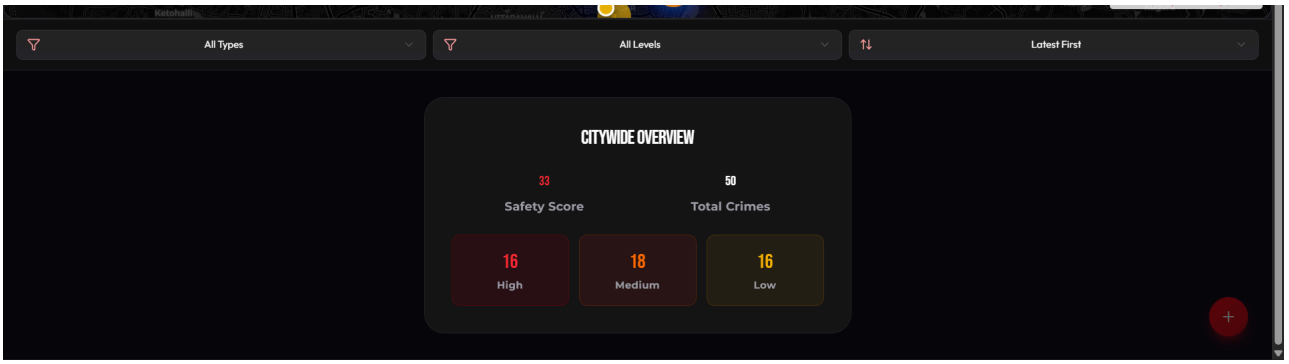
Hotspot Map:



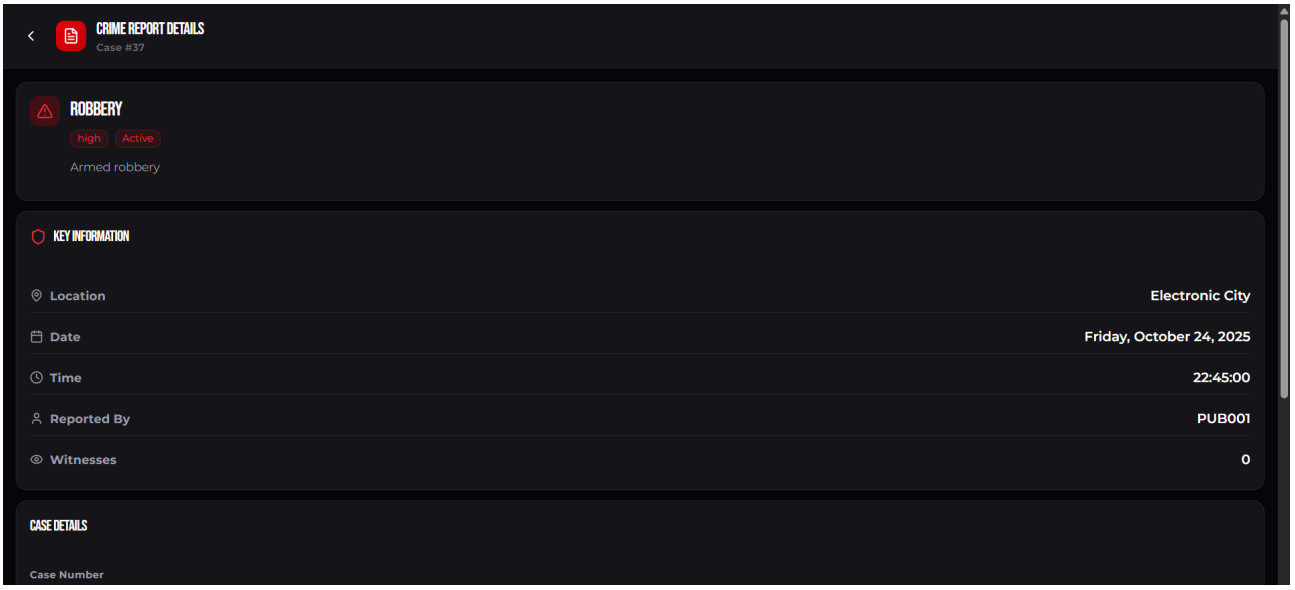
View Reports by filter:



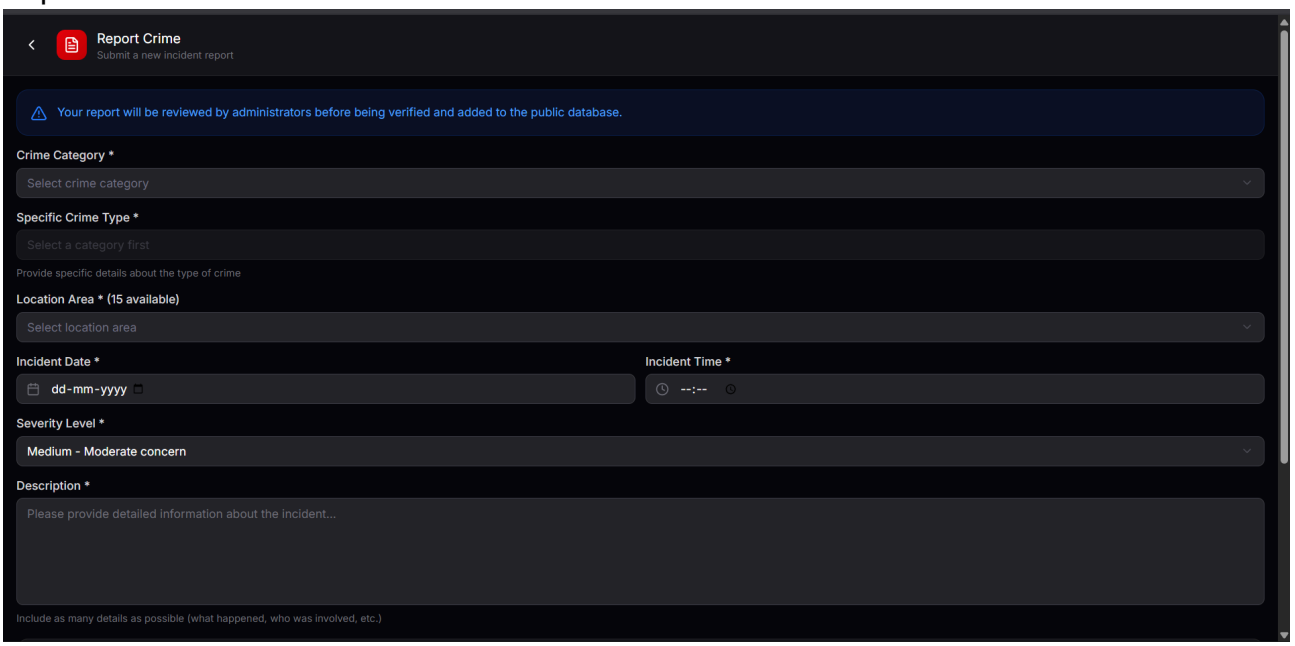
Citywide Safety Score:



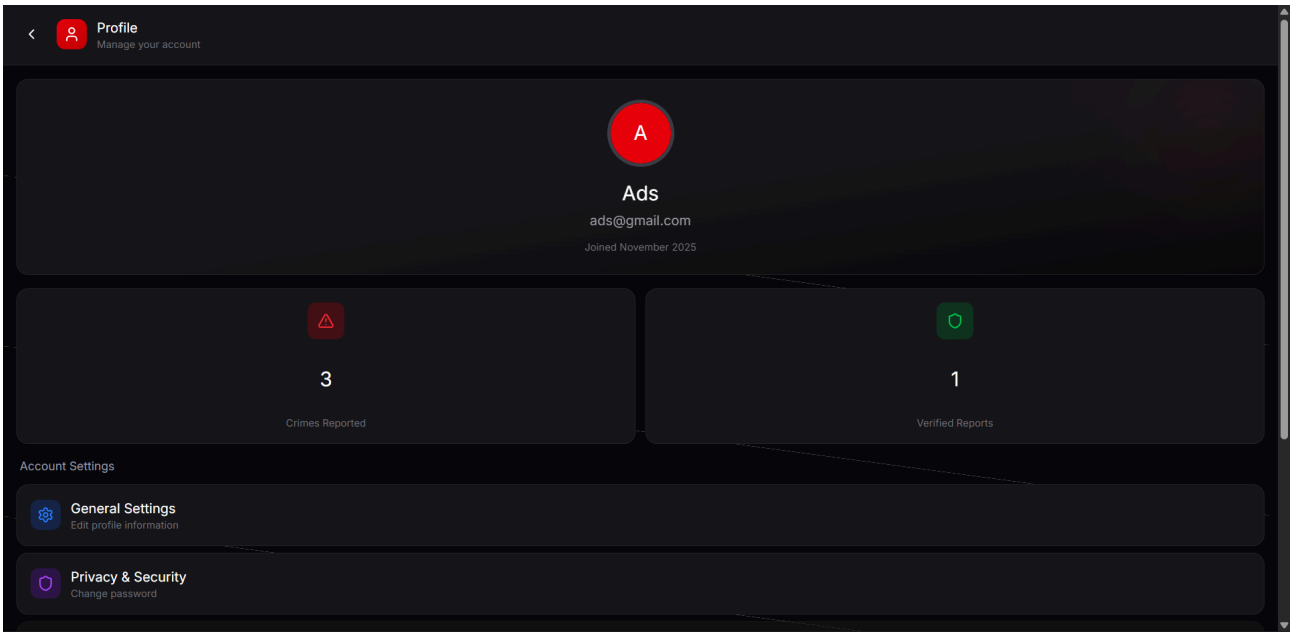
View Report:



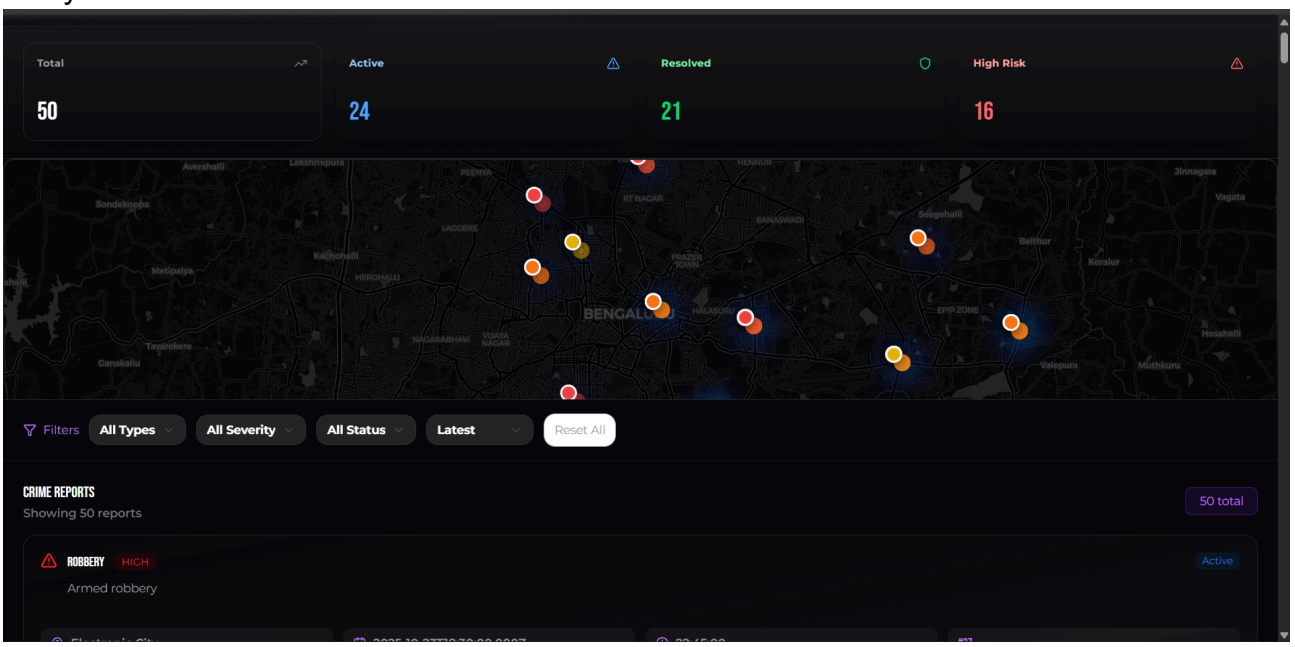
Report Crime:

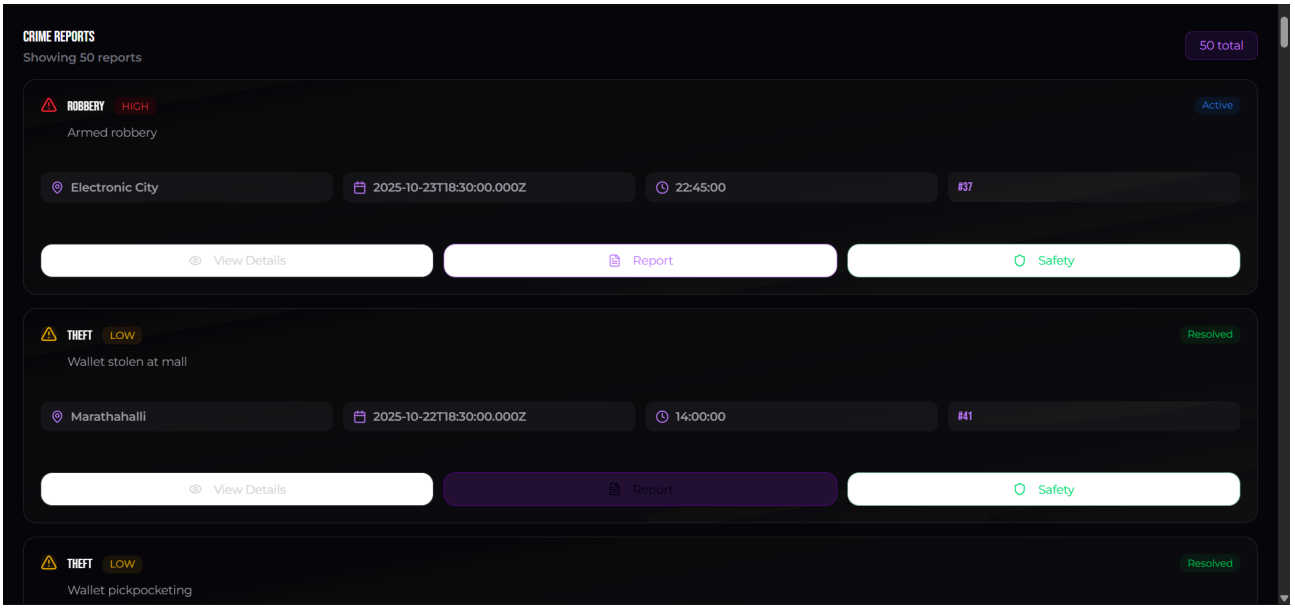


Profile:

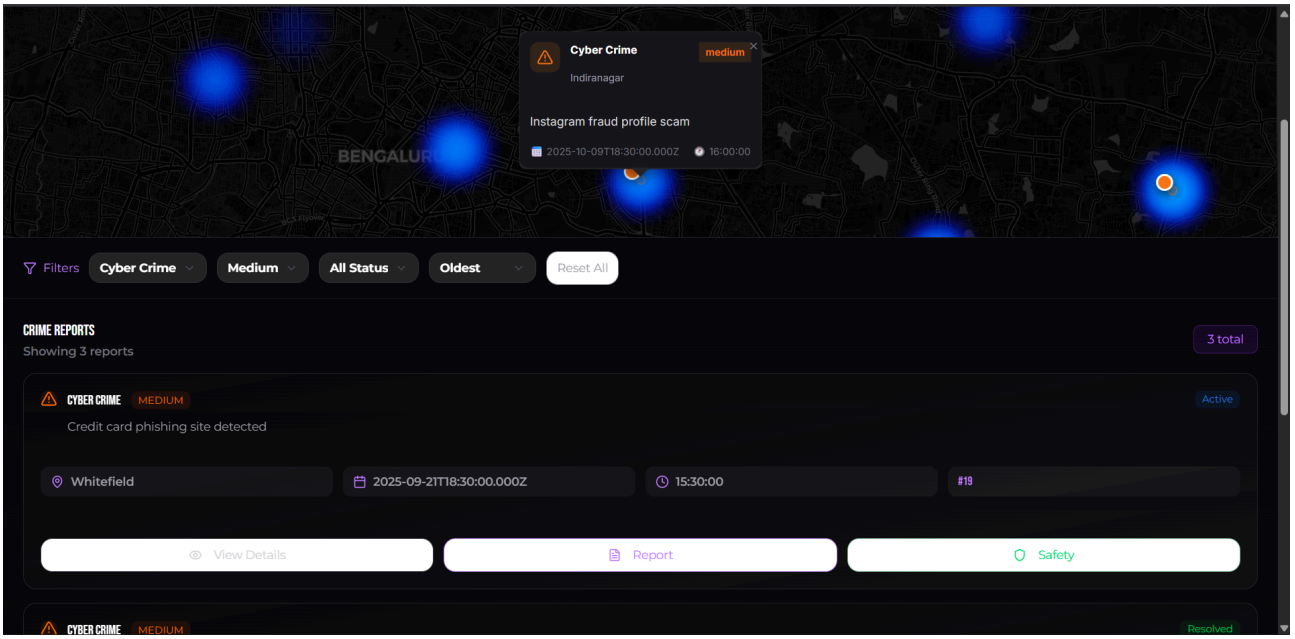


Analyst Dashboard:

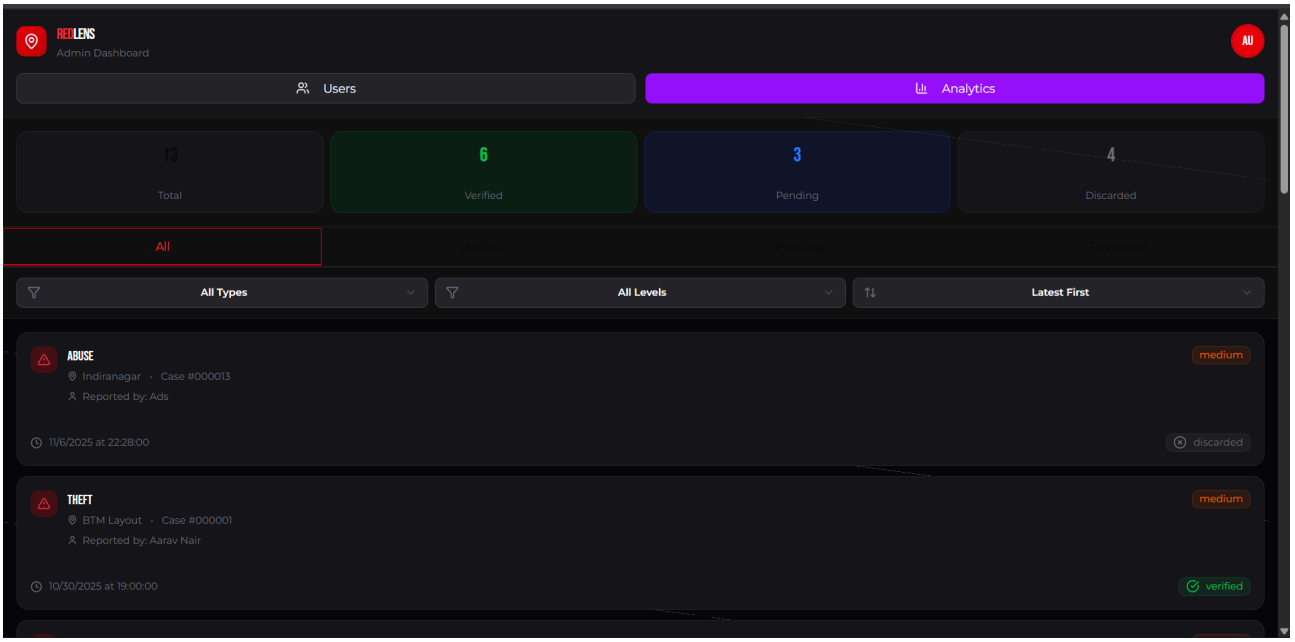


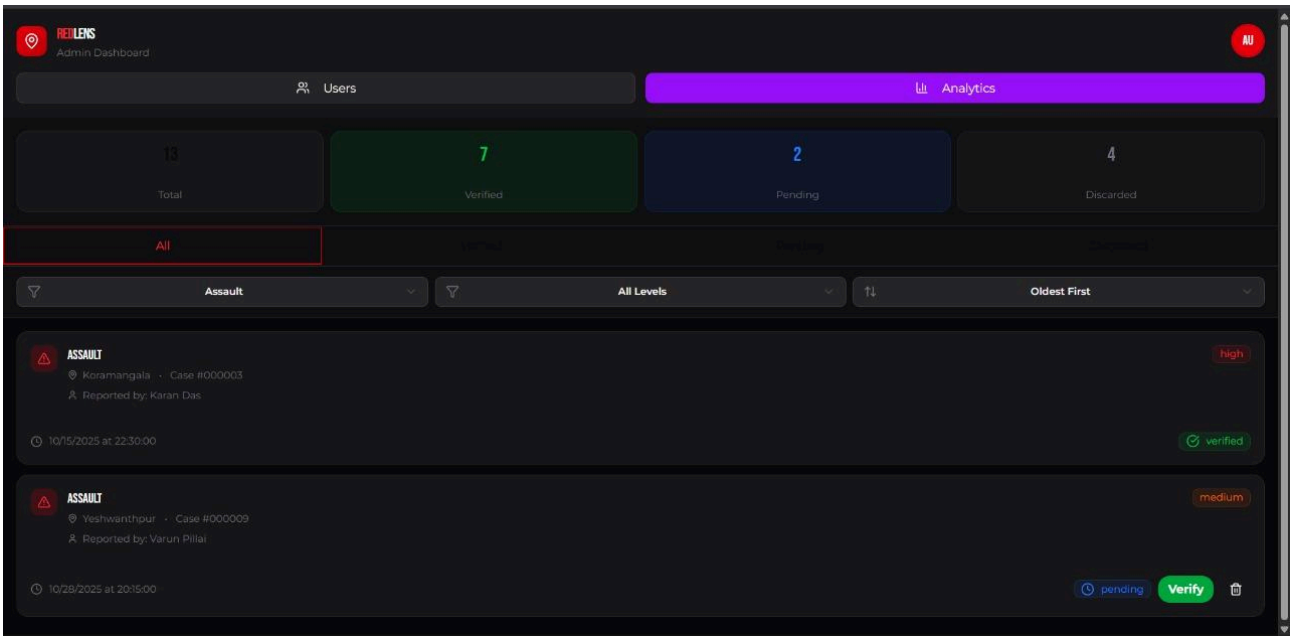


Filter (with hotspot view as well):

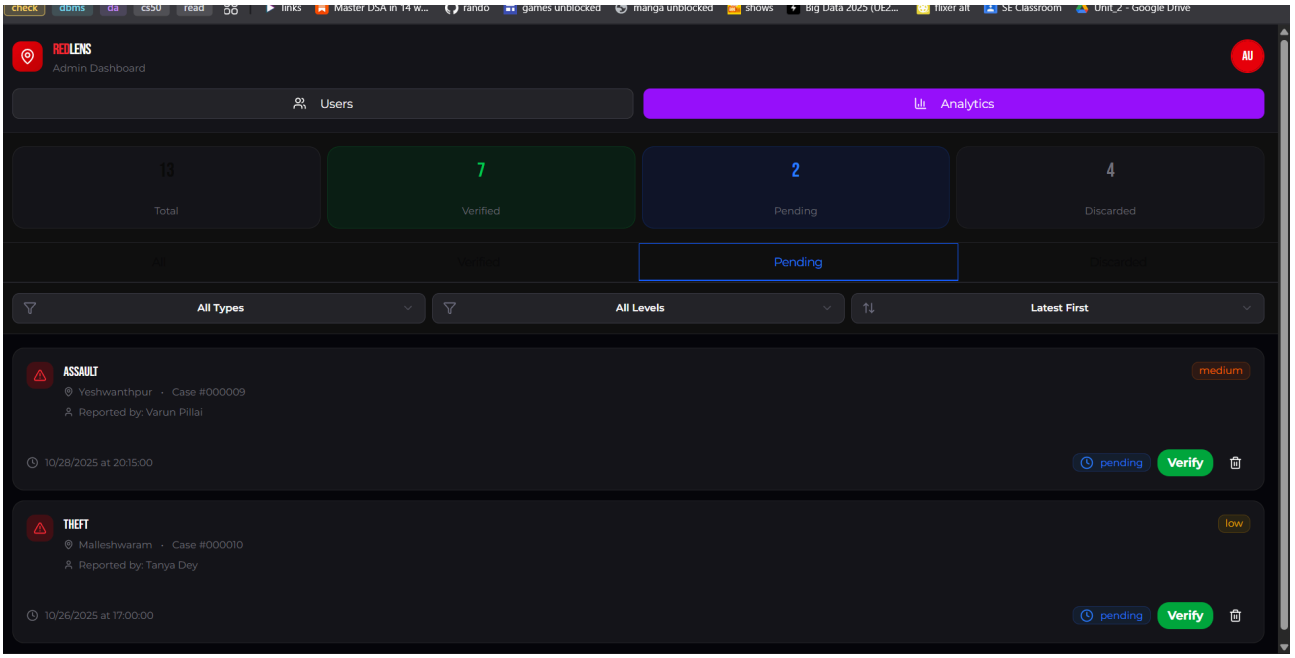


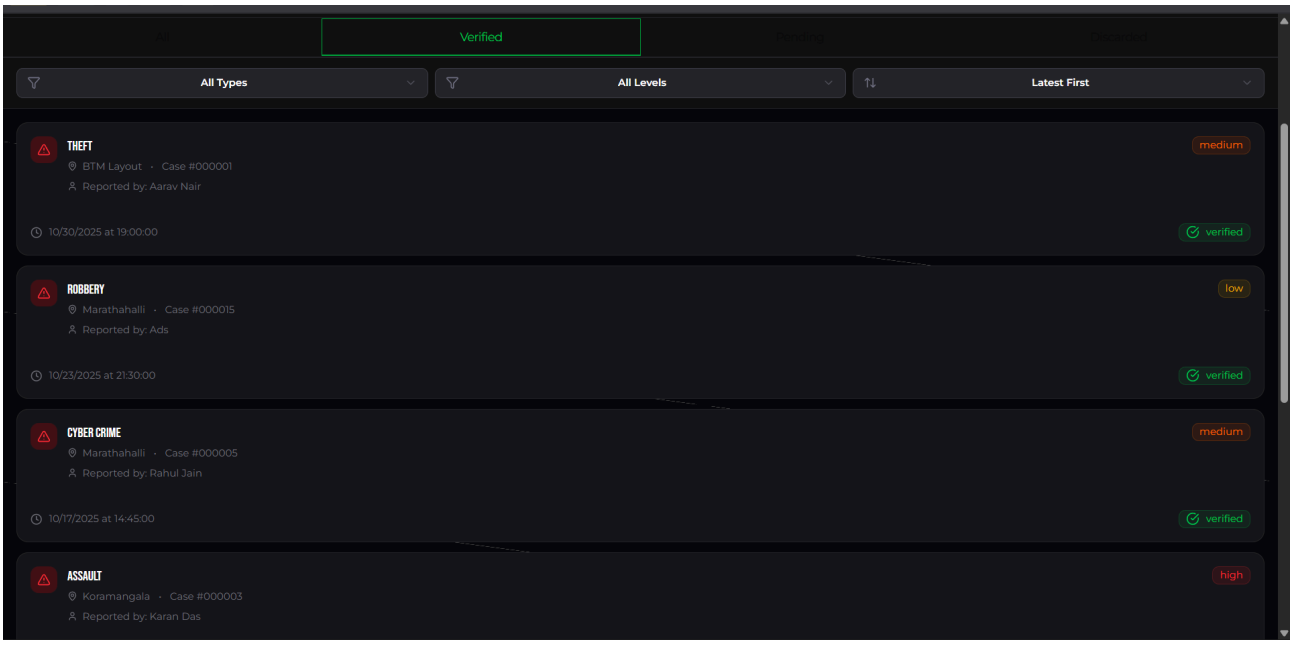
Admin Dashboard:



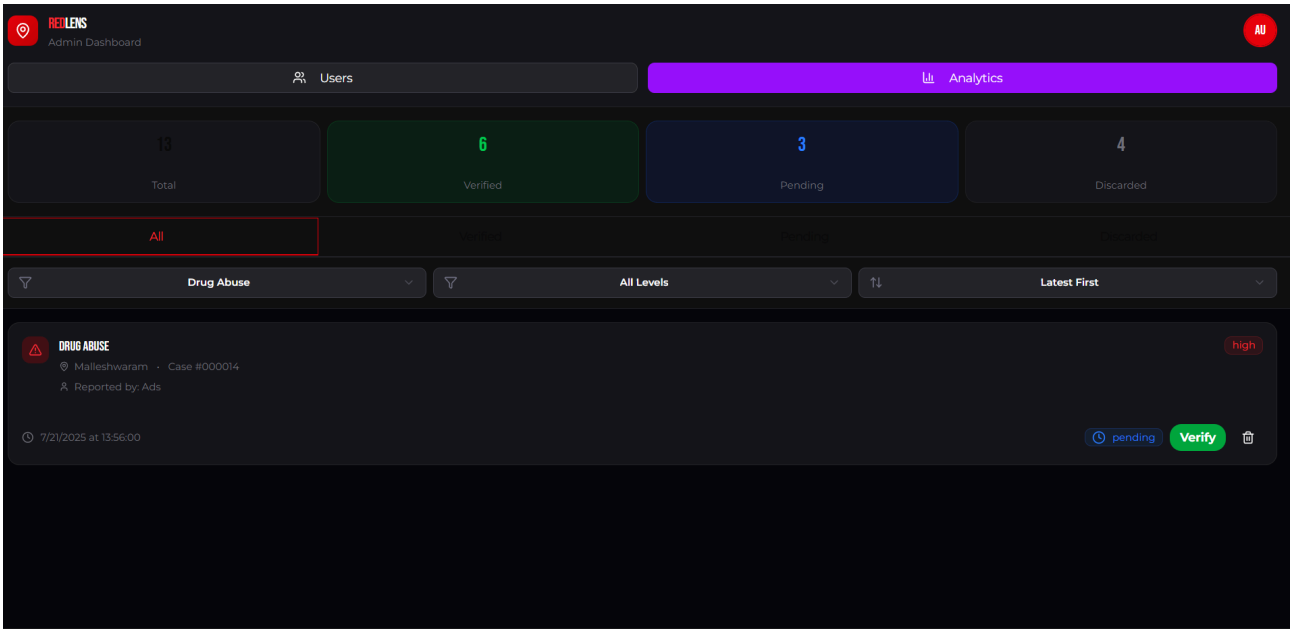


Pending and Verified Reports:

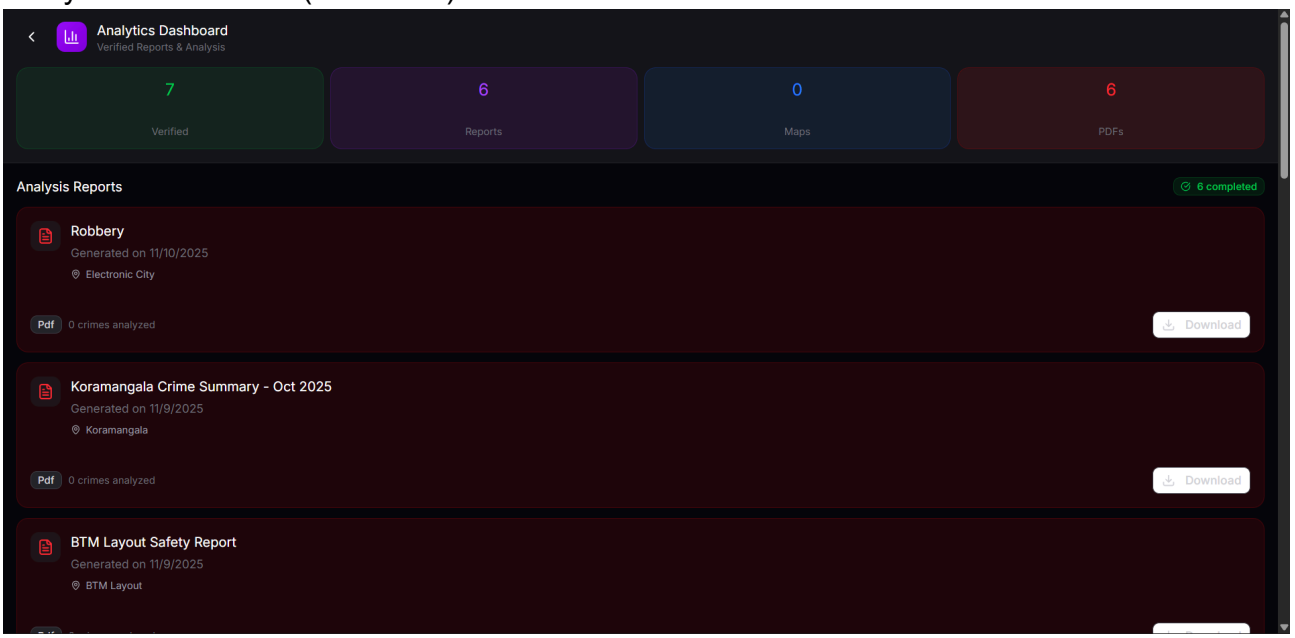




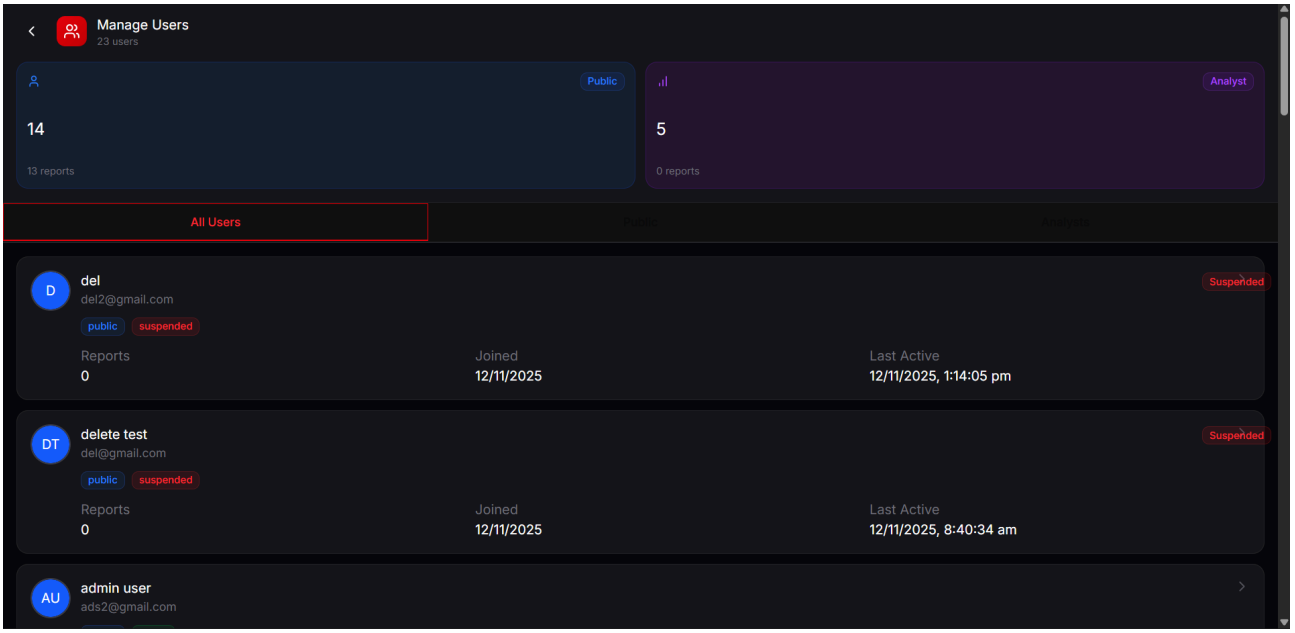
Verify or Delete (and filter) :

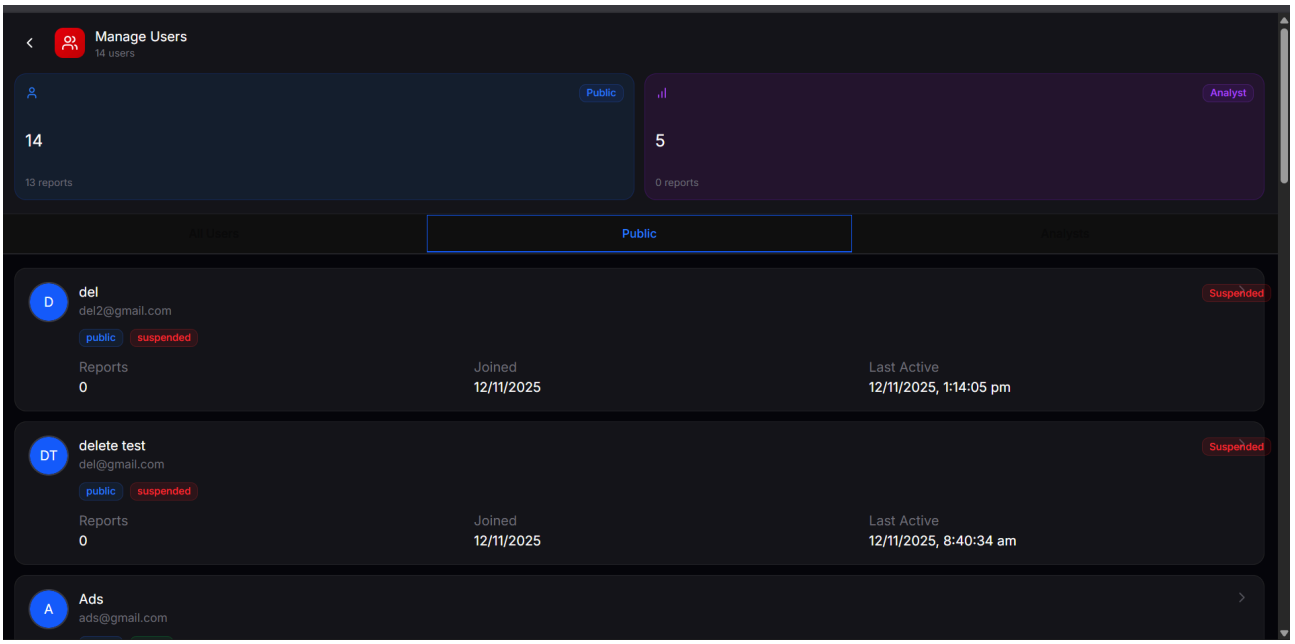


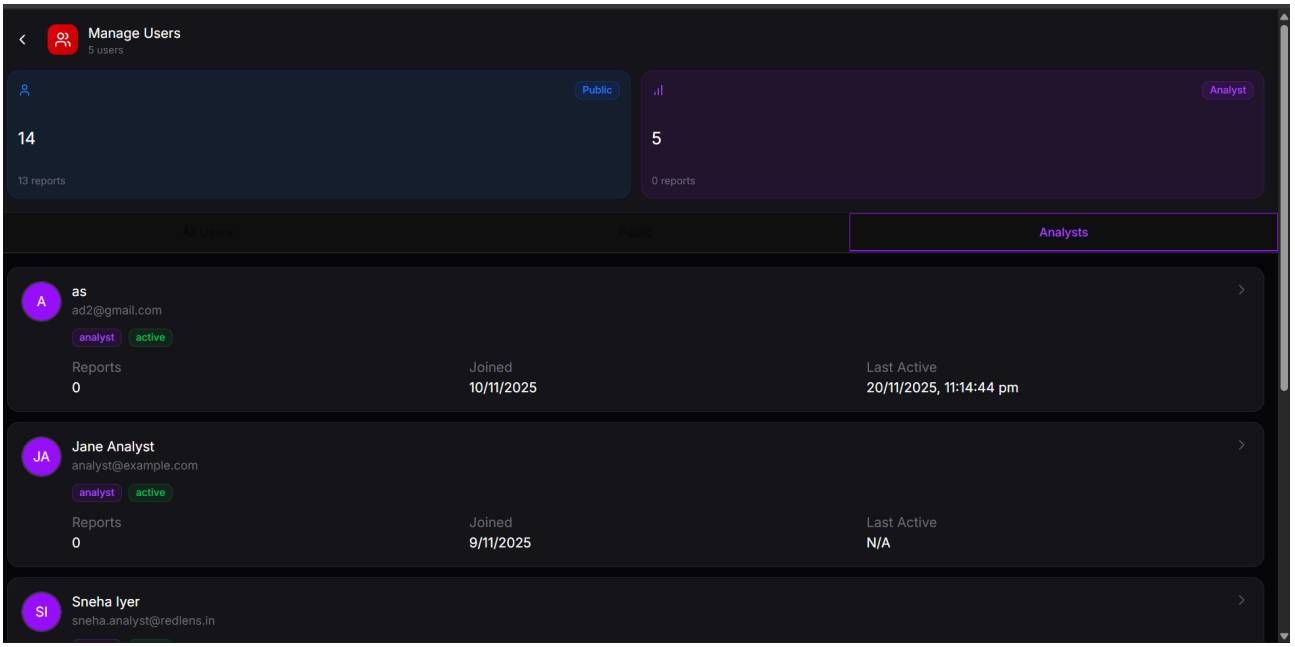
Analytics Dashboard (for admin)



User View (for admin):




Manage Users
14 users
Public
14
13 reports
Analyst
5
0 reports
Public
D
del
del2@gmail.com
public
suspended
Suspended
Reports
0
Joined
12/11/2025
Last Active
12/11/2025, 1:14:05 pm
DT
delete test
del@gmail.com
public
suspended
Suspended
Reports
0
Joined
12/11/2025
Last Active
12/11/2025, 8:40:34 am
A
Ads
ads@gmail.com


Manage Users
5 users
Public
14
13 reports
Analyst
5
0 reports
Analysts
A
as
ad2@gmail.com
analyst
active
Reports
0
Joined
10/11/2025
Last Active
20/11/2025, 11:14:44 pm
JA
Jane Analyst
analyst@example.com
analyst
active
Reports
0
Joined
9/11/2025
Last Active
N/A
SI
Sneha Iyer
sneha.analyst@redlens.in

CONCLUSION:

RedLens represents a successful synthesis of database theory and practical application. The project demonstrates that, with proper planning, design, and implementation, complex data management challenges can be effectively addressed. While the data used is synthetic, the methodologies, architecture, and code patterns developed are production-ready and industry-standard.

This project provided valuable hands-on experience in full-stack development, system design, and problem-solving.

The combination of MySQL's robust relational database capabilities, Express.js's flexible backend framework, and React's dynamic frontend creates a powerful platform that, with real data and proper authorisation, makes our project more robust.

LIST OF SOFTWARES USED:

Frontend
Framework: React with TypeScript
Styling: Tailwind CSS
State Management: React Hooks (useState)
Interactive maps - Leaflet

Backend
Runtime: Node.js with Express.js
Database: MySQL 8.0+
API: RESTful architecture
ORM: mysql2/promise for connection pooling

Database Features
GIS Support: Latitude/Longitude with 6 decimal precision
Stored Procedures and Functions: Complex business logic encapsulation
Triggers: Automated audit logging and data validation
Views: Optimized queries for common reports
Events: Scheduled tasks for maintenance

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