

University of Florida
Computer and Information Science and Engineering

[COP5725] - Database Management Systems

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Crime Data Analysis for Safer Communities

E-R Diagram and User Interface Design

Project Group : 18

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1 Application Overview

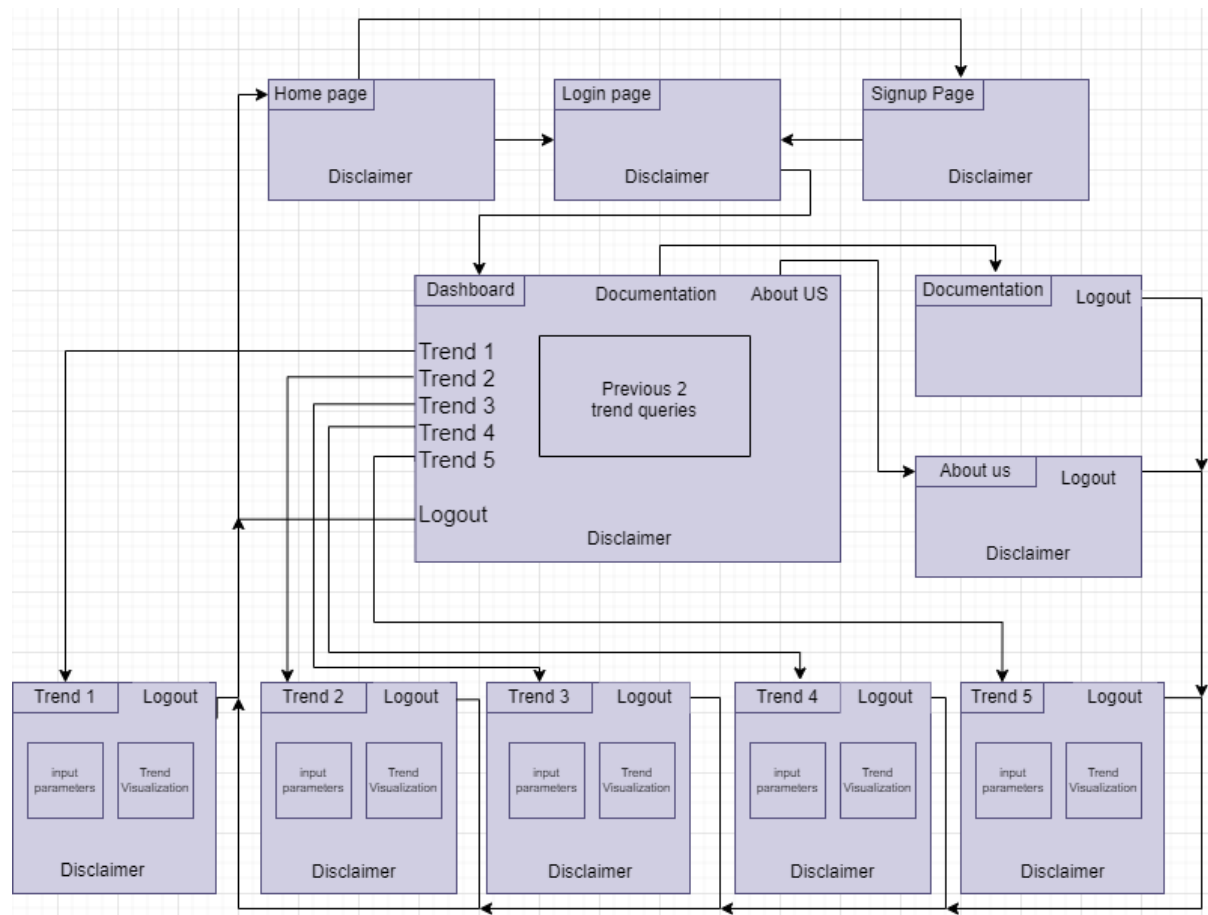
"Crime Data Analysis for Safer Communities" a web-based application, is heavily influenced by the trends it observes in criminal activity data. The functionality and impact of the application depend on these recent advances. Initially, the application's capacity to identify seasonal trends is important for fulfilling its goals. The application enables users to prepare for and respond to increased criminal activity during specific seasons or periods of the year by identifying how crime rates change throughout the years. In this case, if historical data shows that street crimes increase over the summer, police enforcement can use extra resources and public awareness efforts to successfully fight this seasonal trend.

Furthermore, complex trend queries enable users to look deeply into previous crime data, finding ongoing patterns that may prevent simple visualization. Users are provided with the resources required to carry out in-depth analyses of particular crime types or demographics over the years according to this performance. This skill is necessary when developing customized crime prevention measures. For instance, by carefully reviewing complicated trends, law enforcement organizations can identify and address the root causes of chronic criminal problems, resulting in more efficient and long-term solutions.

The application's main function geographical analysis, allows users to identify crime hot-spots and learn about the geographic patterns of criminal activity. For both law enforcement and community members, having a geographical awareness is important. While law enforcement can carefully allocate resources to regions with a history of criminal activity, citizens can exercise caution when traveling through high-crime areas. With the primary goal of making communities safer, these geographical information translate into proactive measures and greater neighborhood safety. As a result, the trends discovered by this web-based application are more than just points of information; there are also important catalysts that promote smart decision-making, resource allocation, and community involvement, ultimately advancing the larger goal of boosting community safety and security.

2 User Interface Design

2.1 Network of Webpages



Network of web pages

Each page in the website includes a common header with navigation bar featuring *website name* on the left, *Documentation* and *About Us* tabs on the right. User can always navigate to the homepage by clicking on *website name*.

Every page on the website features a standardized footer that includes a *disclaimer* regarding the proper and equitable use of data on the site.

2.2 Webpage Layout Design

2.2.1 Home Page

The homepage provides a general overview of the project.

The header and footer on this page adhere to consistent layout applied across all pages.

The body contains a *headline*, *sub-headline*, *Login* and *SignUp* CTA buttons. Clicking the *SignUp* button will direct you to the registration page while clicking *Login* button will direct you to the login page. If there is an active session for the current user, then user will see the dashboard page directly instead of the login page. The body also contain a supporting image to communicate about how a trend look like.

2.2.2 Login Page

The header and footer on this page adhere to consistent layout applied across all pages.

The body of login page has

- *username, password* fields : User can enter their credentials.
- *Login* button : After entering valid login credentials and clicking *Login* button, user is granted access to his dashboard page. If login credentials are incorrect, user gets a prompt "Invalid Credentials, Try Again".
- *SignUp* button : User can click to create a new account. After clicking *Signup* button, user will be redirected to Signup Page.
- *Forgot Password* button : Provides user with the option to reset their password in case they've forgotten it. This involves receiving a password reset link via email.

2.2.3 SignUp Page

The header and footer on this page adhere to consistent layout applied across all pages.

The body of signup page has

- *Name, Email_Id, Password, Re-Enter Password* fields : User can enter their name, email_id, password. Password need to be same in both password and re-enter password fields.
- *SignUp* button : After entering details, user need to click on *SignUp* button and then account will be created with email as username. A message "Account created with user name - email_id" and a login button to allow user to login with his new credentials will be displayed.
- *Login* button: User can click this button if has an account already. After clicking login button, user will be redirected to login page.

2.2.4 Documentation Page

The header and footer on this page adhere to consistent layout applied across all pages.

The body of this page will contain an overview of the application, along with information about trends. It will include descriptions, details about how these trends are generated, and the specific queries utilized in the generation process. It also include disclaimer information for this application.

2.2.5 About Us Page

The header and footer on this page adhere to consistent layout applied across all pages.

The body of this page contain information about course, instructor and team members.

2.2.6 Dashboard Page

The dashboard page header contains *navigation* bar with *website's name*, hamburger button on the left side of the navigation bar, while the right side contains *Documentation*, *About Us* tabs.

User can navigate to the homepage by clicking on *website name*. The hamburger button, when clicked reveals a left panel which contains a tab for each trend queries and a logout button. User can navigate between different trends using the tab for each trend in the side panel. User can click on logout button to log out, exit the dashboard and return to homepage.

The body of this page contain two most recent trends viewed by the user. For new users, it will be empty and displays a message "No previous trends" at the centre of the body.

The footer contains a disclaimer addressing the appropriate and fair usage of data on the website.

2.2.7 Trend Page

The trend analysis page has common layout for all the trends. The header contains *navigation* bar with *website's name*, hamburger button on the left side of the navigation bar, while the right side features *Documentation*, *About Us* tabs. The hamburger button is used to toggle the visibility of a left panel, which includes individual tabs for each trend and a logout button.

User can navigate to each trend page by clicking on the corresponding trend tab in the left panel.

The body of this page contain input parameters that user has to provide for generating the trend and a space where the trend would be displayed.

After providing the requested input parameters and then clicking on generate, trend query will be executed with provided input param values and trend will be displayed.

The footer contains a disclaimer addressing the appropriate and fair usage of data on the website.

Following are the input parameters that need to be provided in case of each trend query:

1. Seasonal Trend

- Season Name - Checkboxes (with season names as choices)
- Crime Type - Dropdown (different crime types, user has to select one. If none is selected, all crime types would be considered)

2. Geospatial Trend

- Ward - Dropdown (user need to choose a ward from list of wards)
- Radius - Textbox (Extent of the area around the selected ward center that will be taken into account when generating trends)

3. Day-of-the-week and Hourly Trend

- Time slot - Dropdown (user need to choose time slot from given list)
- Crime Type - Dropdown (user has to select one crime type. If none is selected, all crime types would be considered)

4. Incident Location Category Trend

- Location Category - Dropdown (user need to choose a location category from given list)
- Severity Level - Radio Buttons (User has the option to choose the level of crime severity, which determines which crimes will be considered when generating the trend)

5. Index vs Non Index Trend

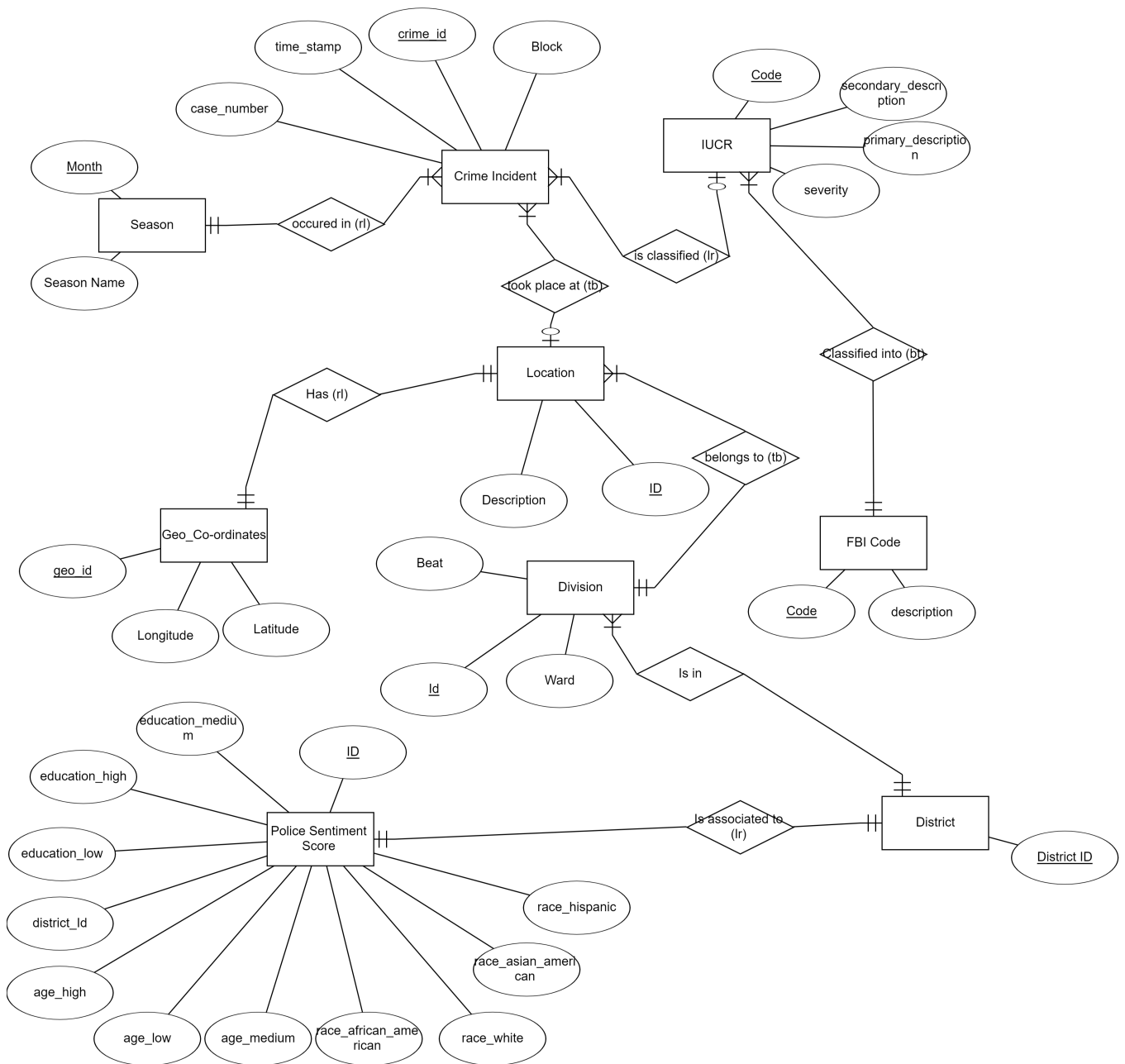
- Crime Category - Radio Buttons (user need to choose one between Index and Non Index categories.)

- Primary Crime Type - Dropdown (user has to select one crime type from dropdown values. If none is selected, all crime types would be considered)
- Timeperiod - Radio Buttons (user has to choose one option from *last 3 yrs*, *last 5yrs*, *last 10yrs*)

6. Police Sentiment Score Trend

- District - Dropdown (user need to choose one district)
- Classification - Dropdown (user need to choose one type for analysis like Race or Education etc)
- Classification Value - Radio buttons (user has to select one value for the selected classification)

3 E-R Diagram



Following is the detailed description about the entity sets, relationship sets and the attributes shown in the above ER diagram.

3.1 Entities and their attributes

Crime Incident: This entity set contains the details about the crimes happened in Chicago city . Since it contains a id attribute to uniquely identify each of its tuples, it is a strong entity. The following is the detailed list of the attributes of a crime:

- **crime_id** : Unique identifier for the record.
- **case_number** : The Chicago Police Department RD Number (Records Division Number), which is unique to the incident.
- **time_stamp** : Time stamp when the incident occurred.
- **block** : The partially redacted address where the incident occurred, placing it on the same block as the actual address.

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IUCR : This entity set contains the details about the Illinois Uniform Crime Reporting (IUCR) Codes. Since it contains a code attribute to uniquely identify each of its tuples, it is a strong entity. The following is the detailed list of the attributes of the IUCR code.

- **code** : Unique identifier for the record.
- **primary_description** : It indicates the main category of a crime incident
- **secondary_description** : It provides additional details or subcategories within that main category.
- **severity** : It reflects the seriousness of the offense.

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FBI Code : This entity set contains the details about the FBI codes issued by the Federal Bureau of Investigation to track and manage cases.

- **Code** : Unique identifier to record the category of the incident.
- **description** : It provide detailed information about specific crimes or offense.

Season : This entity set contains the details about the description or information related to a particular season.

- **month** : It is a division of the calendar year.

- **season** : It refers to a period of the year characterized by specific weather patterns and natural changes.

Location : This entity set contains the details about the location at which the incident happened. The following is the detailed list of the attributes of the location entity.

- **ID** : Unique identifier to identify the location of the incident.
- **description** : Description of the location where the incident occurred.

Geo_Co-ordinates : This entity set contains the details about the geographic data of the incident and it has a unique identifier to identify the details, hence it is a strong entity. The following is the detailed list of the attributes of the Geo_coordinates entity.

- **geo_id** : Unique identifier to record the geo coordinates of the incident.
- **Longitude** : The longitude of the location where the incident occurred. This location is shifted from the actual location for partial redaction but falls on the same block.
- **Latitude** : The latitude of the location where the incident occurred. This location is shifted from the actual location for partial redaction but falls on the same block.

Division : This entity set contains the details about the subdivision or categorization of a geographic area or place into smaller administrative or geographical units. It has a unique identifier id hence it is a strong entity.

- **id** : Unique identifier to identify the record.
- **Ward** : The ward (City Council district) where the incident occurred.
- **Beat** : Indicates the beat where the incident occurred. A beat is the smallest police geographic area – each beat has a dedicated police beat car. Three to five beats make up a police sector, and three sectors make up a police district.

District : This entity set contains the details about the various districts in the city and has a unique identifier district_id.

Police Sentiment Score : This entity set contains the measure of public attitudes towards the local police department, often indicating levels of trust and satisfaction. And has a unique identifier ID to identify the records. Hence it is a strong entity. List of attributes in the entity set are.

- **race_hispanic** : Safety score for Hispanic respondents.
- **race_african_american** : Safety score for Non-Hispanic Black/African American respondents.
- **race_white** : Safety score for Non-Hispanic White respondents.
- **race_asian_american** : Safety score for Non-Hispanic Asian American respondents.
- **age_low** : Safety score for respondents age 18-34.
- **age_medium** : Safety score for respondents age 35-54.
- **age_high** : Safety score for respondents age 55+.
- **district_Id** : Id of the district.
- **education_low** : Trust score for respondents with an education level up to high school graduate.
- **education_medium** : Trust score for respondents with some college or a college degree.
- **education_high** : Trust score for respondents with an advanced degree.

3.2 Relationships

- **took place at** : The two entities Crime incident and Location are associated to each other with the relationship 'took place at' and signifies Crime took place at a particular location.
- **occurred in**: The two entities Crime incident and Season are associated to each other with the relationship 'occurred in' and signifies Crime occurred in a particular season.
- **is classified**: The two entities Crime incident and IUCR are associated to each other with the relationship 'is classified' and signifies Crime incident is classified into IUCR code.
- **classified into**: The two entities IUCR and FBI code are associated to each other with the relationship 'classified into' and signifies FBI codes are classified into IUCR codes.
- **belongs to** : The two entities location and division are associated to each other with the relationship 'belongs to' and signifies Location belongs to a division.

- **has:** The two entities location and Geo-Coordinates are associated to each other with the relationship 'has' and signifies Location has Geo-coordinates.
- **is-in:** The two entities Division and district are associated to each other with the relationship 'is-in' and signifies Division is in a district.
- **is associated to :**The two entities District and Police sentiment score is mapped using the relationship ' is associated to' and signifies Police sentiment score is associated to a district.

3.3 Cardinalities

- Many crimes can occur in a season and there can be atleast one crime occurred in the season.
- One or more crimes fall under a same IUCR code. There can be no crimes corresponding to an IUCR code.
- One FBI code is classified into many IUCR codes.
- Many locations can belong to one division.
- A location have a unique Geo coordinate.
- Many divisions fall into the same district.
- Each district is associated with a police sentiment score .

3.4 Assumption

Severity is determined by analyzing the primary and secondary descriptions found in the IUCR (Illinois Uniform Crime Reporting) code, which are provided by law enforcement agencies in Chicago.