VehID

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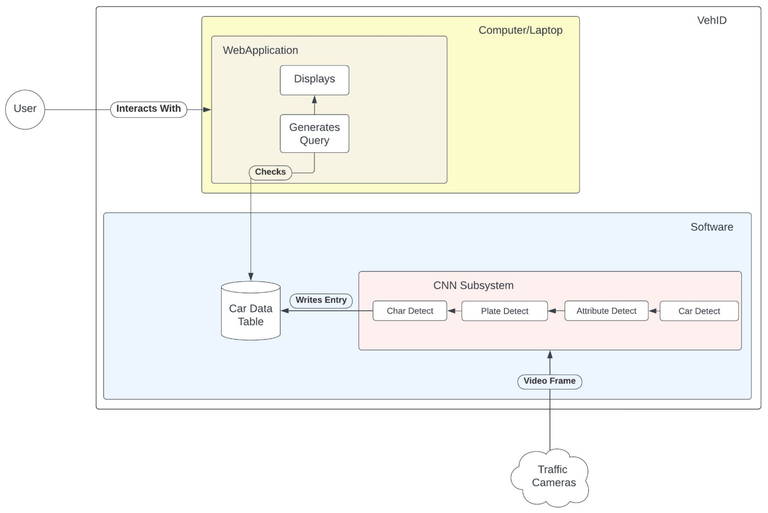
Goal

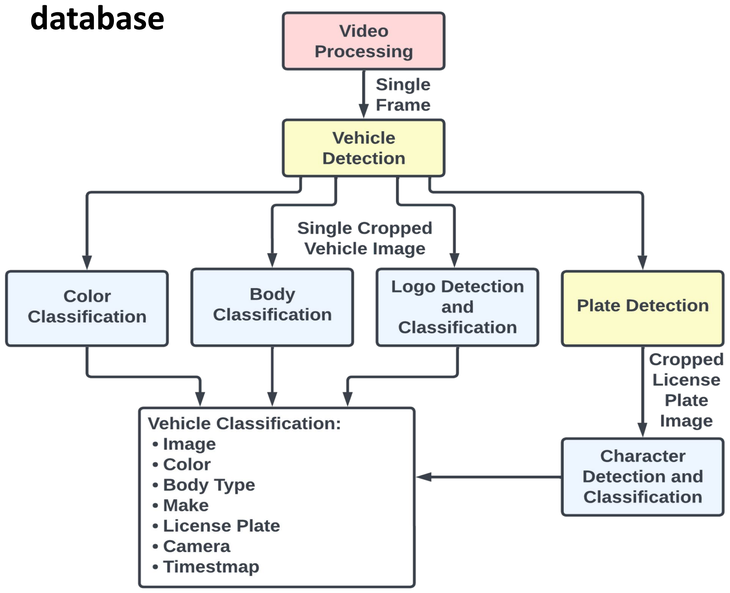
To improve public safety by utilizing machine learning to recognize vehicles based upon a variety of characteristics such as color, body type, make, and/or license plate.

Design



Neural Network (NN) Subsystem

- Utilized pre-exisitng NN architectures
  - MiniVGG (Body and Color Classifications)
  - VoloV8 (Vehicle, Logo, Plate, and Character Detections)
- Exports results to a JSON file for use in the database



Motivation

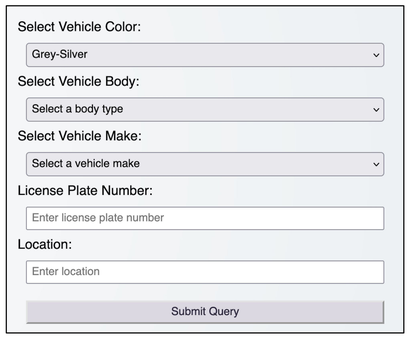
- Aid in AMBER alerts, stolen vehicles, and criminal offenses, which tends to rely on pure human interaction to spot and report the specified vehicles.
- Existing automation only identifies license plate numbers and is not beneficial when only other characteristics are available.

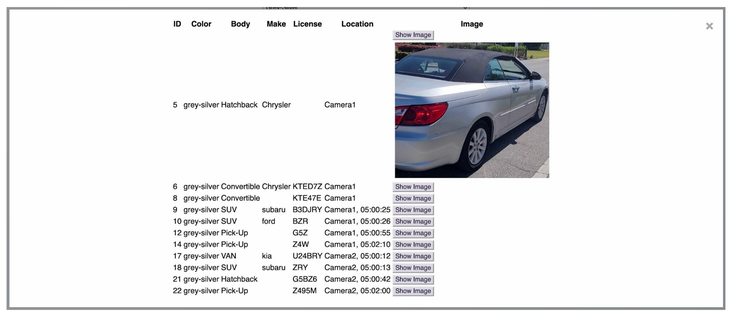
Database

- Car database: Stores entries of vehicles detected by the NN subsystem.
  - Includes image path, color, body type, make, plate, camera ID, and timestamp.

Web Application

- Allows for users to interact with the data contained within the databases.
- User functionalities:
  - Perform queries to search for vehicles with desired characteristics
  - Filter detected vehicle entries to be displayed on its respective web page
  - Edit and delete detected vehicle car entries
  - View saved images for each car entry for manual verification
- Example Query for any detected Grey-Silver vehicles and corresponding results displayed in the modal.





Implementation

- Neural Network Subsystem Tools:
  - Utilized various Python libraries
    - OpenCV
    - Tensorflow: Keras, MiniVGG model
    - Ultralytics: YoloV8 models
- Web Application Tools:
  - HTML/CSS
  - JavaScript
  - Node

Evaluation Results

- Neural Network Subsystem Evaluation:
  - 95% positive vehicle predictions
  - 45% positive color predictions
  - 32% positive body type predictions
  - 47% positive make predictions (out of the ones that had predictions)
  - 71% had 1 or more attributes correctly predicted
  - 28% had 2 or more attributes correctly predicted
- Web Application Evaluation:
  - Accurate and timely query results
  - Accurate and timely filter results
  - Timely table population
  - Sleek and intuitive web application design

Limitations

- Image/Video Quality
- Weather/Environmental Factors

Improvements

- Further training and tuning on select models to improve individual performances.
- Implement web scraping to automatically populate the database with queries from sources such as AMBER alerts.
- Host web application so queries can be ran repeatedly at set time increments
- Incorporate into a network of existing cameras.