CS331: SOFTWARE ENGINEERING LAB

Assignment 2

USE CASES

- **Capture Camera Feed:**
  The system captures live video feed from traffic cameras installed at road intersections for continuous monitoring and analysis.
- **Control Traffic Lights:**
  The system controls traffic signals by switching red, yellow, and green lights based on decisions made by the signal timing logic.
- **Monitor Traffic Hardware:**
  The system monitors traffic light hardware to detect malfunctions, failures, or abnormal behavior of signal equipment.
- **Override Signal Manually:**
  A traffic officer can manually override automatic signal control during emergencies or special traffic situations such as accidents or roadblocks.
- **Display System Status:**
  The system displays real-time information such as camera feed, signal status, vehicle count, traffic density, and timers on the monitoring screen.
- **Trigger Emergency Mode:**
  When an emergency vehicle such as an ambulance or fire truck is detected, the system activates emergency mode to prioritize its movement through the intersection.
- **Count Vehicles:**
  The system analyzes the camera feed to count vehicles such as cars, bikes, and trucks present in each traffic lane.
- **Activate Fail-safe Mode:**
  If camera failure or hardware malfunction is detected, the system automatically switches to a fixed-timer signal mode to ensure uninterrupted traffic flow.
- **Adjust Signal Timing:**
  The system dynamically adjusts green light duration based on traffic density, emergency conditions, manual override, or fail-safe operation.
- **Detect Vehicle Density:**
  The system calculates traffic density using vehicle count data to support intelligent and adaptive signal timing decisions.
- **Detect Traffic Rule Violation:**
  The system detects traffic rule violations such as signal jumping, overspeeding, or illegal lane crossing using camera input and intelligent analysis.

- **Store Violation Data:**
  The system stores detected traffic rule violations along with time, location, and vehicle details in the database for record keeping and future reference.
- **Retrieve Violation Records:**
  Authorized users can retrieve stored violation records from the database for monitoring, reporting, and legal enforcement purposes.

ACTOR

- **Traffic Camera:**
  A hardware device that captures live video feed of traffic for vehicle counting, density detection, and traffic rule violation detection.
- **Traffic Light Hardware:**
  The physical traffic signal equipment that executes signal control commands issued by the system.
- **Traffic Officer:**
  An authorized human user who can manually override traffic signals and view system status and violation records.
- **Emergency Vehicle:**
  An external entity such as an ambulance or fire truck that triggers emergency signal priority.
- **AI Agent:**
  An intelligent software module responsible for analyzing camera feed, counting vehicles, detecting traffic density, identifying traffic rule violations, adjusting signal timing, activating emergency and fail-safe modes, and updating system status.
- **Traffic Database:**
  A storage system that maintains traffic data, signal logs, and traffic rule violation records for monitoring, reporting, and future reference.

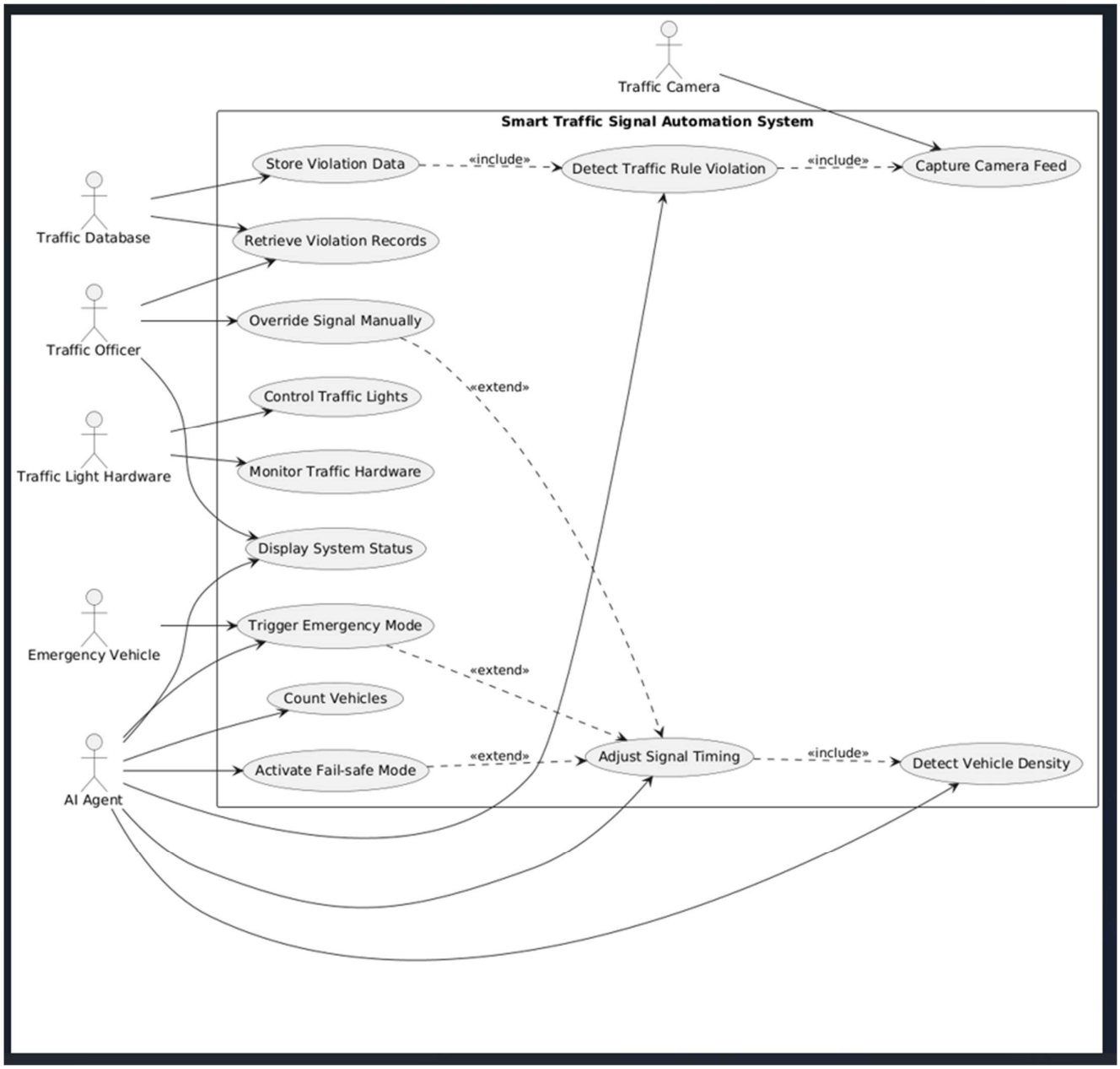
RELATIONSHIP EXPLANATION

- **Adjust Signal Timing** <<include>> **Detect Vehicle Density**
  (Detecting vehicle density is a mandatory step for adjusting signal timing.)
- **Trigger Emergency Mode**, **Override Signal Manually**, and **Activate Fail-safe Mode** <<extend>> **Adjust Signal Timing**
  (These behaviors occur only under specific or exceptional conditions.)
- **Detect Traffic Rule Violation** <<include>> **Capture Camera Feed**
  (Traffic violations are detected using live camera input.)
- **Store Violation Data** interacts with **Traffic Database**
  (Violation records are stored and retrieved from an external database system.)

CONCLUSION

The Smart Traffic Signal Automation System provides an intelligent and automated solution for modern traffic management. By incorporating real-time traffic analysis, emergency handling, traffic rule violation detection, and database support, the system enhances traffic efficiency, safety, and reliability. The use case diagram effectively represents system behavior, actor interactions, and conditional operations, making the system scalable and suitable for smart city applications.

UML:


Traffic Camera
Smart Traffic Signal Automation System
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Detect Traffic Rule Violation
«include»
Capture Camera Feed
Traffic Database
Retrieve Violation Records
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