**Hands Free Driving System 3 (HFDS3) – CSE 435**

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**Questions**

1. If an object is detected in the road how will the system mitigate the collision?

Response: The response will largely be the same as standard adaptive cruise control (assume this feature pre-exists). The system will flash a red light (on steering wheel) to warn the driver of an impeding collision or apply automatic braking if necessary. The system will not steer to avoid any objects, such as other vehicles, animals, potholes, debris, and construction cones. This is the driver’s responsibility.

2. What happens if a driver attempts to enable the system on non-highway roadways?

Response: The driver must first activate the adaptive cruise control feature. If the system detects that the vehicle is on a lidar-mapped road and proper conditions are met, the option to activate HFDS will appear. If HDFS is not available, the HDFS icon within the dashboard will not be illuminated. Drivers can view messages/operation status on the driver information center page (displayed on dashboard).

3. What happens if a driver attempts to engage the system on non-path prediction subsystem highways?

Response: Like response 2.

4. Under what conditions would the system have to relinquish control to the driver?

Response: The driver should be warned and prompted to regain control when:

* The system detects a fault
* Vehicle is exiting the highway
* The lane or freeway is ending
* Lane markings are poor, or visibility becomes limited
* System determines unsafe trajectory (tight curve, current speed)
* Adaptive Cruise Control deactivated

5. What does the system do with training data to improve navigation on highways?

Response: Training data is used off-vehicle to enhance system features. New mappings can be updated Over-the-air to improve navigation on highways.

6. How are software updates to the system handled?

Response: OTA (Over-the-air) mapping updates can be pushed to the vehicle. As for software/system updates, the vehicle is serviced to ensure new functionality is clearly explained to drivers.

7. How is stopping handled if system detects that the user is not paying attention to the road?

Response: Like response 10. If the driver does not regain control, the vehicle will slow down, stop, and turn on flashers.

8. What happens if the Driver Attention System camera is blocked or malfunctions?

Response: HFDS is deactivated.

9. What determines proper driver engagement with road?

Response: The camera mounted on the steering column tracks the driver’s eyes, mouth, nose, ears, and head movement to determine where the driver is looking. If all are not facing forward for more than ~5 seconds, the driver is deemed not attentive.

10. What are the various warnings?

Response: The system will flash a green light on the steering wheel to prompt the driver to return attention to the road (1st alert). If the steering wheel flashes for too long and the system continues to determine the driver is distracted, a red light will flash red to notify the user to take steering control immediately (2nd alert). If the driver remains distracted, a voice prompt will announce to take control immediately (3rd alert). If the driver does not regain control, the vehicle will slow down, stop, and turn on flashers.

11. What are the different warnings for if the driver needs to reclaim control versus if the driver is distracted?

Response: Like response 10.

12. What do you mean by “monitor the driver’s eyes to ensure active engagement with the road”?

Response: The camera mounted on the steering column tracks the driver’s eyes, mouth, nose, ears, and head movement to determine where the driver is looking. If all are not facing forward for more than ~5 seconds, the driver is deemed not attentive.

13. How soon should the system recognize its blue path is different from its current path? What are safe vs unsafe driving conditions?

Response: The system will project the path about 2,500 meters ahead.

Safe driving conditions consist of:

* Vehicle is on a lidar-mapped road
* All sensors are fully operational
* Lane markings are fully visible
* Driver is attentive
* Fair weather conditions

14. What do you consider a safe distance between vehicles? Should we allow the driver to change this distance?

Response: HFDS maintains the set following distance behind a car ahead – This is previously set by adaptive cruise control (far – 3 car lengths, medium – 2 car lengths, near – 1 car length).

15. What is considered an adequate LiDAR mapping?

Response: HDFS relies on a LiDAR-mapped database that is aboard the vehicle.

The Path Prediction Subsystem determines the “blue-path”. This is a virtual line drawn on the road by leveraging the lidar database. The path is optimized to ensure optimal vehicle performance and safety – Which considers curves, elevation, and current speed. If the driving path cannot be performed smoothly, the trajectory is deemed unsafe.

16. What would a HUD for the system look like? How will the user interact with it? Would this interfere with the Driver Attention System?

Response: The HUD is like modern day HUDs – With a few additions. The driver interacts with the HUD through the steering wheel. Drivers can view messages/operation status on the driver information center page (displayed on dashboard). See response 21.

17. Where should the vibrations be sent?

Response: Seat vibrations

18. What is the Path Prediction Subsystem and what does it do?

Response: Like response 15.

19. How should the system respond after a user disengages the system by adjusting the steering wheel, braking, or throttle?

Response: If the system is active, the steering wheel will illuminate a constant green light. If active and the driver takes control, the light will become blue (indicating manual mode). If still active after manual maneuver is complete, the system will resume operation and change the light back to green. If HFDS is not active, there will be no light illuminating from the steering wheel.

20. What are the various types of camera in the vehicle subsystems?

Response:

* Downward-pointing cameras that analyze lane markings
* Infrared Camera to track head movement
* Forward facing cameras
* 360-degree camera – Showing overview of the vehicle for redundancies

21. What are the possible human inputs for the human machine interface?

Response: The Human Machine Interface Subsystem accepts requests to turn on/off HFDS. First, Adaptative Cruise Control must be enabled. If successful and preconditions are met, the user can then activate HFDS.

22. How are destinations handled in hands-free mode?

Response: There are no destinations settings.