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Lane Management System Requirements

Primary Requirement:

1. The system will have a lane management system.

    a. If the system detects that you are not near a certain range of the center of the lane, it will enable the system to override and take over to gently move you back into the center at a safe speed.

    b. Users will be able to override the lane keeping assistance through pulling the wheel.

2. The system will have a lane departure warning system.

    a. The User Interface System shall accurately update the driver about the vehicle's positioning in the lane, using the calculations of the Path prediction Subsystem.

    b. The system will alert the driver in some way if it has found the vehicle is drifting.

    c. There shall be a warning signal in the vehicle's panel to let the driver know when the system is about to intervene.

    d. Before the system takes control, the system must first make sure that the user did not intentionally try to leave the lane.

    e. Turning your turn signal on signals you intend to switch lanes and will not cause alert.

    f. The warning shall contain both sound and vision components.

3. The system will have a lane centering system and lane keeping system.

    a. While active, the Lane Centering System must use the Path prediction Subsystem to accurately calculate if the car is centered in the lane or not.

    b. In a lane that is not linear, there would be an estimation system that predicts and determines the speed, angle, and road curvature.

    c. The system will have cameras that will monitor the sides of the vehicle.

    d. Images are then sent to processing to ID lane markings.

    e. The system's cameras will monitor the front, side, and exterior sides of the vehicle.

f. The system shall recognize different types of lane markings: solid lines, dashed lines, and double lines. It shall only warn the user when the vehicle's about to cross solid and double lines, or when the vehicle's crossing dashed lines with signals left off.

g. This should occur in a set amount of time or distance so that it can continuously and periodically reevaluate the situation.

4. The system shall continuously monitor the status of hardware components.
   a. When inputs from the hardware are inconsistent or unreliable due to hardware failures or hazardous environmental conditions, LMS shall warn the user and be deactivated.

Secondary Requirement:

1. The Lane Departure Warning System should be able to gently alert the driver that the vehicle is leaving the lane without a warning that would impede the ability to operate the vehicle.

2. There will be a disclaimer that the LMS is not a substitute for paying attention and driving carefully.

3. The driver will be alerted if the LMS is turned off if it is not able to detect lines.

4. The system can be turned off by the driver.

5. The system will provide brief steering nudges and not aggressive movements.

Global Invariants (System properties that are always true):

1. Prevent lane drifting.

2. Alerts driver of drifting.

3. The system's purpose is to prevent accidents.

4. The system shall maintain continuous monitoring of the vehicle, the lane boundary, and surrounding objects under all road and environmental conditions.

5. When the user intervenes, the vehicle shall disregard the system's instructions and behave based on the user's instructions.

6. Never go over 5 mph over the current speed when adjusting

7. Continuously adjust the system to adapt to the current landscape.

Constraints

1. Since this will be using lane markers and the paint to determine the boundaries of the lanes, it will be hard to get proper calculations if the paint is fading, there is rain, there is snow covering, or there is dirt covering the lane markers.

2. Lane markers cannot be damaged.

3. Cameras may be obstructed by poor weather such as heavy rain, fog, or snow.

Questions:

1. What are all the factors and data considered when the Path prediction Subsystem is calculating the predicted path of the car?
2. How will the system be able to adapt to the changing weather conditions on the road?
3. When the Lane Management System takes control of the vehicle, how do the cameras and sensors consider other vehicles on the road that could be a hazard to the vehicle?
4. What automotive safety standards should LMS adhere to?
5. How is the system expected to behave in the event of a bumpy road? Will the cameras be able to capture usable shots?
6. What type of information about the system should the LMS log for analysis and reporting?
7. What is the speed threshold indicated that allows for the various systems in the Lane Management System to become present?
8. How often do you want the system to readjust?
9. What specific driving challenges do the users face that this system should address?

10. What settings of the system users can customize (warning preferences, sensitivity settings)?

Citations

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