Active Park Assist Requirements, Invariants, and Questions
Group Homework 2

Primary Requirements:
1. The system will turn on via the vehicle’s interior user interface.
   a. APA can only be activated if the vehicle is moving under 20 mph.
2. The system will be able to park in both parallel and perpendicular spots.
   a. For perpendicular parking: spaces should be at least 8.5 feet wide and 18.5 feet long for a standard sized car [2].
   b. For parallel parking: space should be at least 1.5 times the size of the vehicle [3].
3. The system will use the front, side, and rear mounted cameras and sensors to detect a parking space and the distance compared to surrounding objects.
   a. While scanning for spots, the vehicle must remain under 20 mph.
4. The system will display and highlight possible parking spots on the user interface and the driver will have to make a selection and verify the parking space.
   a. If a spot is verified, the system will beep twice in quick succession to indicate activation.
5. The system will then take control of the vehicle, shift into the correct gear, and begin maneuvering into the selected spot.
   a. Maximum speed of 5 mph while the system is in control and drivers can still brake [4].
   b. Object detection will remain active and monitor the vehicle's surroundings.
   c. The user interface will display a view of the vehicle's cameras and direction.
6. The system will be easy to safely turn off at any time.
7. The system will shut off if any doors are opened.
8. The system will shut off if any override gear shifts, braking and gas, or steering takes place.
9. The system will shut off if any subsystems fail or detect important errors.
10. The system will shift into park and turn off when sufficiently parked.
11. The system will allow remote parking through the mobile Ford Pass application.

Secondary Requirements:
12. The system will operate in a timely manner to not obstruct traffic.
13. The system will have a simple interface that is easy for the driver to navigate.
14. The system will include security to prevent unauthorized control of the vehicle.
15. The system won't brake too abruptly.
16. The system won't annoy the driver with constant and irrelevant beeping.

Global Invariants:
17. The system will prioritize preventing injury and property damage above all else.
18. The driver will be able to easily turn off the system at any time.
19. The vehicle should never surpass 3-5 mph while the system is parking.
20. The system must automatically switch into park and turn off if any hazards or subsystems fail or detect important errors.
Questions:

1. What is the preferred behavior when APA needs to emergency shut off while it's in control of the vehicle?
2. In what conditions should the parking assist deactivate on its own?
3. How would you like to notify the user if the system should fail?
4. What should be the behavior of the assisted parking if the parking spaces change? (i.e. another vehicle or object moves)
5. Will there be a tutorial, manual, or help page for the driver and/or will all instructions need to be on the user interface?
6. Should there be any customization available to the user?
7. What are some unusual safety or security risks you recommend being aware of?
8. How should the system handle avoiding collisions when in control of the vehicle?
9. How can you verify if the driver initiated a system request instead of a hacker?
10. Should all cameras and sensors (front, rear, and side) be displayed to the user?
11. What type of vehicles will this system be implemented in?
12. How should the system handle very faded or non-existent parking lines?
13. How can the system distinguish between regular open space and many available, adjacent parking spaces?
14. How should the system handle if the cameras or sensors are blocked or broken?
15. Will there be assistance for getting out of parking spaces?
16. How should the system handle sloped parking spaces?
17. What are the limitations for the size and type of objects that sensors and cameras can detect and consider a hazard?
18. How would the vehicle differentiate moving objects like cars driving on a nearby road during parallel parking versus surrounding cars moving in a parking lot?
19. During parking there are a lot of objects that will be nearby so how do you combat alerting the driver of hazardous objects versus annoying, false alarms and constant beeping?
References

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