APA3 System Requirements

1. Upon activation by the driver through the HMI or Ford Pass app, the system will scan for available parking spots - either via parallel or perpendicular parking based on driver input.
    a. Using front, rear, and side cameras and ultrasound sensors, the system will search for surrounding vehicles with space in between, if the space is at least 1.2x the length of the car being parked in parallel, it is considered valid.
    b. The system can only activate when the car is at a complete stop.
2. This system should support being enabled entirely through a companion app, all necessary HMI features should be replicated in the app.
    a. There must be a security measure in place to confirm the user of the companion app is the driver of the car
3. The HMI system or Ford Pass app should display all valid parking spots and allow the driver to select the one they desire
    a. Upon selection, the system should activate the car's turn signal in the direction of the selected space until the maneuver is completed.
4. If the car is not already there, the system should position for one of 3 standard procedures
    a. Parallel Parking - the system will line up the back of the parking car with the back of the car positioned ahead of the available parking space
    b. Perpendicular Parking, forward - the system will position the car behind the available parking space with enough room between to drive into
    c. Perpendicular Parking, reverse - the system will position the car ahead of the available parking space with enough room between to reverse into
5. Once in position the system will set the car in the appropriate transmission range, and begin adjusting the steering system, pointing it toward the parking space.
    a. If parallel parking, the system will reverse the car until it is at a 45° to the parking space, then adjust the steering control in the opposite direction while reversing until the car is parallel to the space, and directly behind the car initially positioned against.
    b. If perpendicular parking, the system will reverse or drive as appropriate toward the desired space until the car is aligned with neighboring cars, at which point the steering control will straighten the car and the car will slowly move forward until fully parked.
    c. In either case, parking should take no longer than one minute in ideal conditions
    d. Camera feed should display in the HMI or FordPass app through the entirety of the parking maneuver
6. The driver may override speed control of the car with the brake pedal, canceling the system and slowing the car to a stop.
7. Once entirely in the desired parking space, the system will set the car to park and relinquish control to the driver or turn off the engine if activated from the app.
    a. The driver will be notified through the HMI or app that the maneuver has been completed

8. While the system has control over the vehicle's movement, there will be exceptional cases to monitor for in order to avoid collisions
    a. If any moving obstacle is detected in the path of the car while the system is controlling it, the car will begin to slow down and stop if necessary
    b. If an obstacle is determined to be inside the desired parking space after the maneuver has started, the car will stop and prompt the driver to either abort, reverse the actions made and set the car back to its position before beginning to park, or take over control of the vehicle.
9. The system should be able to recognize faults in the sensors and controllers and determine if it is safe to continue

Global Invariants

1. Prevent injuries
2. When system is in control, car will not exceed 5 mph
3. System can be stopped by pressing the brake pedal

Questions

1. If the system is unable to find a parking spot, how would you want the situation to be handled?
    a. Timeout system - give control back to driver, ask to continue with error message
2. What do you want this program to do in the event of sensor failures or errors?
    a. Sensor check before engaging the procedure - and it should conduct regular troubleshooting maneuvers to regularly check for sensor errors. In case of error, notify the driver and disable the system.
3. In the event that another car is on course to collide with the car attempting to park, how should the system respond?
    a. Stop the vehicle
4. How should the car choose where to park if given multiple viable spots?
    a. Driver selects the space
5. What level of control do you want the customer to have over the car during remote maneuvering using the app?
    a. All normal controls, brakes and transmission, engine control - no steering
6. How fast should the car be trying to park itself so it's both safe and still efficient?
    a. 30 seconds
7. Are the subsystems listed the only subsystems that are included? Are there limitations to what the APA system can control/use?
    a. That's all
8. Can the APA system use other sensors such as radar or sonar sensors?
    a. See above
9. What are some good ways to add safety while parking for bystanders without distracting the driver?
    a. It's all on the system and driver, like normal parking
10. In what ways besides the brake pedal can the driver be able to stop the APA system, and gain control of the vehicle?

    a. Only abort on moving steering wheel or complete stop, otherwise they can slow
11. What level of maintenance, troubleshooting and debugging capabilities need to be installed in the system?
    a. Be able to sense a faulty sensor and respond accordingly
12. How do you want this program to respond to slanted parking spaces?
    a. Just adjust for gravity
13. Handicap capabilities?
    a. None yet - could be considered
14. Overlap in manual and mobile controls?
    a. Weight sensors for seat belt - instruct them to leave if activated from phone within car
15. Width requirement for perpendicular?
    a. We will hear back from her
16. Should we use guiding lines to help park?
    a. No side cameras, can't detect lines, only parked cars and other obstacles
17. Security feature?
    a. Backend system, exchange certificates to make sure the phone activating the APA is already registered with the car.
18. Where is the HMI?
    a. Dashboard - maybe something fancier
19. If engine turned off during the maneuver, the system will shut down itself