1. The Lane Management System (LMS) will have a button to turn on or off functioning through the User Interface system.

1.1. The button will be mounted on the left connector between the center of the steering wheel and the outer rim of the wheel.

2. The LMS will express that it is on via the User Interface system activating a light indicator on the dash display

2.1. The light indicator will be located underneath the speedometer or equivalent instrument

2.2. The system will indicate if it is activated both in the gauge cluster, as well as displaying the car's predicted paths on the central infotainment screen.

2.3. The light will be green in color when LMS is active.

3. The LMS will have a Exiting Lane signal that is produced by the Path Prediction Subsystem.

3.1. The Exiting Lane signal shall indicate to the LMS that the vehicle is on a path that will exit the current lane

3.2. An Exiting Lane signal will be produced when the path of the vehicle will deviate from the lane within 3 seconds of driving.

3.2.1. Deviating from the lane consists of angling the vehicle in such a manner that the current path will intersect with the road lines detected by the Image Processing Subsystem.

3.3. The Exiting Lane signal will be ignored if the vehicle’s blinker is on.

3.4. In the event that the Lane Keeping System (LKS) is activated, the LKS will automatically attempt to adjust trajectory back into the lane.

4. The LMS will sound an alarm and flash a warning via the User Interface system in the event of a Lane Exiting signal (3)

4.1. The signal will only be sent if the Exiting Lane signal is constant for 2 seconds.

4.1.1. The alarm will be a higher pitched bell frequency

4.3. The warning pop-up will constantly be shown on the dash display and the alarm will sound every 3 seconds until the Lane Exiting signal stopped

5. The LMS will pause the LKS and the Lane Departure Warning System (LDWS) itself in the event of no road lines being found by the Camera Sensing Subsystem or the Path Prediction subsystem being unable to predict a path.

5.1. The Driver will be prompted via the User Interface subsystem

5.1.1. A notification will appear on the dash display stating the LMS is paused

5.1.2. A bell sound will be made distinct from the sound found in (4)

6. The LMS will be connected to the vehicle’s built in steering system in order to allow LKS to adjust the trajectory of the vehicle.

7. LMS will toggle off for 5 seconds in the event of a blinker being activated.

7.1. LMS will not toggle back on if a lane lines cannot be found

7.2. LMS will not toggle back on if the Path Prediction subsystem cannot generate a path to predict the vehicle.

8. The LMS will make use of a separate system for its calculations for the Path Prediction subsystem and Image Processing subsystem to ensure the ECU does not become overwhelmed.

9. The LMS will make use of cloud-based updates to enable continual improvement without service visits.

10. The system will always be active in the event of needing to intervene, however, it can be disabled as full control.

11. There will be a scoring system for the driver's ability to maintain a lane, as well as keeping track of how often the system had to intervene for the driver.

Requirements:

1. The Lane Management System (LMS) will have a button to turn on or off the Lane Keeping System (LKS) through the User Interface system.

a. The button will be mounted on the left connector between the center of the steering wheel and the outer rim of the wheel.

2. The LKS will express that it is on via the User Interface system activating a light indicator on the dash display

a. The light indicator will be located underneath the speedometer or equivalent instrument

b. The system will indicate if it is activated both in the gauge cluster, as well as displaying the car's predicted paths on the central infotainment screen.

c. The light will be green in color when LKS is active.

3. The LMS will have an Exiting Lane signal that is produced by the Path Prediction Subsystem.

a. The Exiting Lane signal shall indicate to the LMS that the vehicle is on a path that will exit the current lane

b. An Exiting Lane signal will be produced when the path of the vehicle will deviate from the lane within 3 second of driving.

i. Deviating from the lane consists of angling the vehicle in such a manner that the current path will intersect with the road lines detected by the Image Processing Subsystem.

c. The Exiting Lane signal will be ignored if the vehicles blinker is on.

d. If the Lane Keeping System (LKS) is activated, the LKS will automatically attempt to adjust trajectory back into the lane.

4. The LMS will sound an alarm and flash a warning via the User Interface system in the event of a Lane Exiting signal (3)

a. The signal will only be sent if the Exiting Lane signal was constant for 2 seconds.

b. The alarm will be at higher pitched bell frequency

c. The warning pop-up will constantly be shown on the dash display and the alarm will sound every 3 seconds until the Lane Exiting signal stops

5. The LMS will pause the LKS and the Lane Departure Warning System (LDWS) itself in the event of no road lines being found by the Camera Sensing Subsystem or the Path Prediction subsystem being unable to predict a path.

a. The Driver will be prompted via the User Interface subsystem

i. A notification will appear on the dash display stating the LMS is paused

ii. A bell sound will be made distinct from the sound found in (4)

6. The LMS will be connected to the vehicle’s built-in steering system in order to allow LKS to adjust the trajectory of the vehicle.

7. LMS will toggle off for 5 seconds in the event of a blinker being activated.

a. LMS will not toggle back on if a lane-lines cannot be found

b. LMS will not toggle back on if the Path Prediction subsystem cannot generate a path to predict the vehicle.

8. The LMS will make use of a separate system for its calculations for the Path Prediction subsystem and Image Processing subsystem to ensure the ECU does not become overwhelmed.[BG1]

9. The LMS will make use of cloud-based updates to enable continual improvement without service visits.

10. The system will always be active in the event of needing to intervene, however, it can be disabled as full control.

a. The LDWS will remain active

[BG1]Research more maybe?

Requirements:

1. The Lane Management System (LMS) will have a button to turn on or off functioning through the User Interface system.

1. The button will be mounted on the left connector between the center of the steering wheel and the outer rim of the wheel.

2. The LMS will express that it is on via the User Interface system activating a light indicator on the dash display

a. The light indicator will be located underneath the speedometer or equivalent instrument

b. The system will indicate if it is activated both in the gauge cluster, as well as displaying the car's predicted paths on the central infotainment screen.

c. The light will be green in color when LMS is active.

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a. The Exiting Lane signal shall indicate to the LMS that the vehicle is on a path that will exit the current lane

b. An Exiting Lane signal will be produced when the path of the vehicle will deviate from the lane within 3 second of driving.

i. Deviating from the lane consists of angling the vehicle in such a manner that the current path will intersect with the road lines detected by the Image Processing Subsystem.

c. The Exiting Lane signal will be ignored if the vehicle’s blinker is on.

d. In the event that the Lane Keeping System (LKS) is activated, the LKS will automatically attempt to adjust trajectory back into the lane.

4. The LMS will sound an alarm and flash a warning via the User Interface system in the event of a Lane Exiting signal (3)

a. The signal will only be sent if the Exiting Lane signal was constant for 2 seconds.

b. The alarm will be a higher pitched bell frequency

c. The warning pop-up will constantly be shown on the dash display and the alarm will sound every 3 seconds until the Lane Exiting signal stopped

5. The LMS will pause the LKS and the Lane Departure Warning System (LDWS) itself in the event of no road lines being found by the Camera Sensing Subsystem or the Path Prediction subsystem being unable to predict a path.

a. The Driver will be prompted via the User Interface subsystem

i. A notification will appear on the dash display stating the LMS is paused

ii. A bell sound will be made distinct from the sound found in (4)

6. The LMS will be connected to the vehicle’s built in steering system in order to allow LKS to adjust the trajectory of the vehicle.

7. LMS will toggle off for 5 seconds in the event of a blinker being activated.

a. LMS will not toggle back on if a lane lines cannot be found

b. LMS will not toggle back on if the Path Prediction subsystem cannot generate a path to predict the vehicle.

8. The LMS will make use of a separate system for its calculations for the Path Prediction subsystem and Image Processing subsystem to ensure the ECU does not become overwhelmed.

9. The LMS will make use of cloud-based updates to enable continual improvement without service visits.

10. The system will always be active in the event of needing to intervene, however, it can be disabled as full control.

12. The system will have automatic lane changes as an option. This will allow the driver to signal, resulting in the car taking the lane change when safe.

Questions:

· How would you like the software to determine if your lane departure is purposeful or not?

·

Would you like a

feature to toggle the LMS software on/off?

· How much additional

costs would you be willing to pay for this feature?

· How will the system react to curves?

· How many cars does the system need to be compatible with?

· How might this feature be improved in the future?

· What sort of vehicle will the software be placed on?

·

What are the budget

constraints of the system?

·

Do you want this to be

a feature for future vehicles, or integrated into the current fleet?

· How much do you want the LMS to help you versus just drive for you?

·

How much more would

you pay for this car with LMS versus a car that has all the same other features

but doesn’t have the LMS?

·

What is the best way

to alert the driver when they are heading away from the lane?

· What was your vision for the cameras in terms of positioning?

· Could you elaborate more on the speed threshold that activates the LMS or prevents it from working?

o Does it vary?

o Are there set values in mind?

o Which features shouldn’t activate if the threshold is not met.

· Why shouldn’t the LKS take full control away from the driver?

———————————————————————————————————————

This was submitted for groupwork 1^^

Key:

Unique and Keep

In Multiple Req lists and keep

Discussion warranted

Removed

Ben Gibbons - Requirements:

BG1. The Lane Management System (LMS) will have a button to turn on or off functioning through the User Interface system.

a. The button will be mounted on the left connector between the center of the steering wheel and the outer rim of the wheel.

BG2. The LMS will express that it is on via the User Interface system activating a light indicator on the dash display

a. The light indicator will be located underneath the speedometer or equivalent instrument

b. The light will be green in color when LMS is active.

BG3. The LMS will have an Exiting Lane signal that is produced by the Path Prediction Subsystem.

a. The Exiting Lane signal shall indicate to the LMS that the vehicle is on a path that will exit the current lane

b. An Exiting Lane signal will be produced when the path of the vehicle will deviate from the lane within 3 second of driving.

i. Deviating from the lane consists of angling the vehicle in such a manner that the current path will intersect with the road lines detected by the Image Processing Subsystem.

c. The Exiting Lane signal will be ignored if the vehicles blinker is on.

d. In the event that the Lane Keeping System(LKS) is activated, the LKS will automatically attempt to adjust trajectory back into the lane.

BG4. The LMS will sound an alarm and flash a warning via the User Interface system in the event of a Lane Exiting signal (3)

a. The signal will only be sent if the Exiting Lane signal was constant for 2 seconds.

b. The alarm will be a higher pitched bell frequency

c. The warning pop-up will constantly be shown on the dash display and the alarm will sound every 3 seconds until the Lane Exiting signal stopped

BG5. The LMS will pause the LKS and the Lane Departure Warning System (LDWS) itself in the event of no road lines being found by the Camera Sensing Subsystem or the Path Prediction subsystem being unable to predict a path.

a. The Driver will be prompted via the User Interface subsystem

i. A notification will appear on the dash display stating the LMS is paused

ii. A bell sound will be made distinct from the sound found in (4)

Zack Joyce

Requirements:

1. Cameras with capabilities to view the front left, front right, back left, and back right of car.
2. Image recognition software.
3. Speakers in the car connected to the car's software.
4. Connection between car software and hardware in order to override tire movement when the car is determined to be outside of the lane.
5. Software toggle feature to turn LMS on and off.
6. Feature toggles off when blinker lights are activated and GPS indicates the car is on a known highway, toggles back on when the car is determined on a steady path within lines.
7. Use the GPS system to identify when the car is on known highways.

Michael Monticciolo

Requirements for LMS2:

1. There will be an external system for managing any of the data from the sensors/cameras. This will allow the car's internal ECU not to get overwhelmed or have other systems suffer.
2. There will be multiple cameras placed around the car that have alternative infrared-based versions. This will allow for the lines to be viewed at night, as well as viewed during the day.
3. The system will indicate if it is activated both in the gauge cluster, as well as displaying the car's predicted paths on the central infotainment screen.
4. The system will always be active in the event of needing to intervene, however, it can be disabled as full control.
5. The system will make use of the vehicle's built-in controls for actions, such as steering, braking, accelerating, signaling, etc.
6. There will be a scoring system for the driver's ability to maintain a lane, as well as keeping track of how often the system had to intervene for the driver.
7. The system will make use of cloud-based updates in order to allow for the system to continually improve over time.
8. The system will have automatic lane changes as an option. This will allow the driver to signal, resulting in the car taking the lane change when safe.

Ian Berriel

Requirements:

1. Cameras on the side of the car

2. Sensors on the side of the car

3. Software to determine steering actions

4. System should have proper documentation

5. System should be designed with compatibility in mind

6. System should be designed with scalability in mind

7. Extensive Testing Suites

Tyson Lance - Requirements

1. Cameras for capturing images of the road on either side of the car and in front of the car.
2. Image processing system to keep track of the images and understand them.
3. Functionality for the car to steer the driver in the correct direction.
4. Notification system to alert the driver they are veering one way or the other

Zack

3 Global Invariants:

* Avoid false alarms
* Allow driver to choose if they want the feature
* When on, prevent driver from exiting lanes while blinker is off

3 Questions:

* How would you like the software to determine if your lane departure is purposeful or not?
* Would you like a feature to toggle the LMS software on/off?
* How much additional costs would you be willing to pay for this feature?

Ian

Invariants:

-System should correctly identify lane markers

-System should only be on when driver needs it

Questions:

How will the system react to curves?

How many cars does the system need to be compatible with?

How might this feature be improved in the future?

Michael

Invariants:

1. Ensure the system does not incorrectly identify a line
2. Have different levels of control that can be selected
3. Enable features, such as automatic lane changes

Questions:

1. What sort of vehicle will the software be placed on?
2. What are the budget constraints of the system?
3. Do you want this to be a feature for future vehicles, or integrated into the current fleet?

Tyson Lance

Global Invariants

1. Keeping the car in the lane without irritating the driver or forcefully overtaking them
2. Allowing the driver to manually take over if needed from the LMS
3. Keeping the technology smart but affordable so that more people have access to this safer car

Questions:

1. How much do you want the LMS to help you versus just drive for you?
2. How much more would you pay for this car with LMS versus a car that has all the same other features but doesn’t have the LMS?
3. What is the best way to alert the driver when they are heading away from the lane?