Lane Management System

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Automotive manufacturers are bringing in a variety of features that assist the future drivers as a means to enhance the convenience and ensure safety in driving. Some of these new features rely on the lane markings on the road in order to enable the driver to ensure that the car remains within the lane while driving. The objective of this project is to develop a Lane Management System (LMS) that will include the following features: Lane Keeping Systems (LKS), Lane Departure Warning Systems (LDWS) and Lane Centering Systems (LCS). LMS is a driver assistance system that can include a variety of functions starting with the simplest passive LMS that can detect the lanes and compute the relative position of the vehicle to the most complex active LMS, which can take over the control from the driver to position the vehicle within a lane.

The simplest functionality of LMS is a lane sensing feature, which essentially identifies the lane in which the host vehicle is in and also the relative position of the vehicle within the identified lane. The position information could be accurate with respect to relative position vales or abstract values like, extreme left, in the middle, extreme right etc. Some of the issues that are specific to this feature that need to be taken into account include: what happens when there is no (or there is ambiguity in) lane markings, when the road is curving, initiation and resumption of this feature etc. You may assume a set of cameras for lane marker detection, appropriate roadside units and possibly GPS information, etc.

LDWS would make use of the Lane sensing feature and issues warnings to the driver when the vehicle leaves a lane. Here some issues are: proper definition of lane departure, when and how often to give warnings, how do we deal with momentary/partial departure from a lane, distinguishing intentional departures, prediction of departure, etc.

LKS would be an enhancement to LDWS, where the system could intervene and try to send commands to steer and adjust the position of the vehicle. This functionality is more critical as the control is taken away from the driver. The issues to be addressed include who is the master, when and how to override, period of control. .

Many of these features are enabled only when the speed of the vehicle is between certain thresholds.

Subsystem Elements:

1) Camera Sensing Subsystem: captures images on the sides of vehicle and sends over to the image processing unit for lane marker detection

2) Image Processing Subsystem: Processes the raw images coming from the camera and identifies the lane marker

3) Vehicle State Estimation system: A set of sensors that would periodically determine the speed, steering angle and road curvature

4) Path prediction Subsystem: A software subsystem receives information from 2 and 3 and try to predict the path of the vehicle in order to detect, warn and possibly correct any potential lane violations.

4) User Interface system: The driver and LMS exchange control and data information through this system

5) Supervisory Control Systems: Controls all the other subsystems, decides when to enable and disable other subsystems and possibly provide diagnostic information.

Scenario 1: This is the ideal scenario. Assume a straight line zero road curvature, valid and conforming sequence of images from, vehicle speed is uniform. Demonstrate the working of the system under these condition.

Scenario 2: Non zero curvature. Use a sequence of curvature values to stress the system, where there could be confusion on the lane information,.

Scenario 3: Failure scenario. Lane information might be confusing, absent, vehicle state information lost, etc. Think of one or two subsystems failing and how LMS respond to that.

Scenario 4: Demonstrate the working of the system, when there is change of control back and forth between the driver and LMS.