**Introduction**

Lane changes can be one of the easiest maneuvers with a vehicle, and can be one of the hardest maneuvers at the same time. Changing lanes requires processing information and making a safe decision well in advance to make the maneuver a simple and safe one. The faster your speed is, the faster you have to process information, which in turn makes it a little more difficult. There are important defensive driving procedures you must do, before making a lane change. In this project we try to build a driving assistance system for the same.

**Motivation**

Existing driving assistance systems use RADAR or LIIDAR and cost around $$$ and sometimes can be annoying too.

We as a group decided to use image processing to accomplish the same task using camera’s and FPGA board which costs around $400 for a system with greater than 99% accuracy.

- **Altera DE2 Board**
- **Terasic 5MP Camera**

**Implementation: Image**

### High Level Overview

1. **Video Source to FPGA**
   - We use the Terasic 5MP camera to take images in RGB format and store it in the SDRAM of the DE2 board.
   - The image stored in RGB format is used to detect the cars on the road by a verilog code written by us.
   - Bresenham line drawing algorithm is then used to make a bounding box around the car detected earlier.
   - A simple algorithm is then used to calculate the vertical pixel length between the top edge of the image and the top edge of the car.

2. **FPGA to Monitor**
   - We use the camera modules such as the SDRAM controller, VGA controller etc to modify the 12bit camera data to 10 bit VGA output.
   - We toggle around the CCD_R/G/B, mCCD_R/G/B and VGA_R/G/B to get the out to the VGA.
   - The bounding box around the car is in the form of a cube with also depicts the projected length/depth of the car.
   - The background goes black since there is a limited memory on the board insufficient to process color images in real time with the desired efficiency.

**Future Work**

Some future additions that could be made to increase the functionality of this project.
- Using stereoscopic analysis for
  - Better detection of cars
  - Increasing angle of view
  - Integration of SD card
  - For storing libraries to run OpenCV for real time image processing.

**Contact Information**

If you have any questions or would like information about this project, please feel free to email us at eecs452sfl@gmail.com

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