

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. 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.

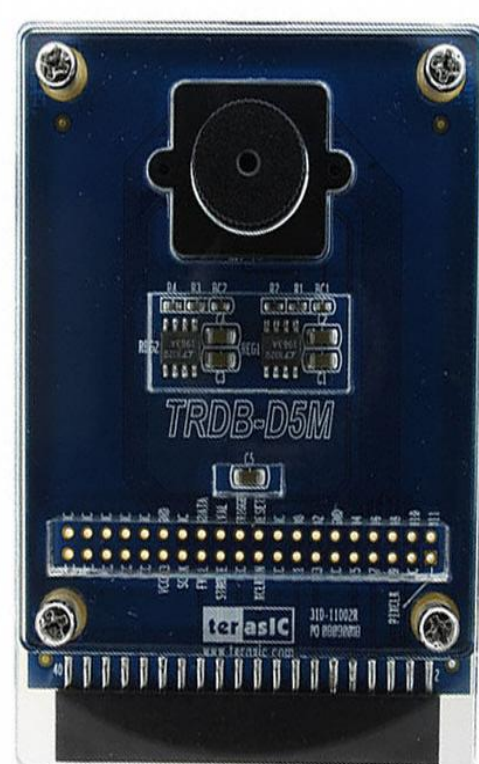
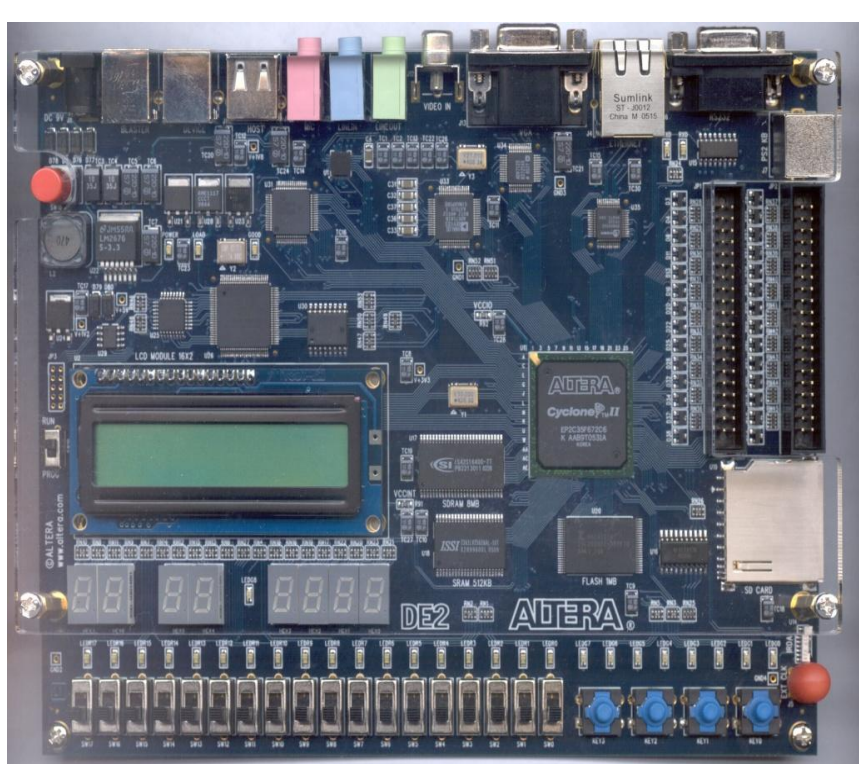
Motivation

Existing driving assistance systems use RADAR or LIDAR 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



Implementation: Image

High Level Overview

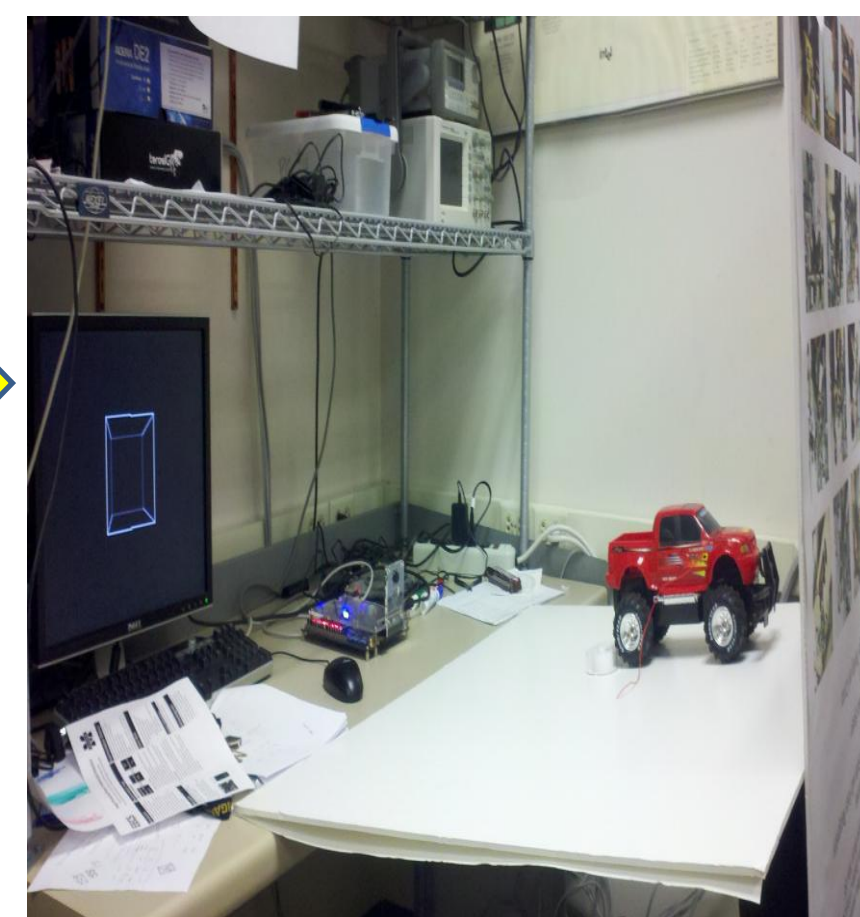
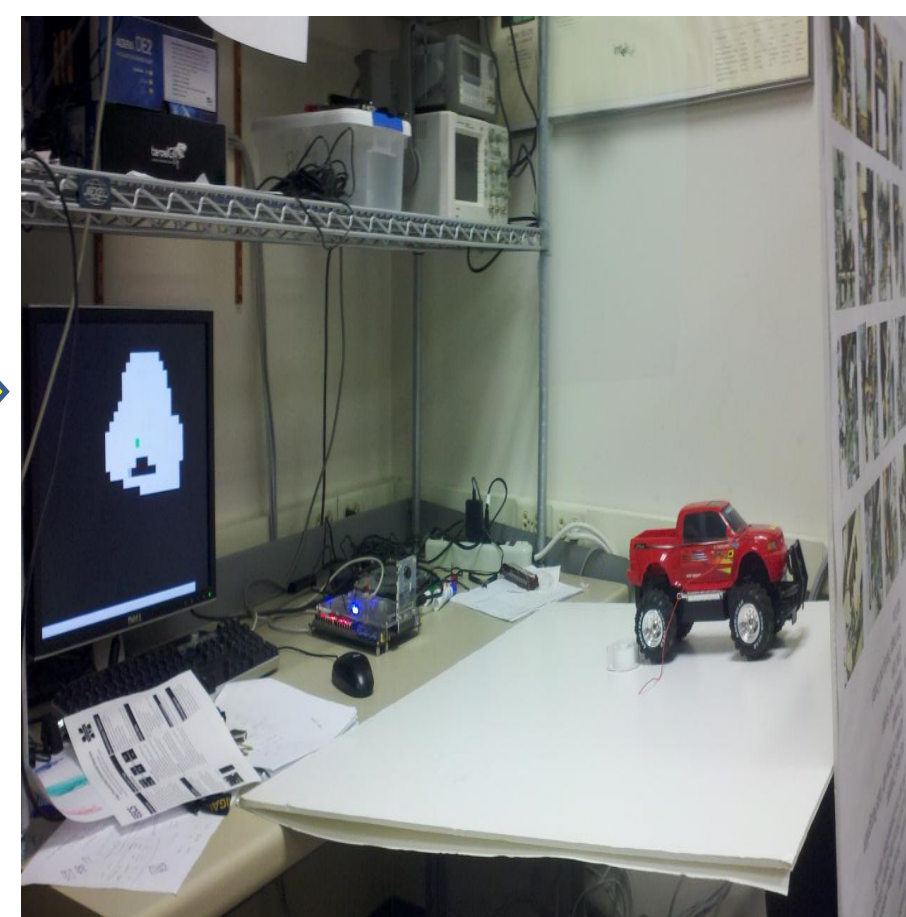
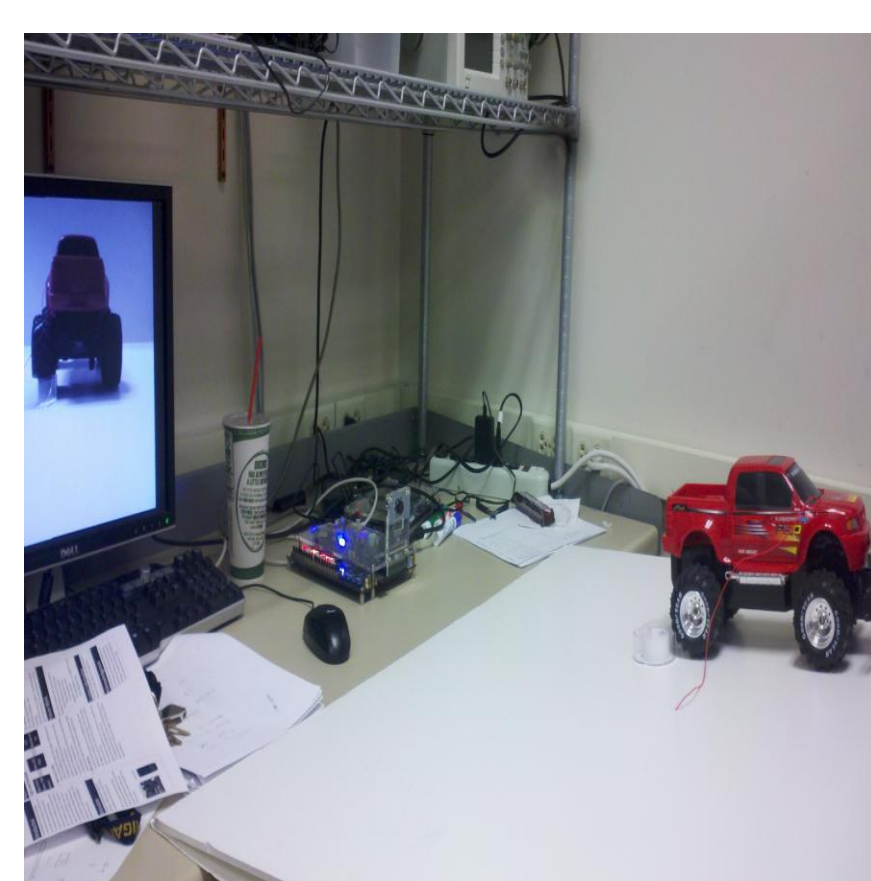


1. Video Source to FPGA

- 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

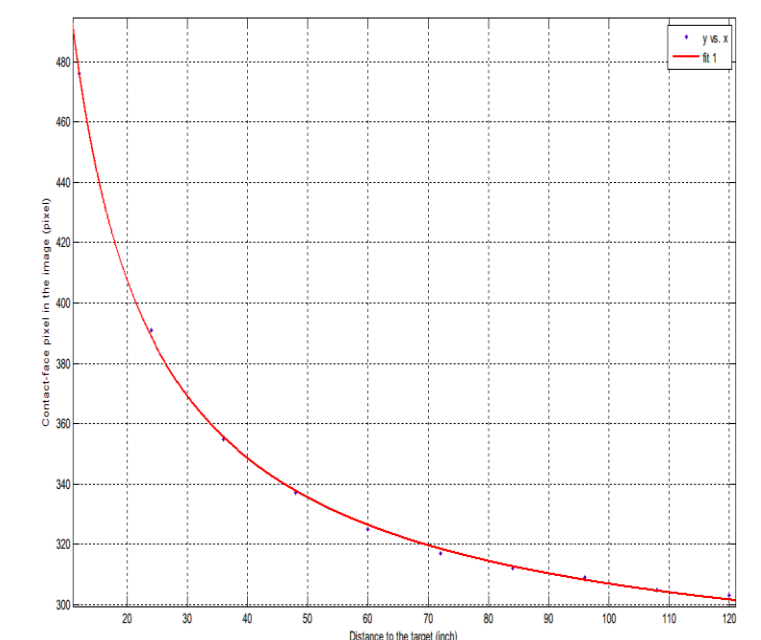
- We use the camera modules such as the SDRAM controller, VGA controller etc to modify the 12bit camera data to 10 bit VGA output.
- We toggle around the CCD_R/G/B, mCCD_R/G/B and VGA_R/G/B to get the out to the VGA.
- The bounding box around the car is in the form of a cube with also depicts the projected 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.



Implementation: Distance

The relative distance of other cars wrt our car depends on the angle of the camera and also the distance of the camera from the ground.

By plotting some test results for a fixed angle and height we found that it behaves exponentially. So we have a look up table for calculating distance v/s the pixel length of the dete



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 free to email us at eecs452sfl@gmail.com

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