

Proposal for a Master Thesis at the  
Chair of Robotic and Embedded system

# An Embedded System on Car to Do Lane Detection

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## Project Description

In the context of TU9 project, research at the Institute of Robotics and Embedded Systems is dealing with the challenge of providing high-performance ECUs as an enabling technology applicable in the automotive field, which will be a heterogeneous system with multi-core CPU, FPGA, and GPU.

A typical application of ECUs in car is to avoid driving accidents. Lane detection is a technology that can detect the lane markings on the road using mainly, image processing techniques on the images captured from a camera on board automobiles. This can help in developing warning systems to alert a driver of an impending accident. This is particularly a challenging problem due to varying light conditions, traffic on the road that obstructs the lane markings, the shadows cast by buildings or trees. A possible solution is that we use FPGA to accelerate the computing of lane detection, thus reducing the computing burden on main processor [1].

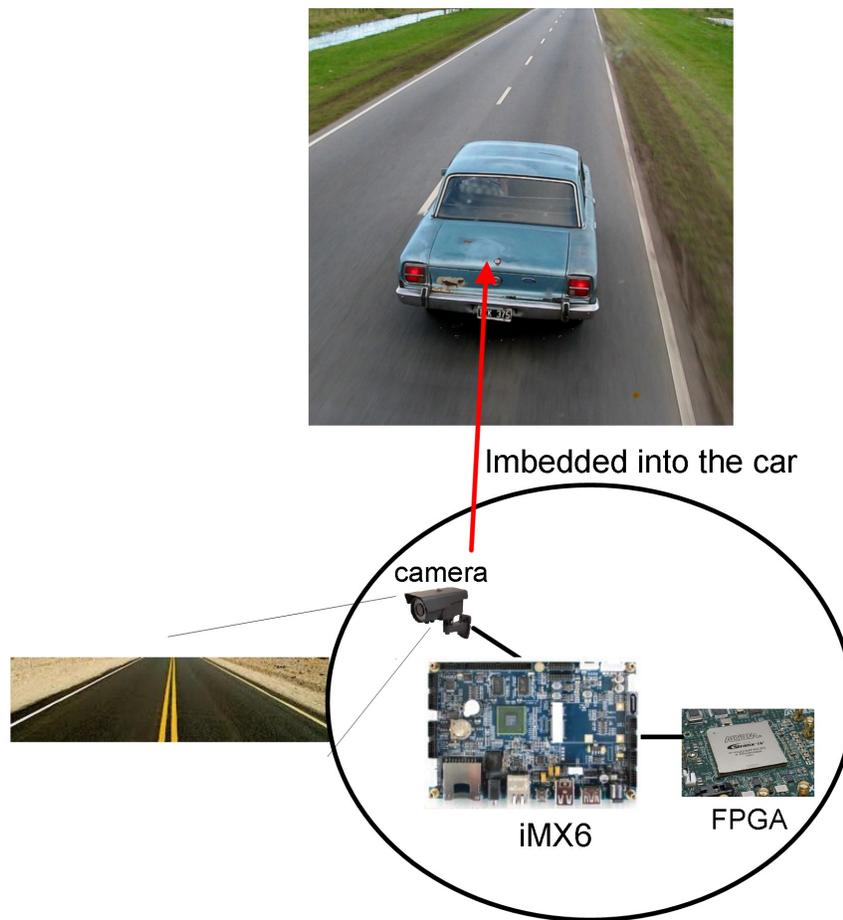


Figure 1: The platform of lane detection system

Our aim is to build an embedded system which will be mounted on a car, as shown in Fig. 1. A camera is used to obtain the road image, and then transfer the image to an ARM core board iMX6. The iMX6 transfers the lane image to FPGA to

do lane detection and tracking. After the processing, FPGA return the detected lane information to iMX6, and iMX6 can help driver to drive the car with the detected lane.

Currently, we have completed the lane detection algorithm. Therefore, the main difficulties in building this embedded system are that the communication between different devices, and how to coordinate the work of iMX6 and FPGA.

The project will include the following phases:

- Learn from the existed materials to realise lane detection algorithm on FPGA.
- Investigate how to communicate with iMX and FPGA, how to coordinate the work of iMX and FPGA.

This work will be carried out in TU9 project to which the Institute of Robotics and Embedded Systems is contributing in terms of hardware and software design and performance analysis.

## Kind of Work

- 10% theory
- 40% implementation
- 30% evaluation
- 20% documentation

## Tasks

- Complete an embedded system on car to do lane detection.
- Evaluate the accuracy and efficiency of this embedded system.

## Contact

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## References

- [1] N. Madduri, "Hardware Accelerated Particle Filter for Lane Detection and Tracking in OpenCL," 2014.