
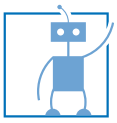


Proposal for a Master Thesis at the
Chair of Robotic and Embedded system

Power Profiling for Heterogeneous Systems

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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.

Currently, a heterogeneous platform with CPU, GPU, and FPGA has been built by us. On this platform, a lot of applications can be run, such as lane detection and lane tracking (as shown in Fig. 1). Compared with the homogeneous processing system, the heterogeneous system has many benefits. The computation power is much greater, and the computing workload can be dynamically distributed according to the processor features.

The increasing demand for battery-powered and energy-efficient products has made power consumption a hot topic for embedded developers. Low power microcontrollers have enabled a host of new applications, from energy-scavenging sensors to the latest hand-held gadget, each with a demanding power budget. Now, we want to optimize the power consumption in running a fixed tasks set in this heterogeneous platform. The first problem is that the power consumption should be profiled before the optimization. Currently, the power scalar is used to measure the computing energy in the processor. The power scalar is shown in Fig. 2. What we need is that the power consumption cost in the heterogeneous system is profiled by the power scalar.

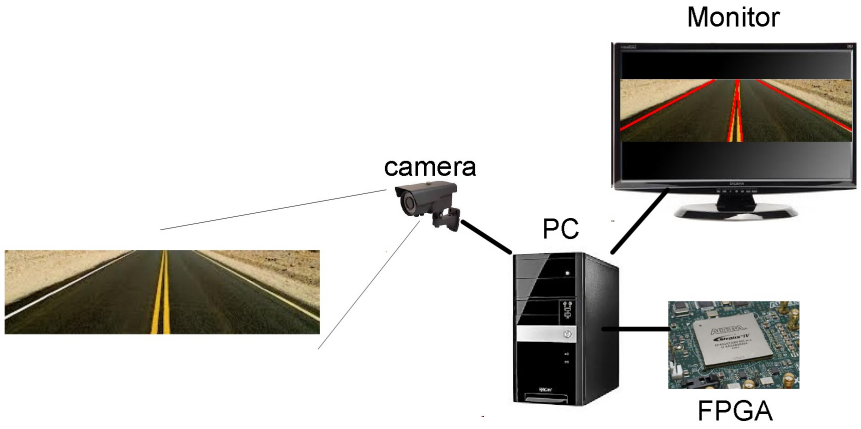

Figure 1: The platform of lane detection system

The project will include the following phases:

- Reading research paper about the energy consumption in heterogeneous systems.
- Investigate how to profile the energy cost in different processors.
- Run a fixed set tasks to optimize the energy consumption while guaranteeing the response time of all tasks.

Figure 2: The power scalar

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

- Profile the computing energy cost in Nvidia GPU, Altera FPGA and Intel CPU.
- Schedule a fixed tasks set to optimize the energy cost.

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References

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