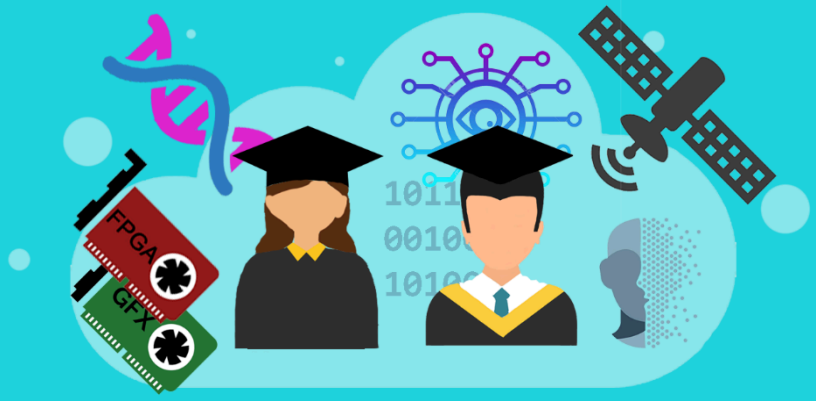


# Diploma Thesis

Microprocessors and  
Digital Systems  
Laboratory



## Acceleration of the Kalman Filter for Real-Time Object Tracking

This thesis aims to develop and optimize an FPGA-based implementation of the Kalman filter for real-time object tracking. The Kalman filter is a powerful algorithm used for estimating the state of a dynamic system from a series of noisy measurements. It is widely used in various applications, including navigation, robotics, and computer vision.

The focus of this research is on implementing the Kalman filter using VHDL/Verilog and optimizing it for performance and resource utilization on AMD/Xilinx UltraScale+ MPSoC FPGAs. These FPGAs offer advanced features and high performance, making them suitable for real-time processing tasks.

The objectives of this thesis include designing and implementing the Kalman filter, optimizing it to achieve the best possible performance and resource efficiency, and evaluating its performance on AMD MPSoC FPGAs. By accelerating the Kalman filter on FPGAs, this research aims to enhance the real-time object tracking capabilities of vision systems, contributing to the development of more efficient and effective solutions in the field of computer vision.

### PREREQUISITES:

Familiarity with:

- Image Processing
- HDLs (Verilog/VHDL)
- Vivado Toolchain
- Low-Level Programming (C)
- Kernel Level Development

Desirable:

- Python
- Simulator environments (Mentor Graphics ModelSim/QuartaSim)
- AXI Protocol

### RELATED MATERIAL:

[https://en.wikipedia.org/wiki/Kalman\\_filter](https://en.wikipedia.org/wiki/Kalman_filter)

<https://www.xilinx.com/products/boards-and-kits/device-family/nav-zynq-ultrascale-mpsoc.html>

<https://www.edge-ai-vision.com/resources/technologies/vision-algorithms/>

<https://ieeexplore.ieee.org/abstract/document/8648530>

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