

Development of a Real-Time Plasma Image Processing and Data Acquisition System Using Zynq ZC702 FPGA with PetaLinux Support.

Abstract

Real-time plasma diagnostics play a critical role in understanding plasma behavior, instability evolution, edge phenomena, impurity transport, and disruption events in tokamak devices. High-speed imaging systems generate a large volume of data that requires low-latency processing for efficient plasma monitoring and control. Conventional CPU-based systems often suffer from latency and limited deterministic performance during high-frame-rate image acquisition and processing. This project proposes the development of a real-time plasma image acquisition and processing framework using GigE Vision cameras interfaced with the ZC702 FPGA platform running a custom PetaLinux operating system. The system will support image acquisition, preprocessing, feature extraction, and deployment of optimized image-processing algorithms directly on the embedded platform.

Academic Project Requirements:

1) Required No. of student(s) for academic project: 2

2) Name of course with branch/discipline: B.E./B.Tech. Electronics and Instrumentation Engineering

3) Academic Project duration:

(a) Total academic project duration: 6 Weeks

(b) Student's presence at IPR for academic project work: 4 Full working Days per week

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