

[Public]

# Multi-Operator Fusion Microscope Autofocusing System based on Zynq

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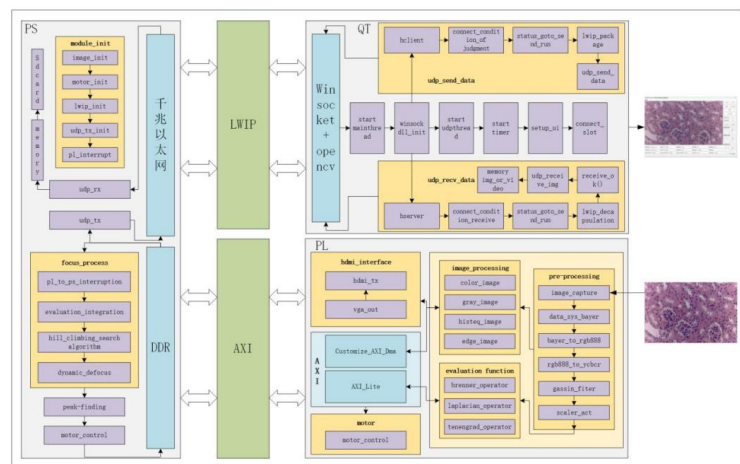
On board test by AMD ZYNQ-7020

OpenHW2023

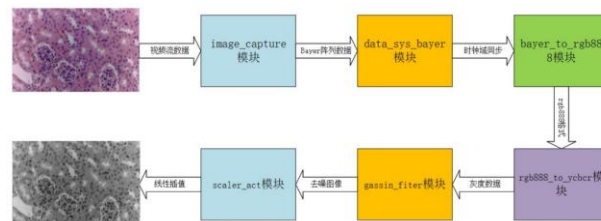


## INTRODUCTION

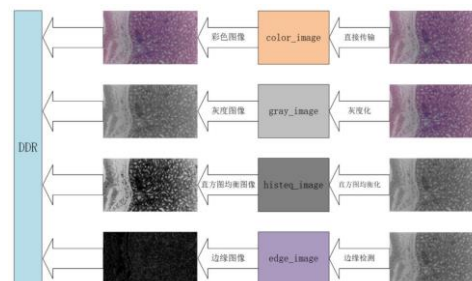
The system consists of PL, PS, and PC with a QT interface. In PL, tasks include image acquisition, preprocessing, format conversion, and motor drive control. PS handles register configuration, motor drive initialization, LWIP protocol stack setup, automatic focusing, and dynamic defocusing detection. Video streaming data is transmitted via Gigabit Ethernet, and a FAT32 file system is established for storing microscopic images. PC, through the QT interface, facilitates video display, control command issuance, and offers various control options, image storage, and video recording capabilities. This versatile system allows flexible control, meets diverse needs, and provides real-time monitoring of system status, facilitating microscope operations.



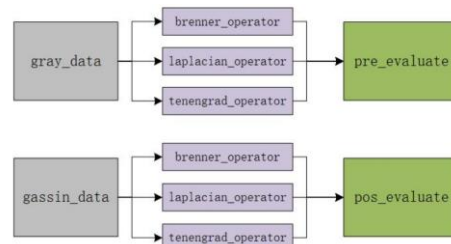
System Overview



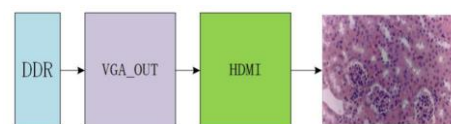
Operation process of Pre-Processing Module



Operation process of Image-Processing Module



Operation process of Evaluation-Function Module



Operation process of HDMI Interface Module

CREATIVE DESIGN

RESULT

Currently, our work has successfully been applied in testing applications for biological microscopes, passing various functional tests. During the testing process, we achieved significant results tailored to the observation needs of different slides. Our electric autofocus function performs exceptionally well, regardless of the information content of the slides. The product can be observed under 4x, 10x, and 40x objectives while maintaining stable and reliable imaging.

For short to medium distances, we can achieve rapid focusing **within 2 seconds, with the fastest at 0.8 seconds.** For longer distances under a 4x objective, fast focusing is

**possible within 6.5 seconds.** In the case of 10x and 40x objectives, short to medium distances can be focused **within 3 seconds,** and longer distances within 7 seconds, surpassing similar products **by 1.5**

**times** in performance. Compared to automatic focusing modules on the market, our work exhibits a 1.2-1.5 times faster autofocus platform speed, comparable to the Leica microscope platform focusing speed.

