

# **FPGA-Based Implementation of Real Time Optical Flow Algorithm and Its Applications for Digital Image Stabilization**

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*Abstract- An efficient simplification procedure of the optical flow (OF) algorithm as well as its hardware implementation using the field programmable gate array (FPGA) technology is presented. The modified algorithm is based on block matching of subsets of successive frames, and exploits one-dimensional representation of subsets as well as the adaptive adjustments of their sizes. Also, an  $l_1$ -norm-based correlation function requiring no multiplication/division operations is used. As a result, it was possible to reduce the computational complexity of the algorithm without compromising the processing accuracy. Both the accuracy and the limitations resulting from the introduced simplifications have been verified based on several examples of both synthetic and real movie samples. The presented algorithm has been implemented using VirtexII-1000 FPGA to realize a digital stabilization system for the CMOS camera images. Experimental results fully confirm the efficiency of the presented algorithm when working with limited computational resources. This demonstrates the possibility of using our algorithm in the autonomous navigation and other battery-powered systems.*

**Index terms:** Optical flow, correlation algorithm, digital image stabilization, FPGA