

MINILAB 2 REPORT

Name: Ananya Virmani

Email: virmani2@wisc.edu

Overview

The required functionality includes:

- Converting Bayer pixel data to grayscale
- Performing 3×3 two-dimensional convolution
- Implementing Sobel edge detection
- Producing grayscale output suitable for VGA display

Implementation

- The input pixel stream from the camera is first passed through a 2×2 grayscale interpolation stage.
- A one-row line buffer delays the input by 1280 cycles to provide access to the previous row, and an additional one-cycle register delay forms the complete 2×2 window.
- The grayscale value is computed as the arithmetic mean of the four samples.
- After grayscale conversion, we used a new line buffer which had 3 taps instead of 2 to store the previous 2 rows as well.
- The convolution stage implements a fixed 3×3 sobel filter. The 3×3 window values are multiplied by the corresponding sobel kernel coefficients and accumulated using signed arithmetic to produce a gradient value.
- The design supports both horizontal (G_x) and vertical (G_y) sobel operators, the convolution output is computed as a weighted sum of the nine window elements.
- Because sobel filtering can produce negative values, the signed result is converted to its absolute value before display.

Screenshots

