

MINILAB 2 REPORT

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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 2x2 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 2x2 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 3x3 sobel filter. The 3x3 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 (Gx) and vertical (Gy) 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

