

# DSD Project

**Deadline:** 6 Dec 2024

In this project, you will implement an edge detection algorithm on an FPGA to find a line in a 10x10 image matrix. The input will be a 10x10 matrix representing the image, and the output will be the start and end coordinates of the detected line, displayed on a 7-segment display.

## Requirements

**1. Input:** The input to your system will be a 10x10 matrix representing the image. Each element in the matrix will be a grayscale value between 0 and 255, where 0 represents black and 255 represents white.

**2. Edge Detection Algorithm:** You will implement an edge detection algorithm on an FPGA to find the line in the input image. The algorithm should be able to detect the start and end coordinates of the line. The algorithm to be implemented will use the Prewitt Filter by sliding it over the entire image in different orientations (vertical and horizontal) to find the line.

**3. Output:** The output of your system will be the start and end coordinates of the detected line, displayed on a 7-segment display. The start coordinate should be displayed on the left 2 digits, and the end coordinate should be displayed on the right 2 digits. So for example if the line goes from (1, 2) to (1,8), the display will give 1 2 \_ \_ 1 8.

**4. FPGA Implementation:** You will implement your edge detection algorithm on an FPGA using VHDL. The FPGA should be able to process the input image and generate the output coordinates in real-time.

## Steps

1. Read about edge detection using the Prewitt Filter and write about it as a section of your report.
2. Design your main entity which takes in the image.
3. Write the edge detection algorithm in VHDL.
4. Write the display module (result to 7-segment display).

## Evaluation Criteria

1. **Functionality:** The system should be able to correctly detect the start and end coordinates of the line in the input image and display them on the 7-segment display.

The detected coordinates should be within a tolerance of 1 pixel from the actual line in the input image.

2. **In-person Evaluation:** The team will present the project and answer questions about its implementation.
3. **Documentation:** Write a report describing the outline of your approach as well as the Prewitt filter.

The project should be done in teams of 5. Your team will receive the FPGA to work on. Please make sure you use it correctly to avoid burning or damaging it. You can come to TA's office (6.02) starting 13-Nov to pick up your team's FPGA.