This project demonstrates different edge detection techniques using OpenCV. Edge detection is used to find object boundaries by identifying areas where image brightness changes suddenly. These edges help in understanding shapes, structures, and important features in images. (OpenCV)

The system takes an input image and applies multiple edge detection algorithms to compare their results.

Processing Flow

Simple pipeline:

Input Image
↓
Convert to Grayscale
↓
Apply Edge Detection Algorithms
↓
Display Different Edge Outputs

Algorithms / Outputs Used (7 Results Explanation)

1. Original Image

- This is the input image uploaded by the user.
- Used as the reference for comparison.

---

2. Grayscale Image

Grayscale converts a color image into shades of black and white by removing color information and keeping only brightness (intensity). Edge detection algorithms work better on grayscale images because they focus on intensity changes instead of colors. It also reduces computation and simplifies image processing.

- Converts color image into black and white.
- Edge detection works better on intensity values.

---

3. Sobel X

Sobel X detects edges by measuring brightness changes in the horizontal direction. It highlights vertical edges and boundaries in the image. This helps identify structures that change from left to right.

- Detects edges in horizontal direction.
- Highlights vertical lines and boundaries.

---

4. Sobel Y

Sobel Y detects edges by measuring brightness changes in the vertical direction. It highlights horizontal edges and lines. This helps detect top-to-bottom intensity changes.

- Detects edges in vertical direction.
- Highlights horizontal edges.

---

5. Combined Sobel

Combined Sobel merges both Sobel X and Sobel Y results to show edges in all directions. It gives a more complete view of the image boundaries.

- Combines Sobel X and Sobel Y.
- Shows overall edge structure.

---

6. Laplacian Edge Detection

Laplacian detects edges by finding areas where brightness changes rapidly. It captures fine details and thin edges but can also detect noise.

- Detects edges in all directions.
- Finds areas where brightness changes quickly.

---

7. Canny Edge Detection

Canny is an advanced edge detection method that removes noise, detects strong edges, and refines them to produce clean and accurate edge maps. It is widely used because of its precision.

- Advanced edge detection method.
- Removes noise.
- Produces clean and thin edges.
- Most accurate among the methods.
