OPEN-ENDED ASSIGNMENT:

Title: Design and implement a technique to store and access the product information in industry (Barcode)

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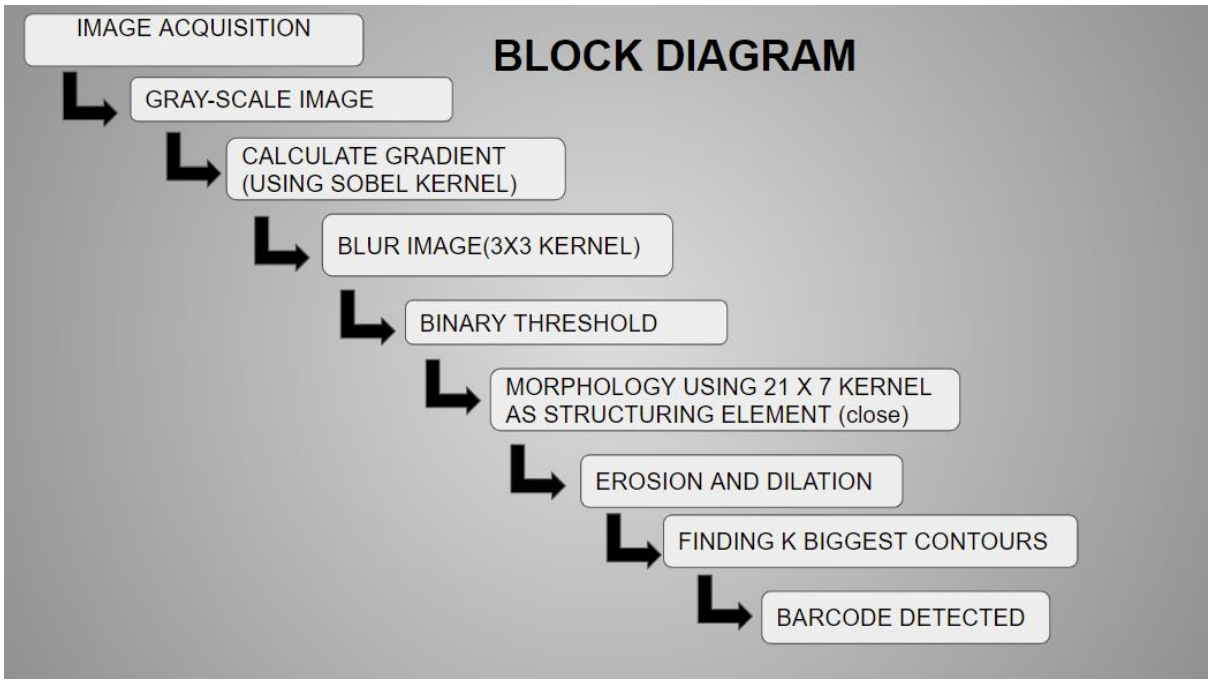


Explanation of blocks:

1. **Gray scale Image:**
    a. Acquired image is converted from RGB to Grayscale
    b. Grayscale is a range of gray shades from white to black, as used in a monochrome display or printout

2. Gradient Calculation

a. Sobel operator is used to detect edges of an image in both horizontal and vertical directions
b. The Sobel Operator detects edges that are marked by sudden changes in pixel intensity
c. The rise in intensity is even more evident, when we plot the first derivative of the intensity function

Kernels for Sobel edge detection:

X – Direction Kernel

-1	0	1
-2	0	2
-1	0	1

Y – Direction Kernel

-1	-2	-1
0	0	0
1	2	1

3. Blur Image

a. When an image is blurred, there is color transition from one side of an edge in the image to another smooth rather than sudden
b. The effect is to average out rapid changes in pixel intensity

4. **Binary Thresholding:**

    a. We apply thresholding most commonly on Grayscale Image
    b. Creates a binary image based on setting a threshold value on the pixel intensity of the original image.

dst(x,y) = maxval if src(x,y)>thresh
= 0 otherwise

5. **Morphology:**

    a. In closing type, Dilation followed by Erosion is performed.
    b. It is useful in closing small holes inside the foreground objects, or small black points on the object

EROSION:

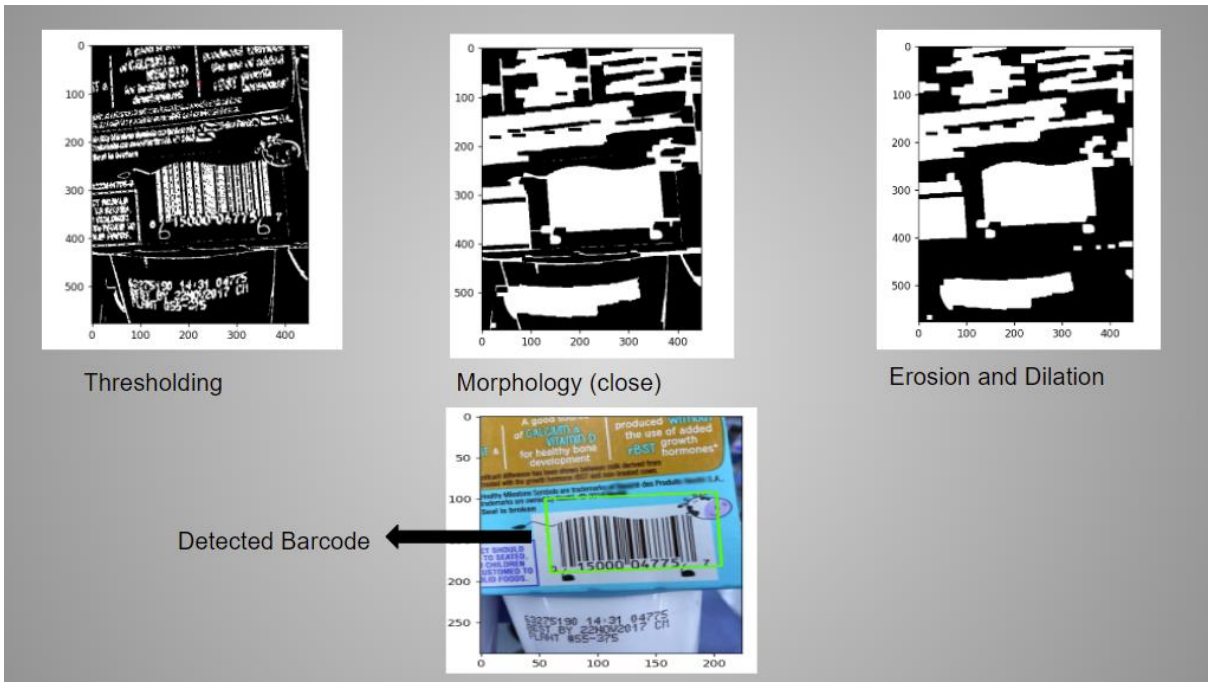
    c. A kernel with all one's is used in this process.
    d. A pixel in the original image (either 1 or 0) will be considered 1 only if all the pixels under the kernel is 1, otherwise it is eroded (made to zero).
    e. So the thickness or size of the foreground object decreases or simply white region decreases in the image

DILATION:

    f. It is just opposite of erosion.
    g. A pixel element is '1' if at least one pixel under the kernel is '1'.
    h. So it increases the white region in the image or size of foreground object increases.

6. **Finding contours:**

a. Contours are defined as the line joining all the points along the boundary of an image that are having the same intensity.
b. Contours come handy in shape analysis, finding the size of the object of interest, and object detection.



CONCLUSION:

- In this application, the bar code is identified by detecting the lines that conform the bar code, as these lines can be easily detected using the Sobel operator
- Sobel operator is used as an edge detection technique. It is simple and more time efficient as compared to other techniques
- Morphological transformations such as erosion, dilation are some simple operations based on the image shape. It is normally performed on binary images. It needs two inputs, one is our original image, second one is called structuring element or kernel which decides the nature of operation.
- Generally retail shops use the handy barcode reader which is used for small amounts of products, while big organisations use barcode recognition systems using image processing for reading their large amount of diverse products