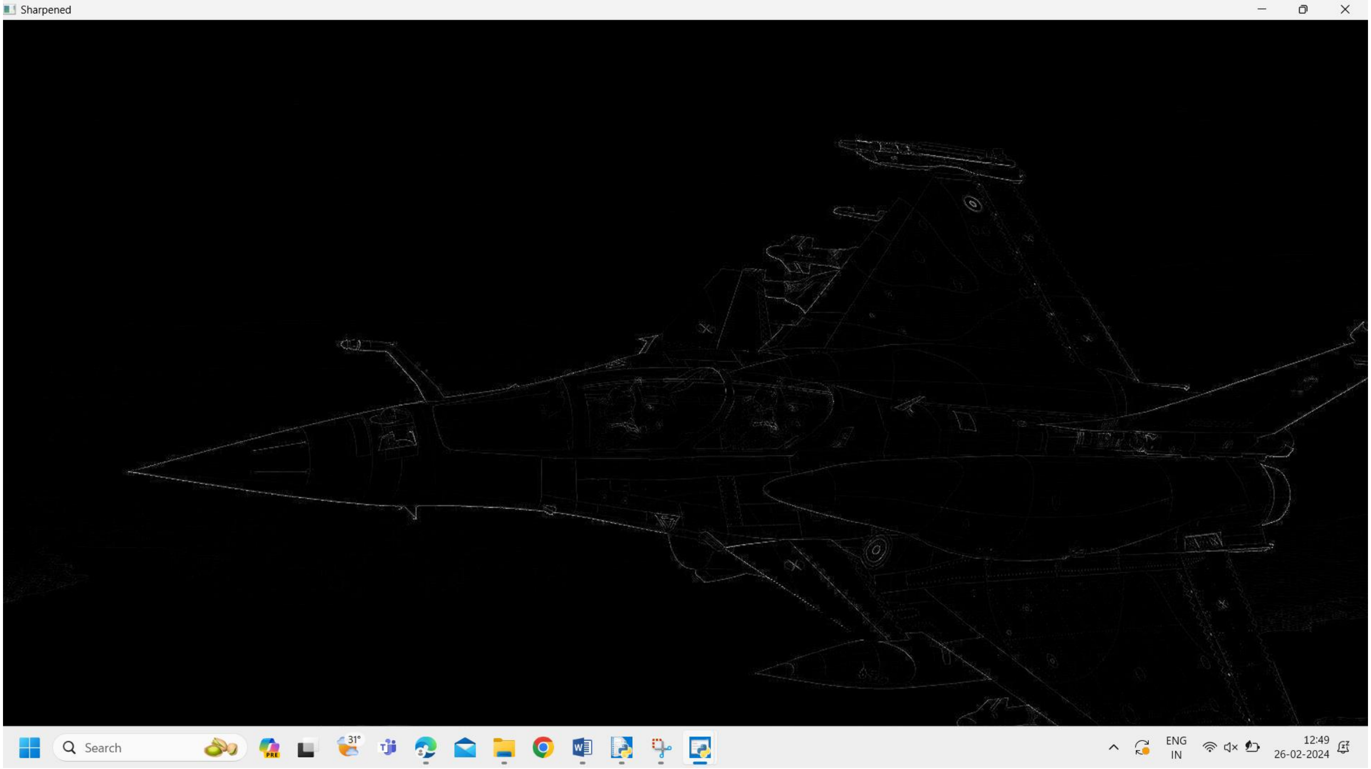
21. Perform Sharpening of Image using Laplacian mask implemented with an extension of diagonal neighbors.

PROGRAM:

```
import cv2

import numpy as np

img = cv2.imread(r"C:\Users\ACER\Downloads\army-jet-5.JPG")

gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)

kernel = np.array([[0,1,0], [1,-4,1], [0,1,0]])

sharpened = cv2.filter2D(gray, -1, kernel)

cv2.imshow('Original', gray)

cv2.imshow('Sharpened', sharpened)

cv2.waitKey(0)

cv2.destroyAllWindows()
```

OUTPUT:

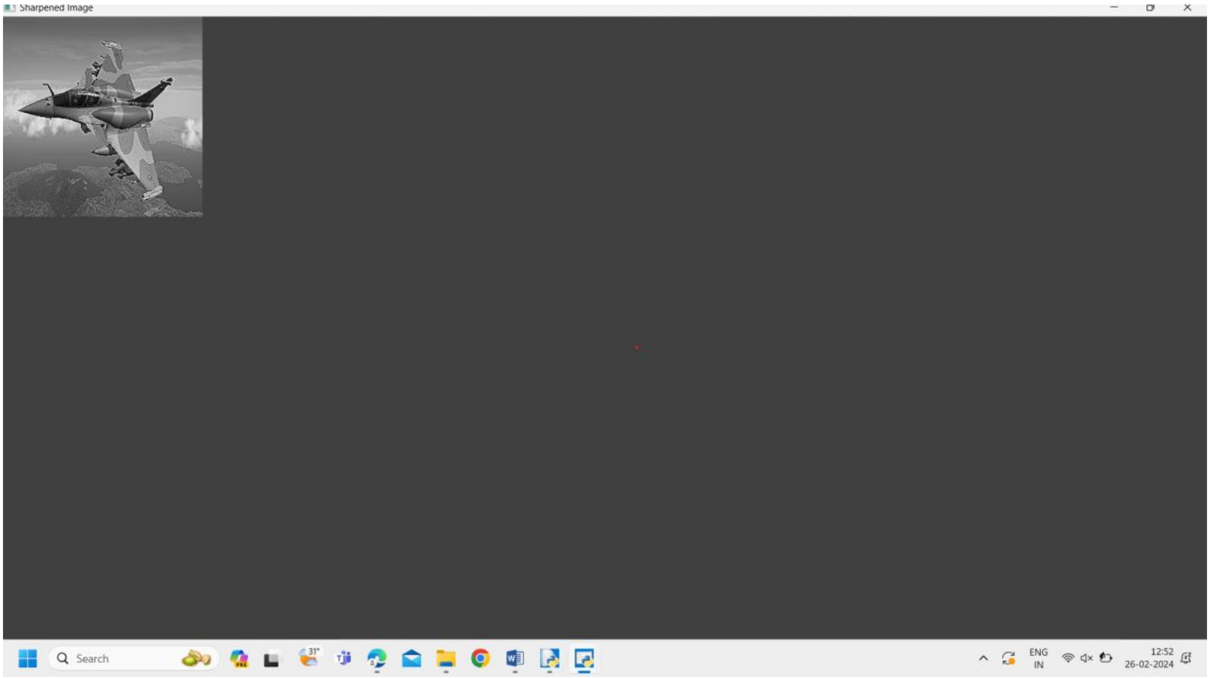


22. Perform Sharpening of Image using Laplacian mask with positive center coefficient.

PROGRAM:

```
import cv2
import numpy as np
img = cv2.imread(r"C:\Users\ACER\Downloads\army-jet-5.JPG")
img = cv2.resize(img,(255, 255))
gray_img = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
# Apply the Laplacian filter with a positive center coefficient
laplacian_kernel = np.array([[0, -1, 0], [-1, 5, -1], [0, -1, 0]])
sharpened_img = cv2.filter2D(gray_img, -1, laplacian_kernel)
sharpened_img = cv2.cvtColor(sharpened_img, cv2.COLOR_GRAY2BGR)
cv2.imshow('Original Image', img)
cv2.imshow('Sharpened Image', sharpened_img)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

OUTPUT:

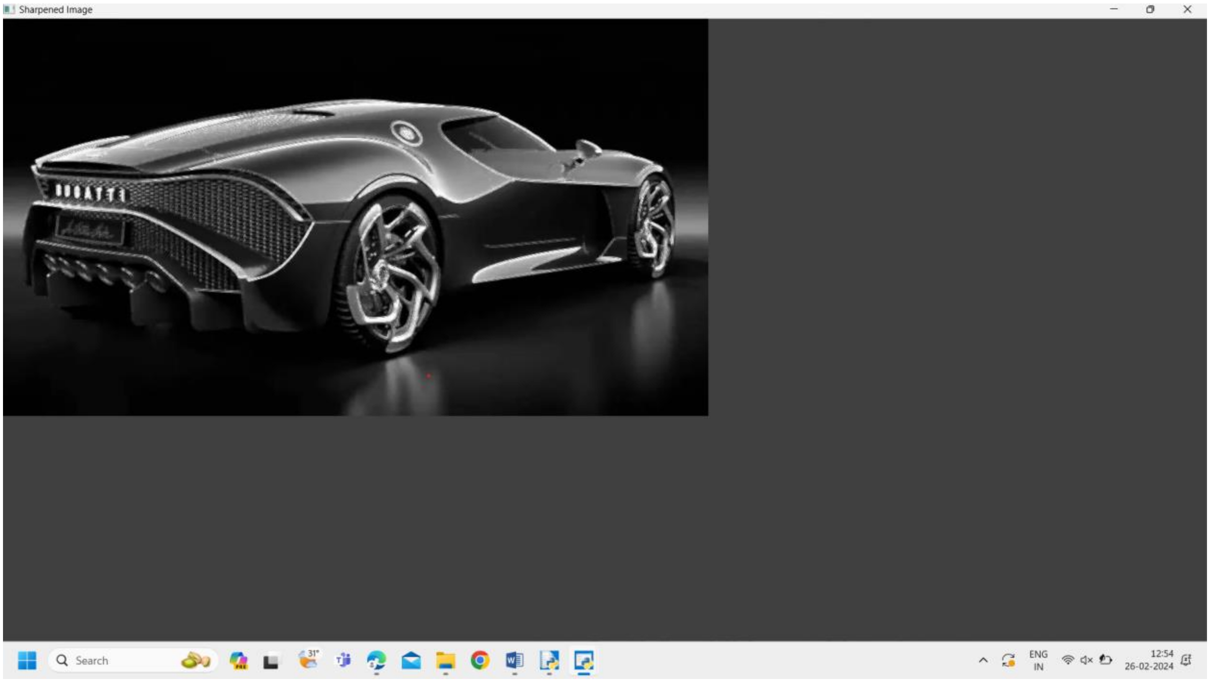


23. Perform Sharpening of Image using unsharp masking.

PROGRAM:

```
import cv2
import numpy as np
img = cv2.imread(r"C:\Users\ACER\Downloads\Buagti.jpg")
gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
laplacian_kernel = np.array([[0, 1, 0],
[1, -4, 1],
[0, 1, 0]])
laplacian = cv2.filter2D(gray, -1, laplacian_kernel)
sharpened = cv2.add(gray, laplacian)
cv2.imshow('Original Image', gray)
cv2.imshow('Sharpened Image', sharpened)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

OUTPUT:

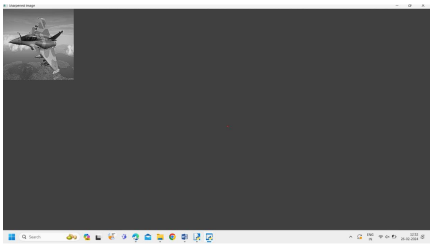


24. Perform Sharpening of Image using High-Boost Masks.

PROGRAM:

```
import cv2
image_path = r"C:\Users\ACER\Downloads\army-jet-5.JPG"
resized_img = cv2.imread(image_path)
if resized_img is None:
    print("Error: Unable to load image.")
    exit()
h_img, w_img, _ = resized_img.shape
center_y = int(h_img/2)
center_x = int(w_img/2)
h_wm, w_wm, _ = resized_wm.shape
top_y = center_y - int(h_wm/2)
left_x = center_x - int(w_wm/2)
bottom_y = top_y + h_wm
right_x = left_x + w_wm
roi = resized_img[top_y:bottom_y, left_x:right_x]
result = cv2.addWeighted(roi, 1, resized_wm, 0.3, 0)
resized_img[top_y:bottom_y, left_x:right_x] = result
filename = r"C:\Users\ACER\Downloads\army-jet-5_with_watermark.JPG"
cv2.imwrite(filename, resized_img)
cv2.imshow("Resized Input Image", resized_img)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

OUTPUT:

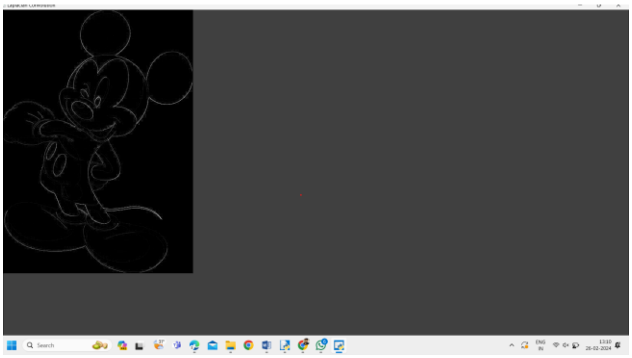


25. Perform Sharpening of Image using Gradient masking

PROGRAM:

```
import cv2
import numpy as np
a = cv2.imread(r"C:\Users\ACER\Downloads\MICKYMOUSE.JPG",
cv2.IMREAD_GRAYSCALE)
if a is None:
   print("Error: Unable to load image.")
   exit()
Lap = np.array([[0, 1, 0], [1, -4, 1], [0, 1, 0]])
a1 = cv2.filter2D(a, -1, Lap)
a2 = np.uint8(a1)
cv2.imshow("Laplacian Convolution", a2)
cv2.waitKey(0)
cv2.destroyAllWindows()
lap = np.array([[-1, -1, -1], [-1, 8, -1], [-1, -1, -1]])
a3 = cv2.filter2D(a, -1, lap)
a4 = np.uint8(a3)
cv2.imshow("Laplacian Edge Enhancement", a4)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

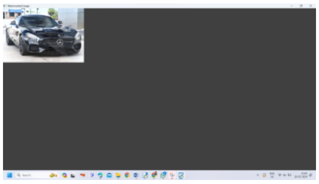
OUTPUT:



26. Insert water marking to the image using OpenCV.

PROGRAM: import cv2

```
img = cv2.imread(r"C:\Users\ACER\Downloads\MERCEDES-BENZ.JPG")
wm = cv2.imread(r"C:\Users\ACER\Downloads\army-jet-5.JPG")
h_wm, w_wm = wm.shape[:2]
h_img, w_img = img.shape[:2]
center_x = int(w_img/2)
center_y = int(h_img/2)
top_y = center_y - int(h_wm/2)
left_x = center_x - int(w_wm/2)
bottom_y = top_y + h_wm
right_x = left_x + w_wm
roi_top = max(0, top_y)
roi_bottom = min(h_img, bottom_y)
roi_left = max(0, left_x)
roi_right = min(w_img, right_x)
roi = img[roi_top:roi_bottom, roi_left:roi_right]
wm = cv2.resize(wm, (roi.shape[1], roi.shape[0]))
result = cv2.addWeighted(roi, 1, wm, 0.3, 0)
img[roi_top:roi_bottom, roi_left:roi_right] = result
cv2.imshow("Watermarked Image", img)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

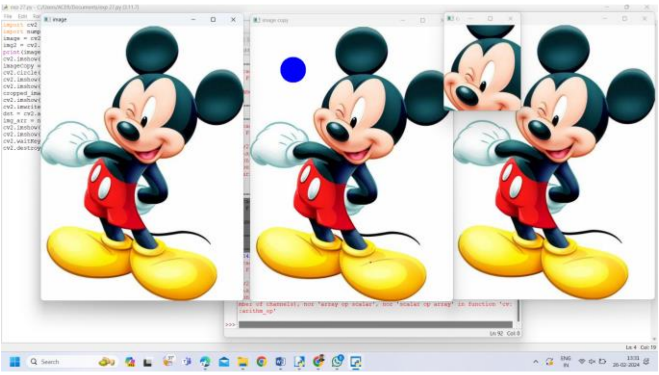
OUTPUT: 

27. Do Cropping, Copying and pasting image inside another image using OpenCV

PROGRAM:

```
import cv2

import numpy as np

image = cv2.imread(r"C:\Users\ACER\Downloads\MICKYMOUSE.JPG")

img2 = cv2.imread(r"C:\Users\ACER\Downloads\army-jet-5.JPG")

print(image.shape)

cv2.imshow("original", image)

imageCopy = image.copy()

cv2.circle(imageCopy, (100, 100), 30, (255, 0, 0), -1)

cv2.imshow('image', image)

cv2.imshow('image copy', imageCopy)

cropped_image = image[80:280, 150:330]

cv2.imshow("cropped", cropped_image)

cv2.imwrite("Cropped Image.jpg", cropped_image)

dst = cv2.addWeighted(image, 0.5, img2, 0.7, 0)

img_arr = np.hstack((image, img2))

cv2.imshow('Input Images',img_arr)

cv2.imshow('Blended Image',dst)

cv2.waitKey(0)

cv2.destroyAllWindows()
```

OUTPUT:



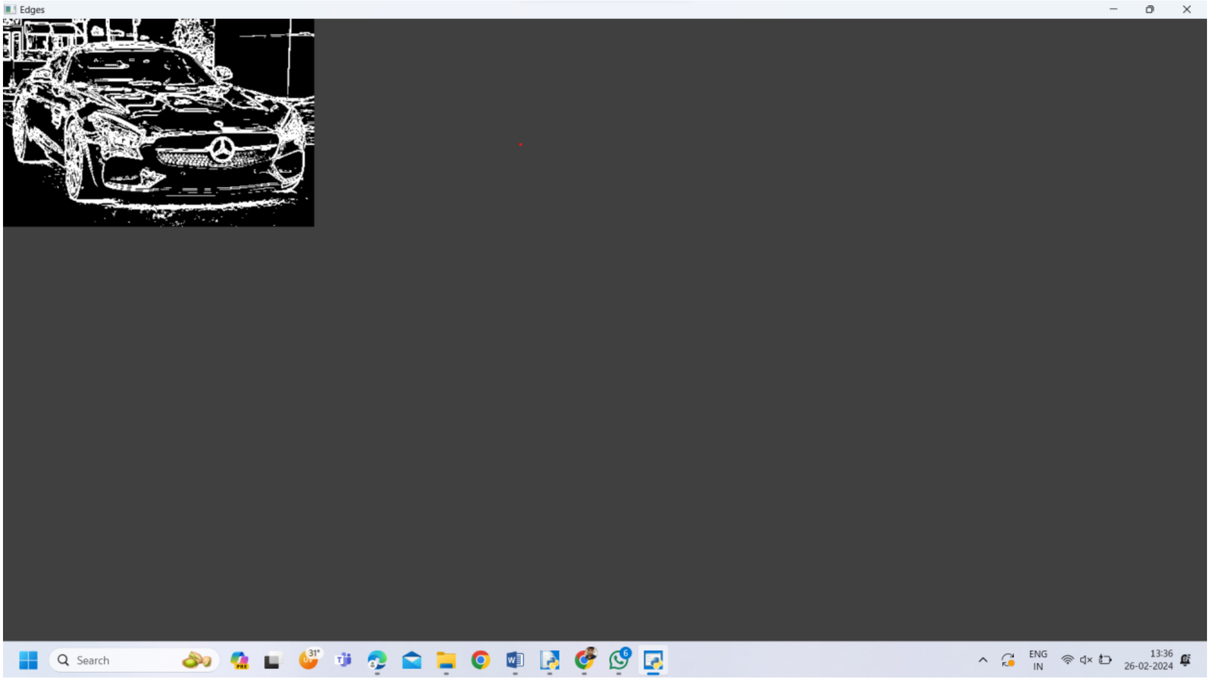
```
mber of channels), nor 'array op scalar', nor 'scalar op array' in function 'cv:
:arithm_op'
>>>
```

28. Find the boundary of the image using Convolution kernel for the given image.

PROGRAM:

```
import cv2

import numpy as np

img = cv2.imread(r"C:\Users\ACER\Downloads\MERCEDES-BENZ.JPG",

cv2.IMREAD_GRAYSCALE)

dx = cv2.Sobel(img, cv2.CV_64F, 1, 0)

dy = cv2.Sobel(img, cv2.CV_64F, 0, 1)

edges = cv2.magnitude(dx, dy)

thresh = 100

edges[edges < thresh] = 0

edges[edges >= thresh] = 255

cv2.imshow("Edges", edges)

cv2.waitKey(0)

cv2.destroyAllWindows()
```

OUTPUT:

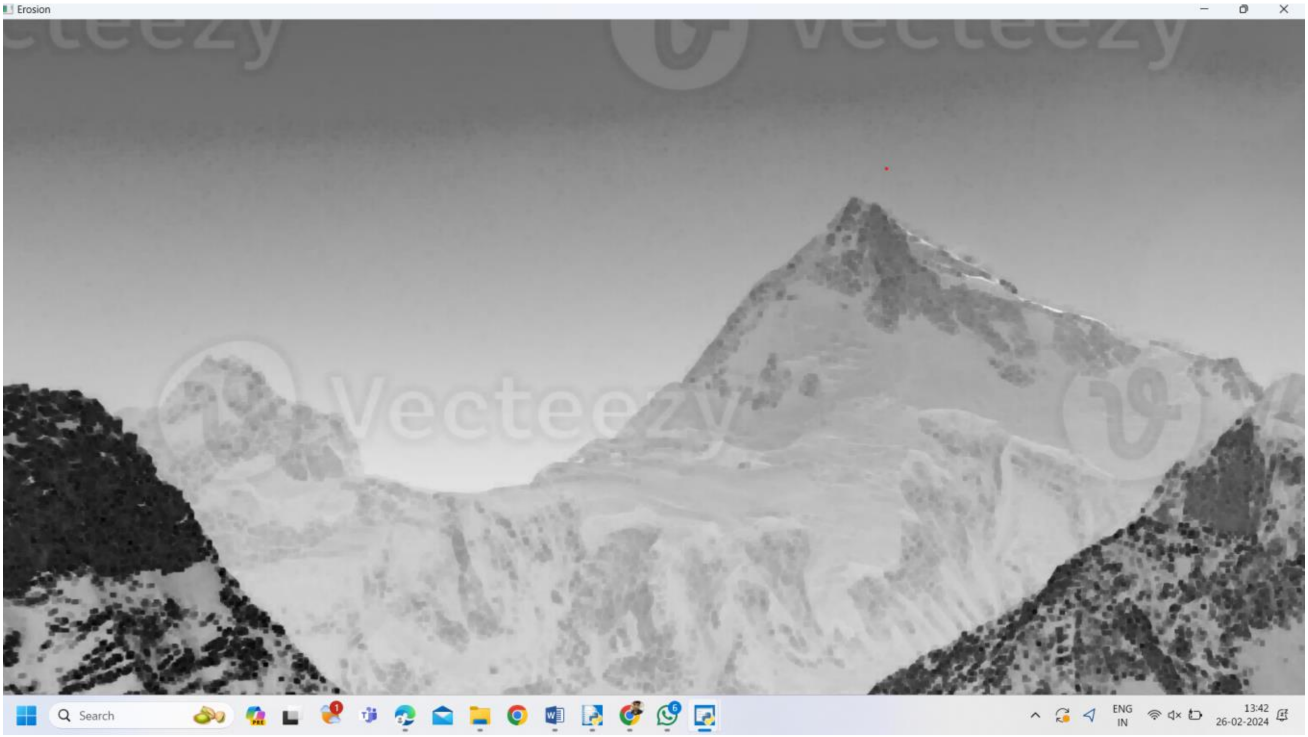


29. Morphological operations based on OpenCV using Erosion technique

PROGRAM:

```
import cv2

import numpy as np

img = cv2.imread(r"C:\Users\ACER\Downloads\MOUNTAIN.jpg", cv2.IMREAD_GRAYSCALE)

kernel = np.ones((5,5), np.uint8)

erosion = cv2.erode(img, kernel, iterations=1)

cv2.imshow("Original", img)

cv2.imshow("Erosion", erosion)

cv2.waitKey(0)

cv2.destroyAllWindows()
```

OUTPUT:

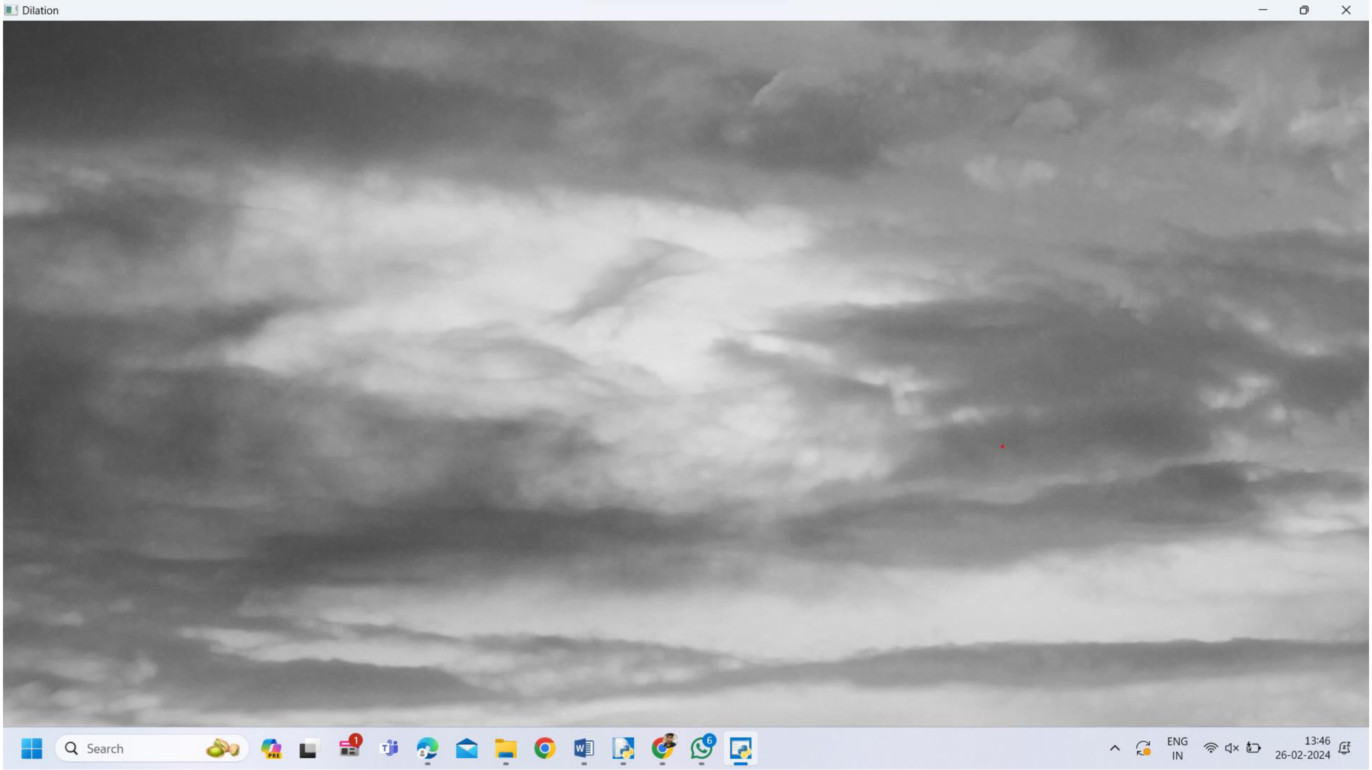


30. Morphological operations based on OpenCV using Dilation technique

PROGRAM:

```
import cv2

import numpy as np

img = cv2.imread(r"C:\Users\ACER\Downloads\HIMALAYA.JPG", cv2.IMREAD_GRAYSCALE)

kernel = np.ones((5,5), np.uint8)

dilation = cv2.dilate(img, kernel, iterations=1)

cv2.imshow("Original", img)

cv2.imshow("Dilation", dilation)

cv2.waitKey(0)

cv2.destroyAllWindows()
```

OUTPUT:


Dilation
Search
ENG
IN
13:46
26-02-2024