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Batch : A3-49

Subject : TA2

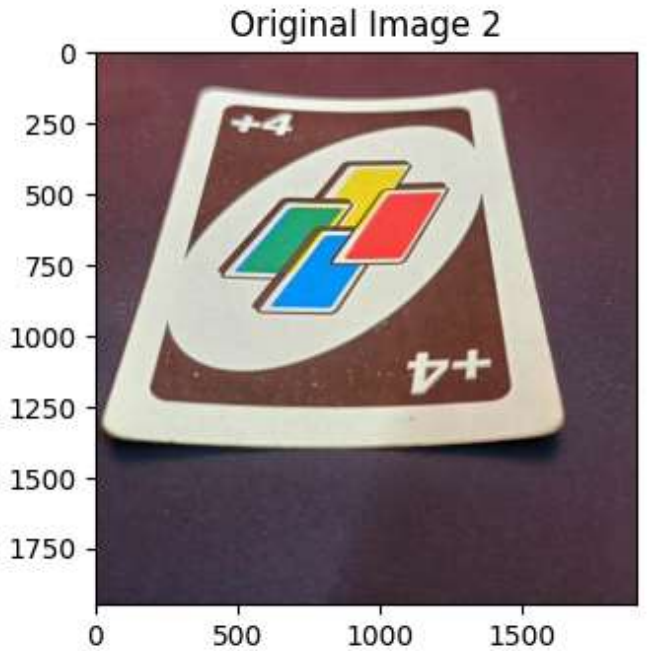
In [2]:
```
import cv2
import numpy as np
import matplotlib.pyplot as plt
import cv2
print(cv2.__version__)
```

```
4.11.0
```

In [3]:
```
# Load images for feature matching
img1 = cv2.imread('UNO.jpg')
img1 = cv2.cvtColor(img1,cv2.COLOR_BGR2RGB)
img2 = cv2.imread('UNO1.jpg')
img2 = cv2.cvtColor(img2,cv2.COLOR_BGR2RGB)
```

In [4]:
```
# Display Original Images
plt.figure(figsize=(15, 8))
plt.subplot(2, 3, 1)
plt.imshow(img1)
plt.title('Original Image 1')

plt.subplot(2, 3, 2)
plt.imshow(img2)
plt.title('Original Image 2')
```

Out[4]:
```
Text(0.5, 1.0, 'Original Image 2')
```

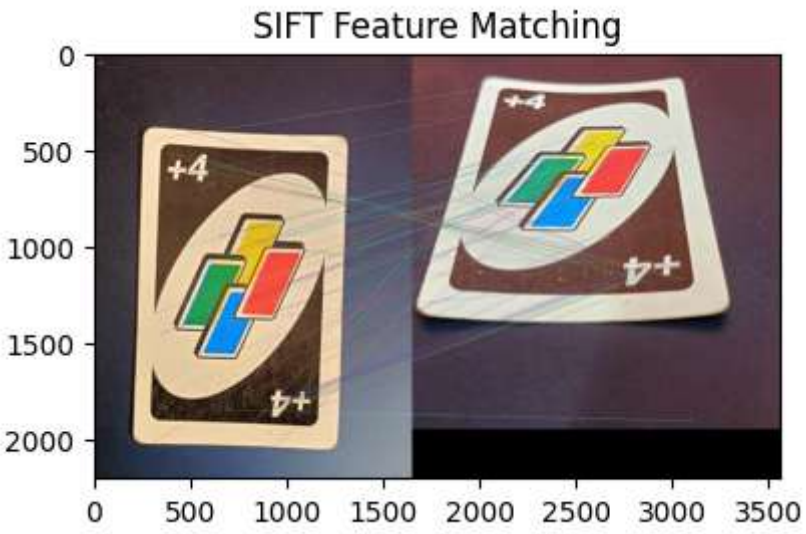


In [29]:
```
# 1. SIFT Feature Detection and Matching
sift = cv2.SIFT_create()
kp1, des1 = sift.detectAndCompute(img1, None)
kp2, des2 = sift.detectAndCompute(img2, None)
```

```
bf = cv2.BFMatcher()
matches = bf.knnMatch(des1, des2, k=2)

good_matches = []
for m, n in matches:
    if m.distance < 0.65 * n.distance:
        good_matches.append(m)

img_sift = cv2.drawMatches(img1, kp1, img2, kp2, good_matches, None, flags=cv2.DrawMatchesFlags_I
```

In [30]:
```
plt.figure(figsize=(15, 8))

plt.subplot(1, 3, 1)
plt.imshow(img_sift, cmap='gray')
plt.title('SIFT Feature Matching')
```

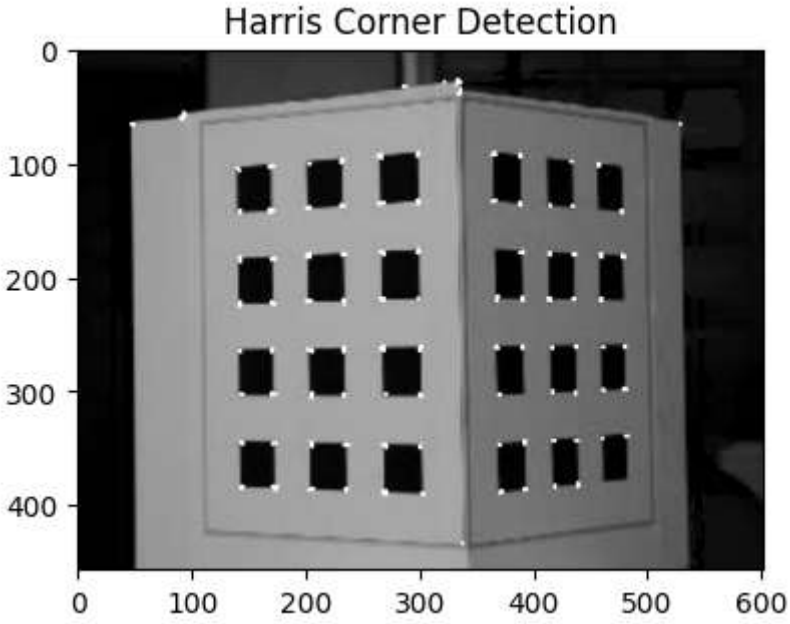
Out[30]: Text(0.5, 1.0, 'SIFT Feature Matching')



In [21]:
```
# 2. Harris Corner Detector
img_gray = cv2.imread('grid.png', cv2.IMREAD_GRAYSCALE)
img_harris = img_gray.copy()

dst = cv2.cornerHarris(np.float32(img_gray), 2, 3, 0.04)
dst = cv2.dilate(dst, None)
img_harris[dst > 0.01 * dst.max()] = 255
```

In [22]:
```
# Display Results
plt.figure(figsize=(15, 8))
plt.subplot(1, 3, 3)
plt.imshow(img_harris, cmap='gray')
plt.title('Harris Corner Detection')
```

Out[22]: Text(0.5, 1.0, 'Harris Corner Detection')

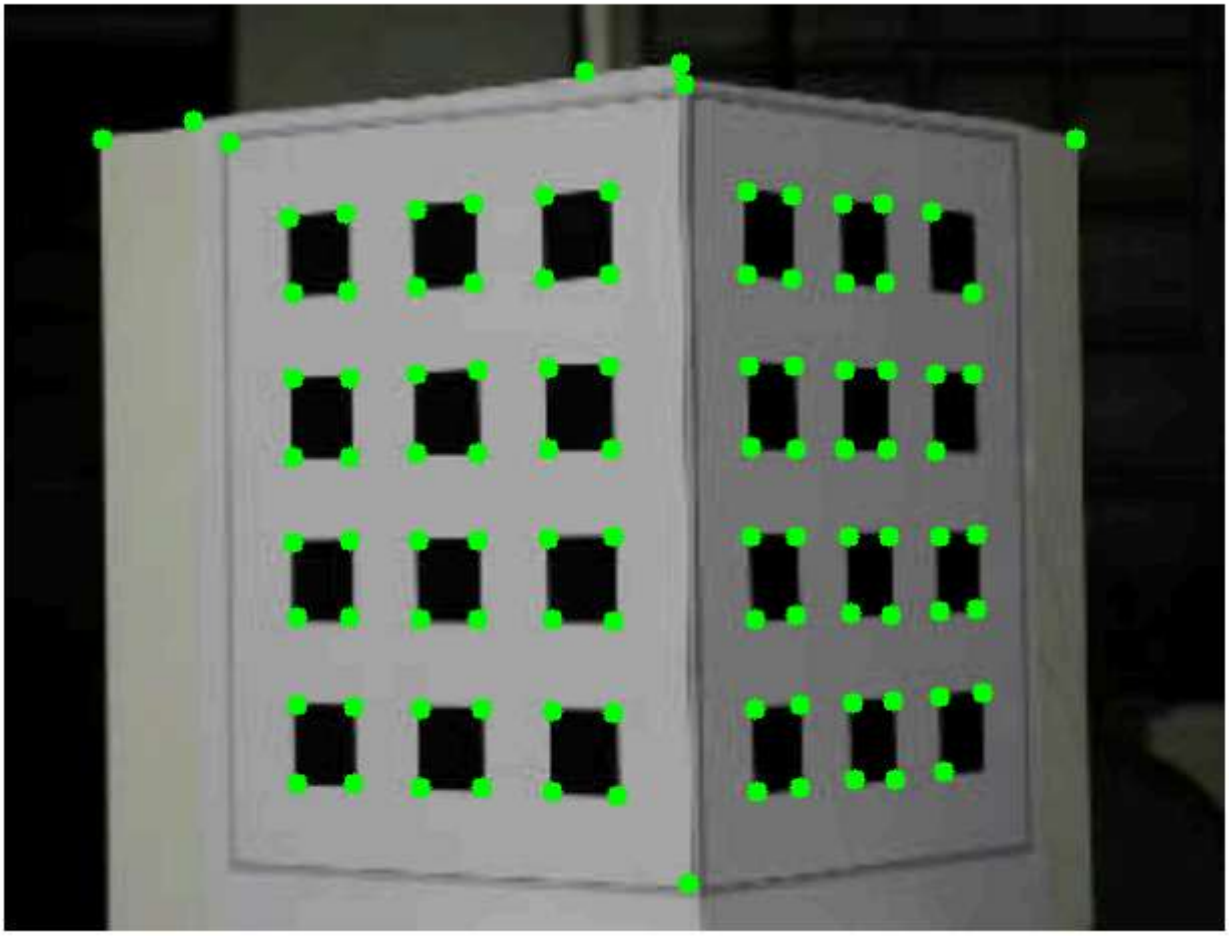


In [23]:
```python
import cv2
import numpy as np
import matplotlib.pyplot as plt

# Load the image
img = cv2.imread('grid.png')
gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)

# Shi-Tomasi corner detection
corners = cv2.goodFeaturesToTrack(gray, maxCorners=100, qualityLevel=0.01, minDistance=10)
corners = np.int0(corners)  # Convert to integer

# Draw the corners
for corner in corners:
    x, y = corner.ravel()  # Flatten array
    cv2.circle(img, (x, y), radius=5, color=(0, 255, 0), thickness=-1)

# Convert BGR to RGB for Matplotlib
img_rgb = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
```

```
C:\Users\Pranay Rokade\AppData\Local\Temp\ipykernel_19592\1415820688.py:11: DeprecationWarning: `
np.int0` is a deprecated alias for `np.intp`.  (Deprecated NumPy 1.24)
  corners = np.int0(corners)  # Convert to integer
```

In [24]:
```python
# Display the image with Matplotlib
plt.figure(figsize=(8, 6))
plt.imshow(img_rgb)
plt.title("Shi-Tomasi Corner Detection")
plt.axis("off")  # Hide axes
plt.show()
```

Shi-Tomasi Corner Detection



Conclusion

During my experiment with the test image, I changed certain parameter values and observed the following effects:

1. SIFT Feature Matching

- **Initial Ratio Threshold:** 0.75
- **Changed to:** 0.80
- **Observation:** Increasing the ratio threshold resulted in more matches, but also introduced more false matches, reducing accuracy. Lowering it to 0.70 reduced false matches but also missed some valid key points.

2. Harris Corner Detection

- **Initial Sensitivity Factor (k):** 0.04
- **Changed to:** 0.05
- **Observation:** Increasing the sensitivity factor detected fewer corners, missing some edges. When reduced to 0.03, more corners were detected, but there was noise and false detections.
- **Initial Block Size:** 3
- **Changed to:** 4

- **Observation:** A larger block size resulted in more robust corner detection but missed finer details. Reducing it to 2 detected more corners but introduced noise.

3. Shi-Tomasi Corner Detection

- **Initial Quality Level:** 0.01
- **Changed to:** 0.015
- **Observation:** Increasing the quality level reduced the number of detected corners, keeping only the strongest ones. Lowering it to 0.005 detected more corners, but some were false detections.
- **Initial Minimum Distance:** 10
- **Changed to:** 8
- **Observation:** Reducing the minimum distance resulted in more clustered corner detections, leading to redundancy. Increasing it to 12 spaced out the detected corners but missed some important key points.

Final Insight

I observed that adjusting these parameters significantly impacted the accuracy of feature detection and corner detection. Fine-tuning these values is necessary for optimal results, depending on the application.