COMPUTER VISION

Task1:AUGMENTED REALITY

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1.Introduction

In this report, we explore the application of ArUco markers for transforming The goal is to seamlessly integrate posters onto detected markers within classroom images.This process involves precise marker detection,calculation of transformation matrices,and blending techniques to achieve realistic results, and with the use of this algorithm, we performed ArUco generated image.

2.Flow chart

Detecting ArUco Markers.

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Performing Perspective Transformation.

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Warping the Images.

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Masking.

↓

Bitwise Operations.

↓

Evaluating the results.

3.Algorithm

1.Loading The Images:

Reading the ArUco marker image and poster image using **cv2.imread()**. These are the input images for marker detection and overlaying of the poster image.

2.Detecting ArUco Markers:

Initially using **cv2.aruco.getPredefinedDictionary()**to load the ArUco marker dictionaries.**cv2.aruco.detectParameters()** for parameter object and**cv2.aruco.detectMarkers()** for ArUco marker detection and the outcomes results in ArUco corner points.

3.Detecting Poster Corners:

The center point of the poster is calculated using the width and height of the poster image and later it is scaled down by a factor of 6 and 4, respectively. Then the corner points of the poster are calculated by the reduced width and height from the center point.

4.Performing Perspective Transformation:

Now we are performing **Perspective transformation** on both corner points. Using **cv2.getPerspectiveTransform()** we get the matrix (M) as output for both corner points, **cv2.warpPerspective()** performs perspective transformation on the ArUco image and the corners of the poster image, resulting in the alignment of the poster image with the ArUco image. with the use of **cv2.perspectiveTransform** the final poster region points are obtained.

5.Masking:

The whole image is masked using **np.zeros()** and later creating a mask for the poster region in particular using **cv2.fillPoly()**.

6.Bit-wise Operations:

Created masks are inverted by using **cv2.bitwisenot()**,and then apply mask to the ArUco image using **cv2.bitwiseand()** then the transformed image is added to the above output image using **cv2.bitwiseor()** that results in augmented images.

4.Results

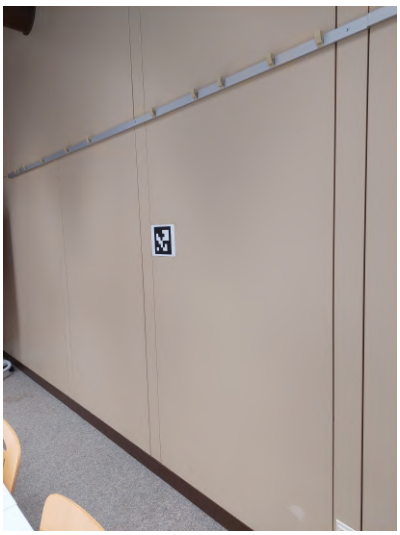

Figure 1: Detected ArUco Image

Figure 2: Poster image

Figure 3: Masking poster corners

Figure 4: Augmented image

4.1: Images that are perfectly aligned

Figure 5

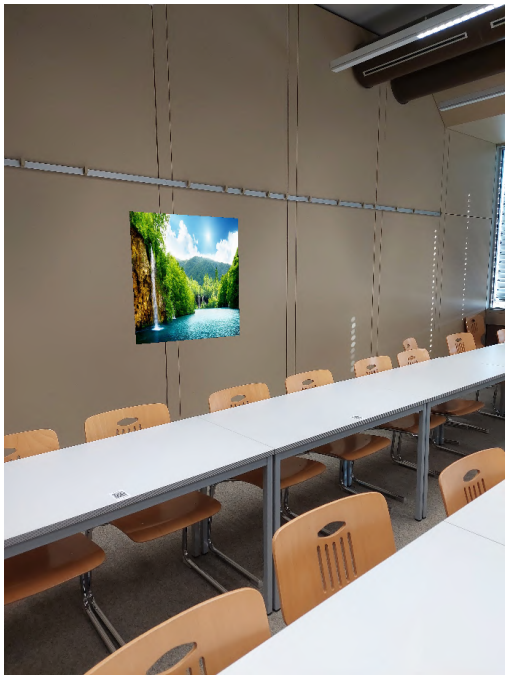

Figure 6

Figure 7

Figure 8

4.2: Images not perfectly aligned

Figure 9

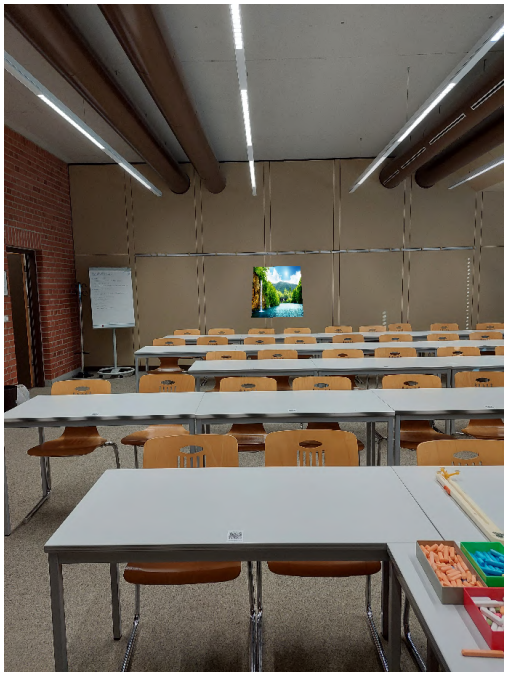

Figure 10

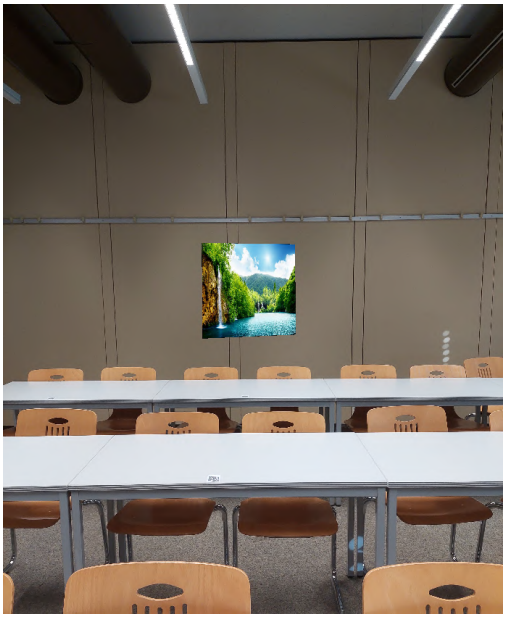

Figure 11

Figure 12

7. Task 1.2:

These are the augmented images generated with our own ArUco marker,we noticed that the poster image is perfectly aligned with the wall edges,hence we obtained the following the results shown below .

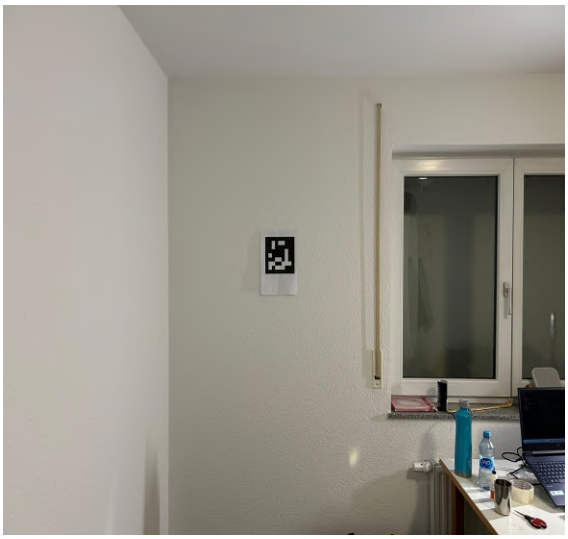

Figure 13: ArUco image

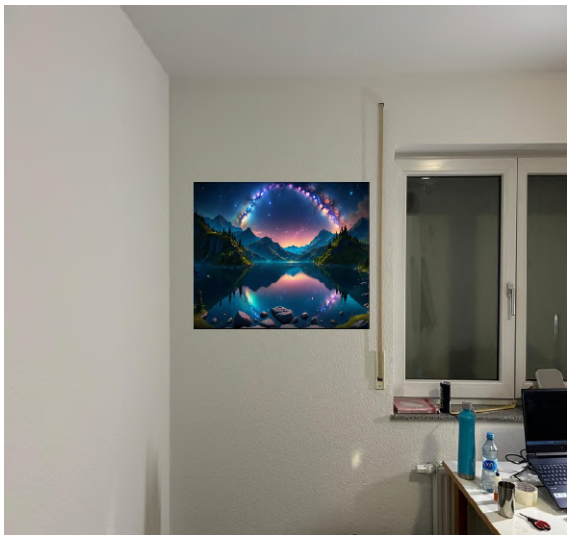

Figure 14: Perfectly aligned image

Figure 15: Perfectly aligned image

Figure 16: Partially misaligned image

6. Conclusion

From the above Augmented images, we noticed that the Poster images are perfectly placed on the top of ArUco marker and also poster edges are perfectly aligned with wall edges, but some of the poster images are misaligned.

Hence we observed it may because of the following factors.

1. Poor Marker Detection
2. Perspective Distortion
3. Depends on Environmental condition.

7.References

1. Elser, Stefan. *Room with ArUco Markers.* [Dataset] [Accessed: 15 November 2024]. Available at: ArUco images .

2. EDUCBA. *OpenCV warpPerspective.* [Online]. [Accessed: 20 November 2024]. Available at: OpenCV WarpPerspective Tutorial.

3. Geeks for Geeks.*About Perspective Warping,Python and OpenCV.*[online]. [Accessed: 15 November 2024]. Available at: Perspective Warping with OpenCV and Python.

4. 4k Nature Wallpapers. *4k Nature Wallpaper .* [online]. [Accessed: 26 November 2024]. Available at: Poster Image.