I. Affine Transformation

Using the homogeneous coordinate system, project a ladder onto a walkway to reflect perspective transformation. Then perform the affine transformations such as rotations and reflections.

Solution:

Approach: The problem is approached by a ladder image and projecting it on perspective transformation. The ladder image is given as

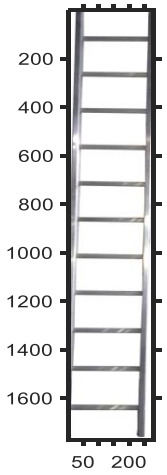

Fig. 1: Ladder Image.

The experiment is performed on a walkway. Figure 2 shows the walkway. The image is converted into grayscale configuration to reduce the complexity of calculation of RGB image.

Fig. 2: Walkway

Perspective transformation is done using a transformation matrix. The matrix can be written as,

```
%% Transformtion matrix
tm =

    1.0000         0    0.0010
         0    1.0000    0.0100
         0         0    1.0000
```

Then the ladder is projected into the walkway image.

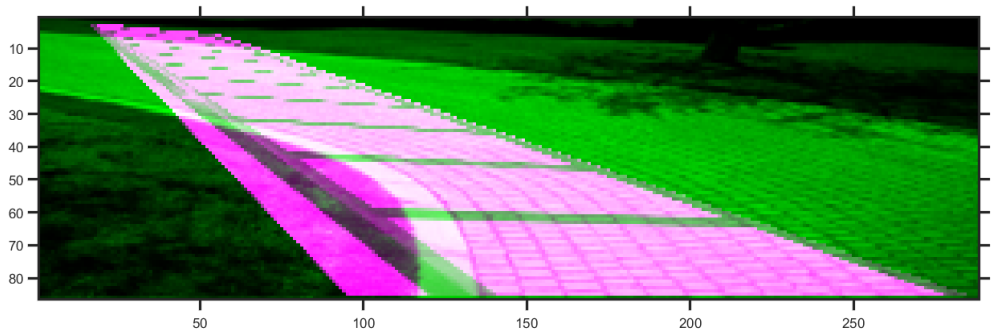

Fig. 3: Projected Ladder on walkway

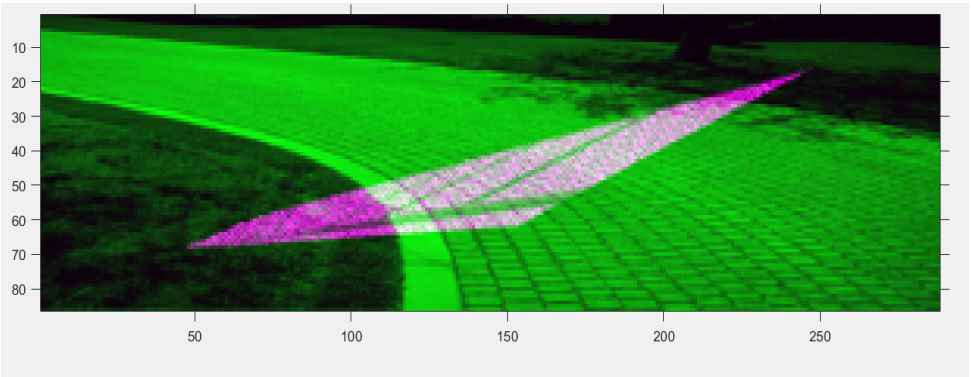

Fig. 4: Rotation of Ladder in the walkway

The rotation yields a rotated ladder across the walkway. It can be seen from the figure 4, the ladder has been moved counterclockwise from its initial position. 45-degree rotation transformation is applied on the projected ladder.

Reflection is also performed on the projected ladder and the behavior is observed using the code below:

```
%% Reflection
pers_angle = imrotate(pers,10);
pers1 = fliplr(pers_angle);
pers_r = [pers1 pers_angle];
pers_r = imresize(pers_r,size(im_r));
figure,imshow(pers_r)

im_ref = imfuse(im_r,pers_r);
figure,imshow(im_ref)
```

Figure 5 gives the idea about reflection done on the ladder projected on walkway.

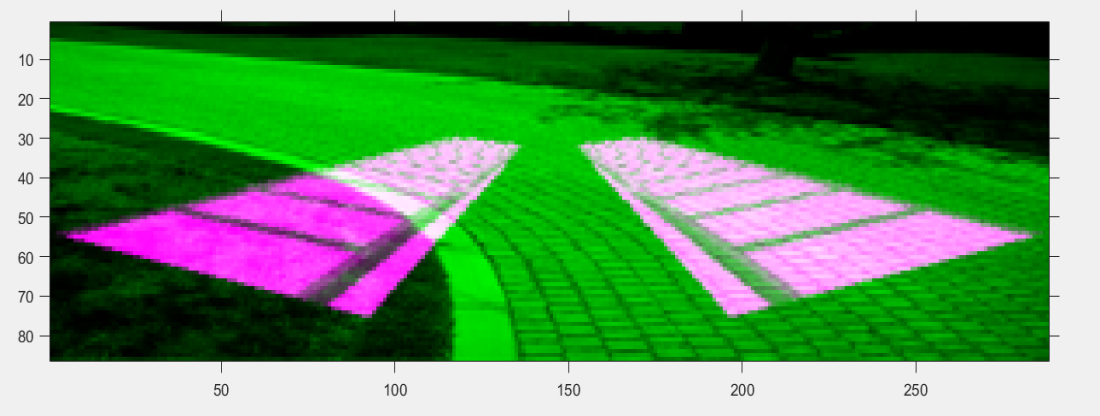

Fig. 5: Reflection performed on Projected Ladder