In [40]:

```
import numpy as np
import cv2 as cv
from matplotlib import pyplot as plt
from scipy import ndimage
```

Assignment 2 Question 1.a

Reading a frame from the video

In [45]:

```
vidcap = cv.VideoCapture(r'E:\u\sem1\cv\aat2\question1\video1.mp4')
check,image = vidcap.read()
count = 0
inc=0
while check:
    check,image = vidcap.read()
    if count%59==0 :
      inc+=1
      if inc==2:#storing the first frame image
          cv.imwrite(r"E:\u\sem1\cv\aat2\question1\frame%d.jpg" % inc, image)
    count += 1
```

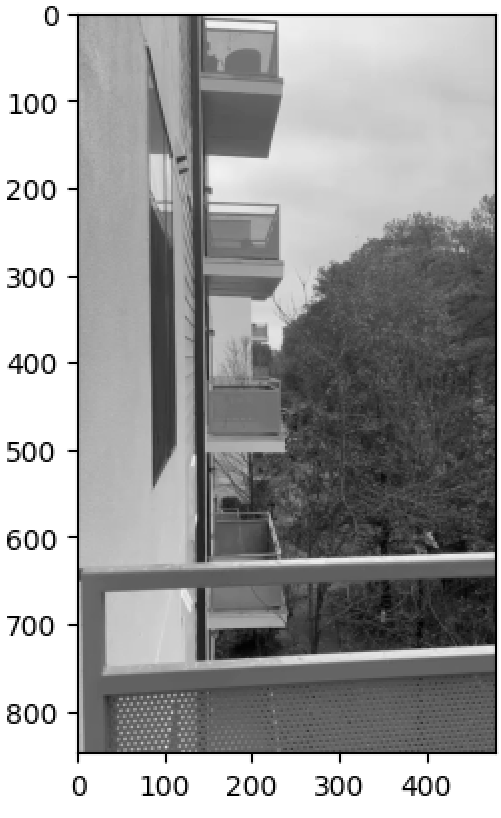
Original Image

In [21]:

```
img = cv.imread(r'E:\u\sem1\cv\aat2\question1\frame1.jpg',0)
#original image in gray scale
plt.imshow(img,cmap='gray')
```

Out[21]:

```
<matplotlib.image.AxesImage at 0x2296cf6ed30>
```



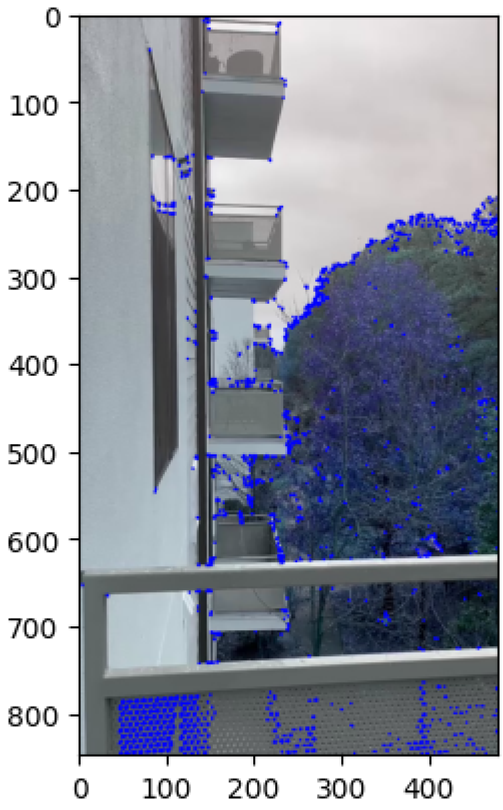
HarrisCorner Detection

In [33]:

```
import numpy as np
import cv2 as cv
import matplotlib.pyplot as plt
filename = r'E:\u\sem1\cv\aat2\question1\frame1.jpg'
img = cv.imread(filename)
gray = cv.cvtColor(img,cv.COLOR_BGR2GRAY)
gray = np.float32(gray)
dst = cv.cornerHarris(gray,2,3,0.07)
dst = cv.dilate(dst,None)
img[dst>0.01*dst.max()]=[0,0,255]
cv.imwrite(r'E:\\u\sem1\cv\aat2\question1\cornersPicture.jpg',img)
plt.imshow(img,cmap='gray')
```

Out[33]:

```
<matplotlib.image.AxesImage at 0x2296e0f5940>
```



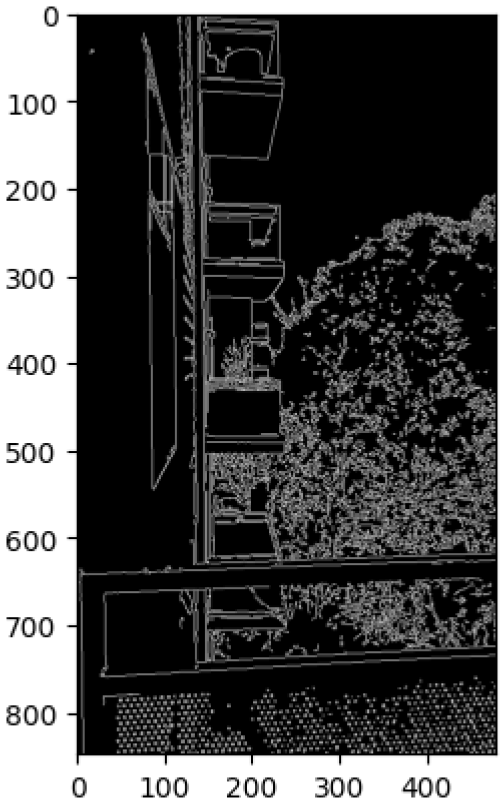
Canny Edge Detection

In [22]:

```
img = cv.imread(r'E:\u\sem1\cv\aat2\question1\frame1.jpg',0)
edges = cv.Canny(img,100,200)
plt.imshow(edges,cmap='gray')
```

Out[22]:

```
<matplotlib.image.AxesImage at 0x2296cf9c460>
```



Canny Edge Detection without using inbuilt functions

```
The Canny edge detection algorithm is composed of 5 steps:

    Noise reduction;
    Gradient calculation;
    Non-maximum suppression;
    Double threshold;
    Edge Tracking by Hysteresis.
```

In [34]:

```
def gaussian_kernel(size, sigma=1):
    size = int(size) // 2
    x, y = np.mgrid[-size:size+1, -size:size+1]
    normal = 1 / (2.0 * np.pi * sigma**2)
    g =  np.exp(-((x**2 + y**2) / (2.0*sigma**2))) * normal
    return g
```

In [41]:

```
def sobel_filters(img):
    Kx = np.array([[-1, 0, 1], [-2, 0, 2], [-1, 0, 1]], np.float32)
    Ky = np.array([[1, 2, 1], [0, 0, 0], [-1, -2, -1]], np.float32)
    Ix = ndimage.convolve(img, Kx)
    Iy = ndimage.convolve(img, Ky)

    G = np.hypot(Ix, Iy)
    G = G / G.max() * 255
    theta = np.arctan2(Iy, Ix)

    return (G, theta)
```

In [42]:

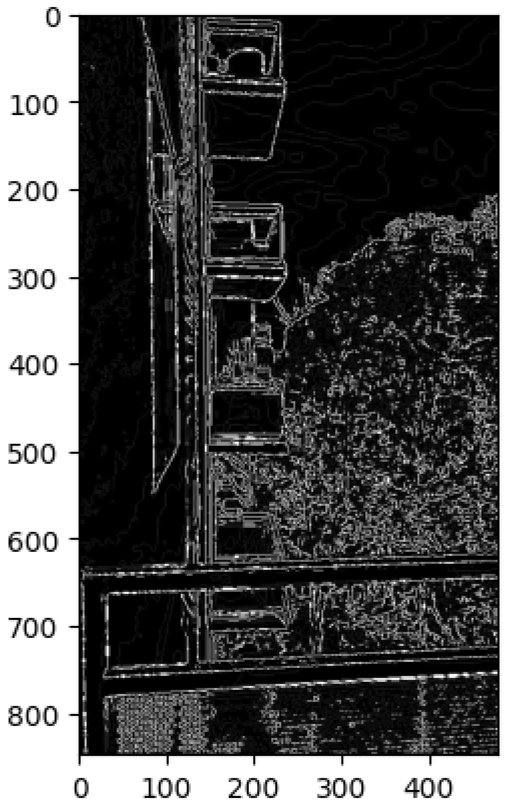
```
def non_max_suppression(img, D):
    M, N = img.shape
    Z = np.zeros((M,N), dtype=np.int32)
    angle = D * 180. / np.pi
    angle[angle < 0] += 180


    for i in range(1,M-1):
        for j in range(1,N-1):
            try:
                q = 255
                r = 255

               #angle 0
                if (0 <= angle[i,j] < 22.5) or (157.5 <= angle[i,j] <= 180):
                    q = img[i, j+1]
                    r = img[i, j-1]
                #angle 45
                elif (22.5 <= angle[i,j] < 67.5):
                    q = img[i+1, j-1]
                    r = img[i-1, j+1]
                #angle 90
                elif (67.5 <= angle[i,j] < 112.5):
                    q = img[i+1, j]
                    r = img[i-1, j]
                #angle 135
                elif (112.5 <= angle[i,j] < 157.5):
                    q = img[i-1, j-1]
                    r = img[i+1, j+1]

                if (img[i,j] >= q) and (img[i,j] >= r):
                    Z[i,j] = img[i,j]
                else:
                    Z[i,j] = 0

            except IndexError as e:
                pass

    return Z
```

In [43]:

```
def threshold(img, lowThresholdRatio=0.05, highThresholdRatio=0.09):

    highThreshold = img.max() * highThresholdRatio
    lowThreshold = highThreshold * lowThresholdRatio

    M, N = img.shape
    res = np.zeros((M,N), dtype=np.int32)

    weak = np.int32(25)
    strong = np.int32(255)

    strong_i, strong_j = np.where(img >= highThreshold)
    zeros_i, zeros_j = np.where(img < lowThreshold)

    weak_i, weak_j = np.where((img <= highThreshold) & (img >= lowThreshold))
    res[strong_i, strong_j] = strong
    res[weak_i, weak_j] = weak

    return (res, weak, strong)
```

In [44]:
```
import matplotlib.pyplot as plt
import cv2 as cv
frame = cv.imread(r'E:\u\sem1\cv\aat2\question1\frame1.jpg',0)
g=gaussian_kernel(5,5)
weak_th = None
strong_th = None
img= cv.filter2D(src=frame, kernel=g, ddepth=19)
mag,ang=sobel_filters(img)
mag_max = np.max(mag)
c=non_max_suppression(mag,ang)
a,b,d=threshold(c)
plt.imshow(a,cmap='gray')
```

Out[44]:
```
<matplotlib.image.AxesImage at 0x22974e20550>
```



Assignment2 Question 1.b

```
homography matrix
```

In [46]:
```
MIN_MATCH_COUNT = 10
img1 = cv.imread(r'E:\u\sem1\cv\aat2\question1\frame1.jpg',0)
img2 = cv.imread(r'E:\u\sem1\cv\aat2\question1\frame2.jpg',0)
sift = cv.SIFT_create()
kp1, des1 = sift.detectAndCompute(img1,None)
kp2, des2 = sift.detectAndCompute(img2,None)
```

```
FLANN_INDEX_KDTREE = 1
index_params = dict(algorithm = FLANN_INDEX_KDTREE, trees = 5)
search_params = dict(checks = 50)
flann = cv.FlannBasedMatcher(index_params, search_params)
matches = flann.knnMatch(des1,des2,k=2)
good = []
for m,n in matches:
    if m.distance < 0.7*n.distance:
        good.append(m)
```

In [47]:

```
if len(good)>MIN_MATCH_COUNT:
    src_pts = np.float32([ kp1[m.queryIdx].pt for m in good ]).reshape(-1,1,2)
    dst_pts = np.float32([ kp2[m.trainIdx].pt for m in good ]).reshape(-1,1,2)
    M, mask = cv.findHomography(src_pts, dst_pts, cv.RANSAC,5.0)
    matchesMask = mask.ravel().tolist()
    h,w = img1.shape
    pts = np.float32([ [0,0],[0,h-1],[w-1,h-1],[w-1,0] ]).reshape(-1,1,2)
    dst = cv.perspectiveTransform(pts,M)
    img2 = cv.polylines(img2,[np.int32(dst)],True,255,3, cv.LINE_AA)
    print("Homography Matrix")
    print(M)
else:
    print( "Not enough matches are found - {}/{}".format(len(good), MIN_MATCH_COUNT
    matchesMask = None
```

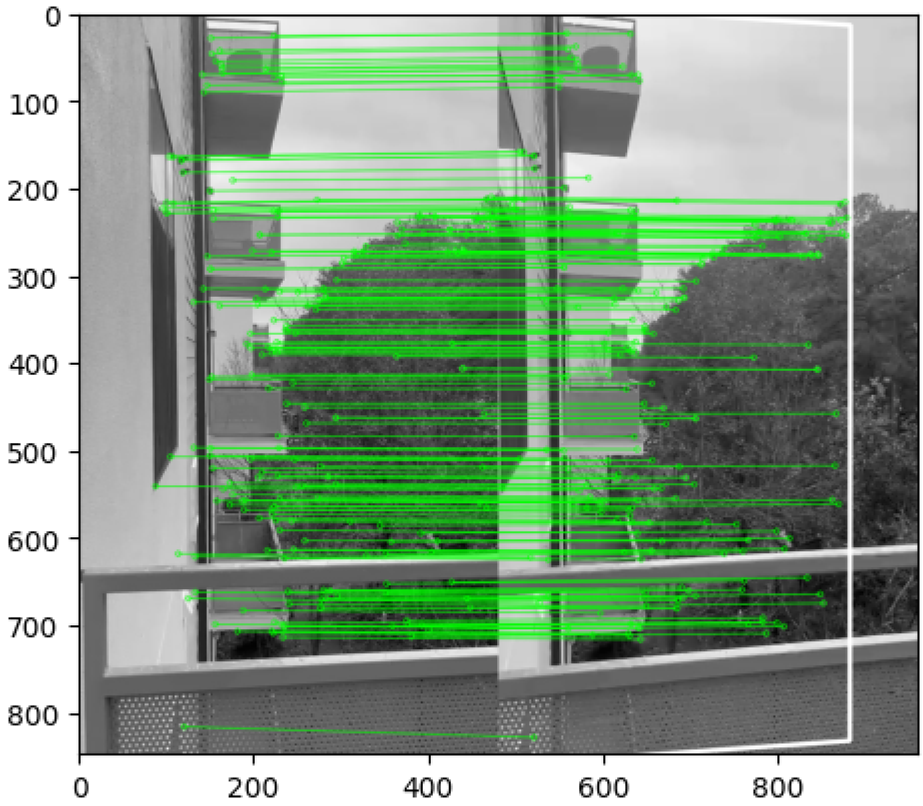
```
Homography Matrix
[[ 1.09081607e+00 -2.01988728e-03 -8.52700159e+01]
 [ 7.19471288e-02  1.04635324e+00 -1.87077488e+01]
 [ 1.72447406e-04  9.23721420e-08  1.00000000e+00]]
```

In [50]:

```
draw_params = dict(matchColor = (0,255,0),
                   singlePointColor = None,
                   matchesMask = matchesMask,
                   flags = 2)
img3 = cv.drawMatches(img1,kp1,img2,kp2,good,None,**draw_params)
cv.imwrite(r'E:\u\sem1\cv\aat2\question1\MathingPointsBetweenFrame1andFrame2.jpg',i
plt.imshow(img3, 'gray')
#plt.show()
```

Out[50]:

```
<matplotlib.image.AxesImage at 0x2296e86faf0>
```


0
100
200
300
400
500
600
700
800
0
200
400
600
800