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Problem statement-1 : Write a program to find the real time dimensions of any object

```
# USAGE
# python object_size.py --image images/example_01.png --width 0.955
# python object_size.py --image images/example_02.png --width 0.955
# python object_size.py --image images/example_03.png --width 3.5

# import the necessary packages
from scipy.spatial import distance as dist
from imutils import perspective
from imutils import contours
import numpy as np
import argparse
import imutils
import cv2

def midpoint(ptA, ptB):
    return ((ptA[0] + ptB[0]) * 0.5, (ptA[1] + ptB[1]) * 0.5)

# construct the argument parse and parse the arguments
ap = argparse.ArgumentParser()
ap.add_argument("-i", "--image", required=True,
    help="path to the input image")
ap.add_argument("-w", "--width", type=float, required=True,
    help="width of the left-most object in the image (in inches)")
args = vars(ap.parse_args())

# load the image, convert it to grayscale, and blur it slightly
image = cv2.imread(args["image"])
gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
gray = cv2.GaussianBlur(gray, (7, 7), 0)

# perform edge detection, then perform a dilation + erosion to
# close gaps in between object edges
edged = cv2.Canny(gray, 50, 100)
edged = cv2.dilate(edged, None, iterations=1)
edged = cv2.erode(edged, None, iterations=1)

# find contours in the edge map
cnts = cv2.findContours(edged.copy(), cv2.RETR_EXTERNAL,
    cv2.CHAIN_APPROX_SIMPLE)
cnts = imutils.grab_contours(cnts)

# sort the contours from left-to-right and initialize the
# 'pixels per metric' calibration variable
(cnts, _) = contours.sort_contours(cnts)
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pixelsPerMetric = None

# loop over the contours individually
for c in cnts:
    # if the contour is not sufficiently large, ignore it
    if cv2.contourArea(c) < 100:
        continue

    # compute the rotated bounding box of the contour
    orig = image.copy()
    box = cv2.minAreaRect(c)
    box = cv2.cv.BoxPoints(box) if imutils.is_cv2() else cv2.boxPoints(box)
    box = np.array(box, dtype="int")

    # order the points in the contour such that they appear
    # in top-left, top-right, bottom-right, and bottom-left
    # order, then draw the outline of the rotated bounding
    # box
    box = perspective.order_points(box)
    cv2.drawContours(orig, [box.astype("int")], -1, (0, 255, 0), 2)

    # loop over the original points and draw them
    for (x, y) in box:
        cv2.circle(orig, (int(x), int(y)), 5, (0, 0, 255), -1)

    # unpack the ordered bounding box, then compute the midpoint
    # between the top-left and top-right coordinates, followed by
    # the midpoint between bottom-left and bottom-right coordinates
    (tl, tr, br, bl) = box
    (tltrX, tltrY) = midpoint(tl, tr)
    (blbrX, blbrY) = midpoint(bl, br)

    # compute the midpoint between the top-left and top-right points,
    # followed by the midpoint between the top-righ and bottom-right
    (tlblX, tlblY) = midpoint(tl, bl)
    (trbrX, trbrY) = midpoint(tr, br)

    # draw the midpoints on the image
    cv2.circle(orig, (int(tltrX), int(tltrY)), 5, (255, 0, 0), -1)
    cv2.circle(orig, (int(blbrX), int(blbrY)), 5, (255, 0, 0), -1)
    cv2.circle(orig, (int(tlblX), int(tlblY)), 5, (255, 0, 0), -1)
    cv2.circle(orig, (int(trbrX), int(trbrY)), 5, (255, 0, 0), -1)

    # draw lines between the midpoints
    cv2.line(orig, (int(tltrX), int(tltrY)), (int(blbrX), int(blbrY)),
        (255, 0, 255), 2)
    cv2.line(orig, (int(tlblX), int(tlblY)), (int(trbrX), int(trbrY)),
        (255, 0, 255), 2)

    # compute the Euclidean distance between the midpoints
    dA = dist.euclidean((tltrX, tltrY), (blbrX, blbrY))
    dB = dist.euclidean((tlblX, tlblY), (trbrX, trbrY))

    # if the pixels per metric has not been initialized, then
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    # compute it as the ratio of pixels to supplied metric
    # (in this case, inches)
    if pixelsPerMetric is None:
        pixelsPerMetric = dB / args["width"]

    # compute the size of the object
    dimA = dA / pixelsPerMetric
    dimB = dB / pixelsPerMetric

    # draw the object sizes on the image
    cv2.putText(orig, "{:.1f}in".format(dimA),
        (int(tltrX - 15), int(tltrY - 10)), cv2.FONT_HERSHEY_SIMPLEX,
        0.65, (255, 255, 255), 2)
    cv2.putText(orig, "{:.1f}in".format(dimB),
        (int(trbrX + 10), int(trbrY)), cv2.FONT_HERSHEY_SIMPLEX,
        0.65, (255, 255, 255), 2)

    # show the output image
    cv2.imshow("Image", orig)
    cv2.waitKey(0)
```

Input:

Outputs:

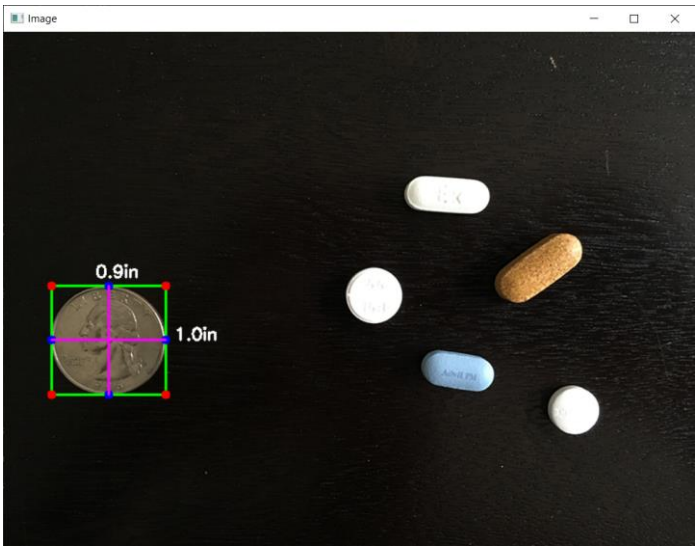
Image
0.9in
1.0in

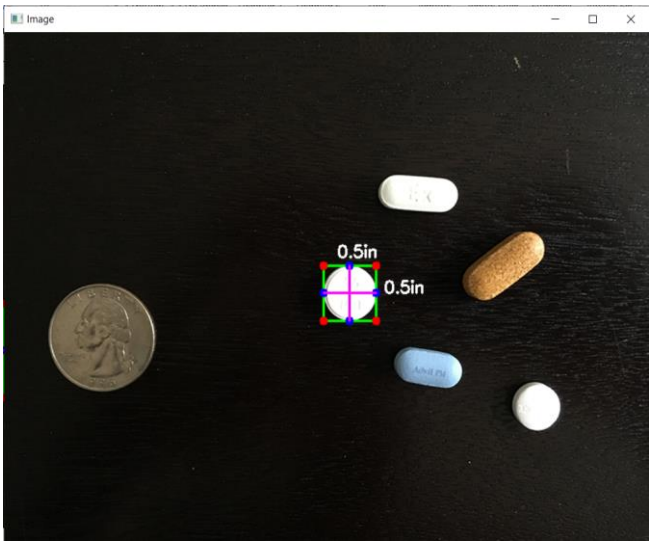
Image
0.5in
0.5in

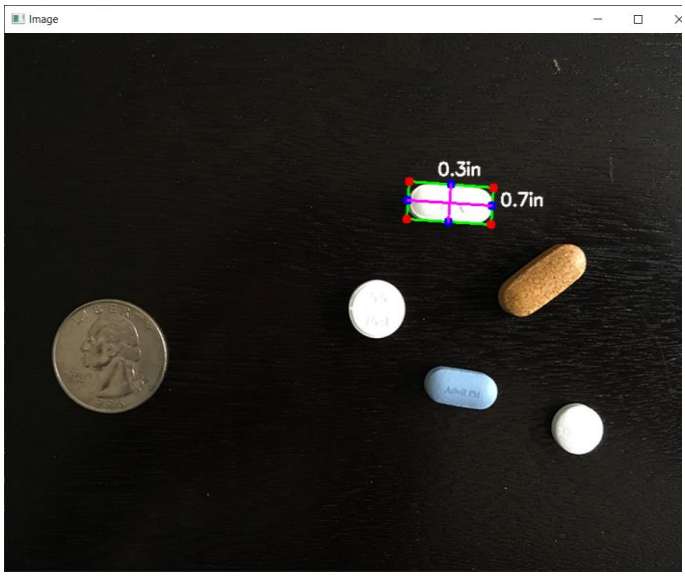
Image
0.3in
0.7in

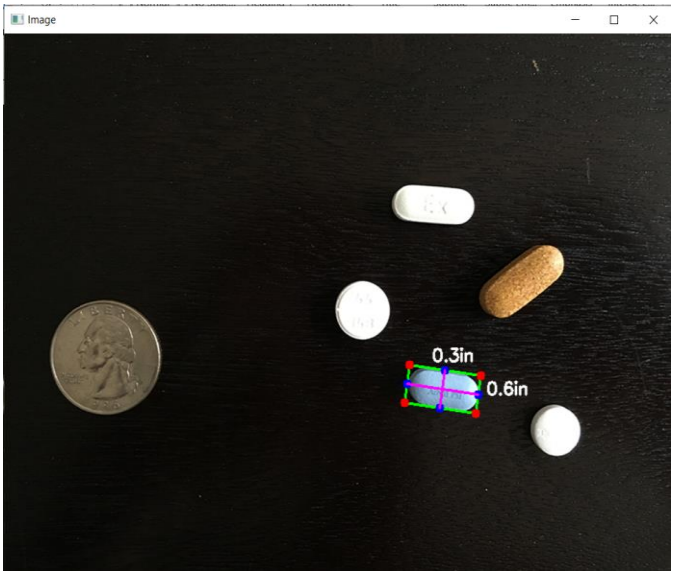
Image
0.3in
0.6in

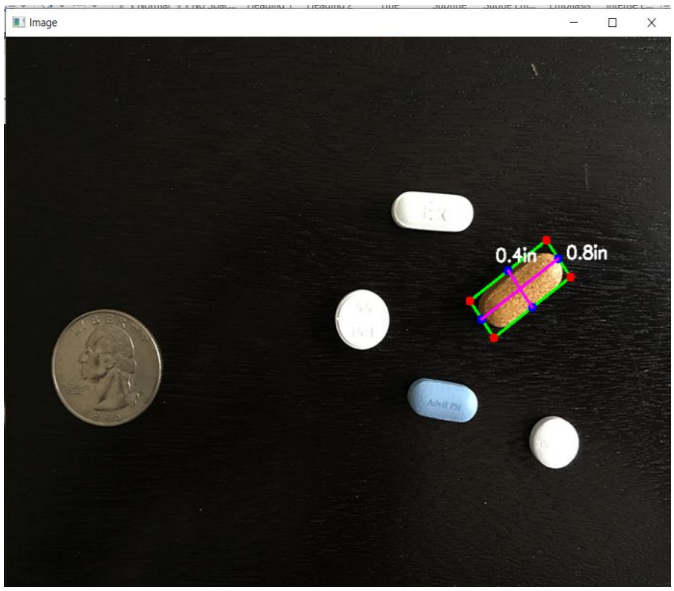
Image
0.4in
0.8in

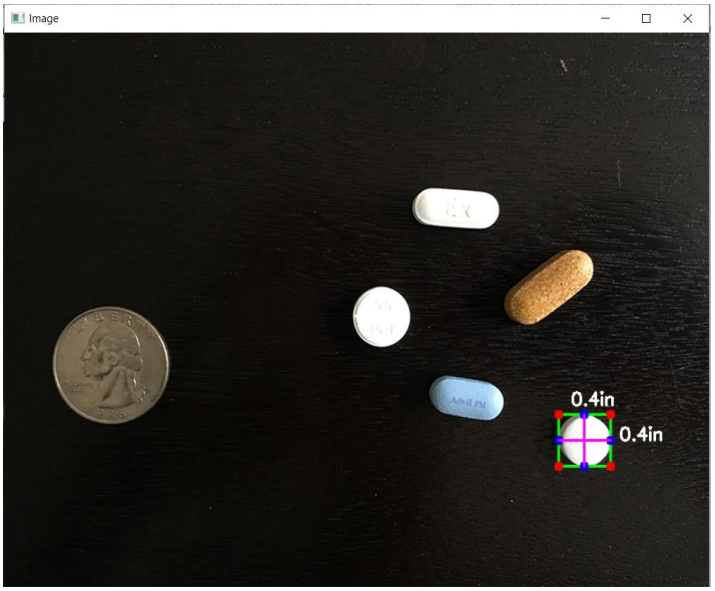
Image
0.4in
0.4in

Problem statement-2 : Write a program to take a user defined input and detect the respective shape.

```
import cv2
import numpy as np
from matplotlib import pyplot as plt

# reading image
img = cv2.imread('sharps.png')

# converting image into grayscale image
gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)

# setting threshold of gray image
_, threshold = cv2.threshold(gray, 127, 255, cv2.THRESH_BINARY)

# using a findContours() function
contours, _ = cv2.findContours(
    threshold, cv2.RETR_TREE, cv2.CHAIN_APPROX_SIMPLE)

i = 0

# list for storing names of shapes
for contour in contours:

    # here we are ignoring first counter because
    # findcontour function detects whole image as shape
    if i == 0:
        i = 1
        continue

    # cv2.approxPloyDP() function to approximate the shape
    approx = cv2.approxPolyDP(
        contour, 0.01 * cv2.arcLength(contour, True), True)

    # using drawContours() function
    cv2.drawContours(img, [contour], 0, (0, 0, 255), 5)

    # finding center point of shape
    M = cv2.moments(contour)
    if M['m00'] != 0.0:
        x = int(M['m10']/M['m00'])
        y = int(M['m01']/M['m00'])

    # putting shape name at center of each shape
    if len(approx) == 3:
        cv2.putText(img, 'Triangle', (x, y),
                    cv2.FONT_HERSHEY_SIMPLEX, 0.6, (255, 255, 255), 2)
```

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    elif len(approx) == 4:
        cv2.putText(img, 'Quadrilateral', (x, y),
                    cv2.FONT_HERSHEY_SIMPLEX, 0.6, (255, 255, 255), 2)

    elif len(approx) == 5:
        cv2.putText(img, 'Pentagon', (x, y),
                    cv2.FONT_HERSHEY_SIMPLEX, 0.6, (255, 255, 255), 2)

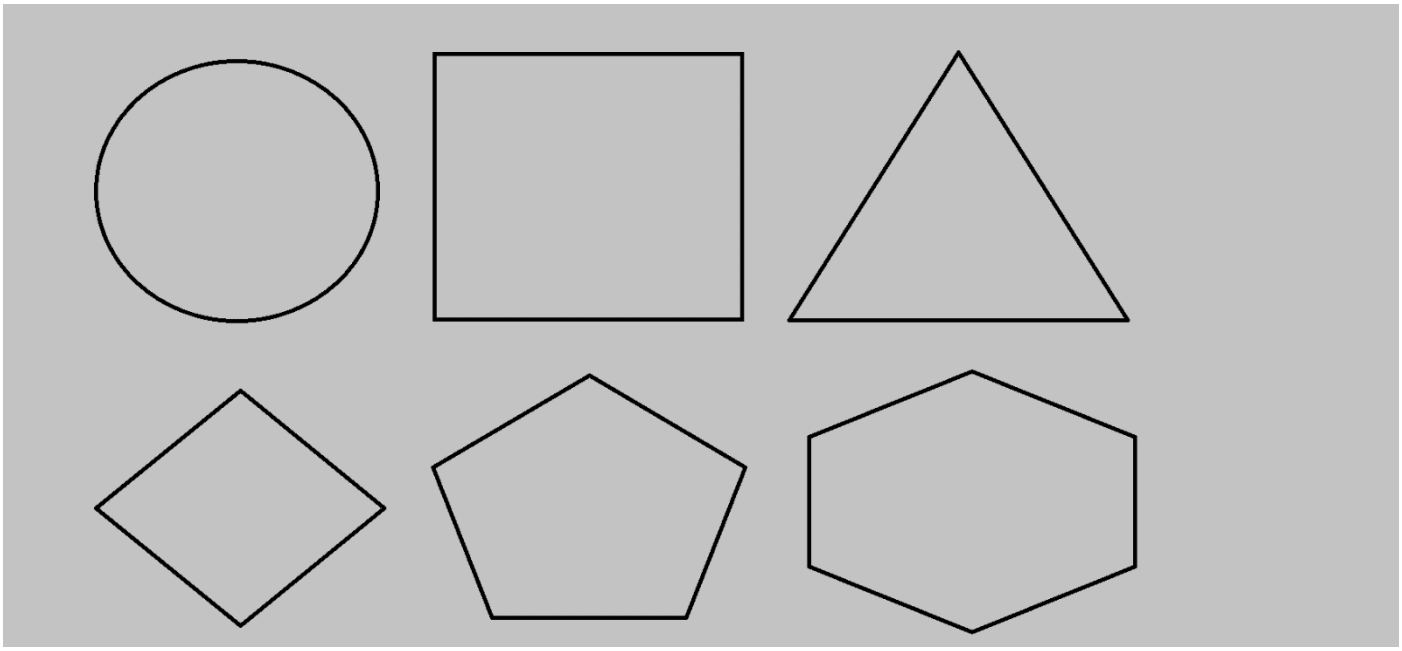
    elif len(approx) == 6:
        cv2.putText(img, 'Hexagon', (x, y),
                    cv2.FONT_HERSHEY_SIMPLEX, 0.6, (255, 255, 255), 2)

    else:
        cv2.putText(img, 'circle', (x, y),
                    cv2.FONT_HERSHEY_SIMPLEX, 0.6, (255, 255, 255), 2)

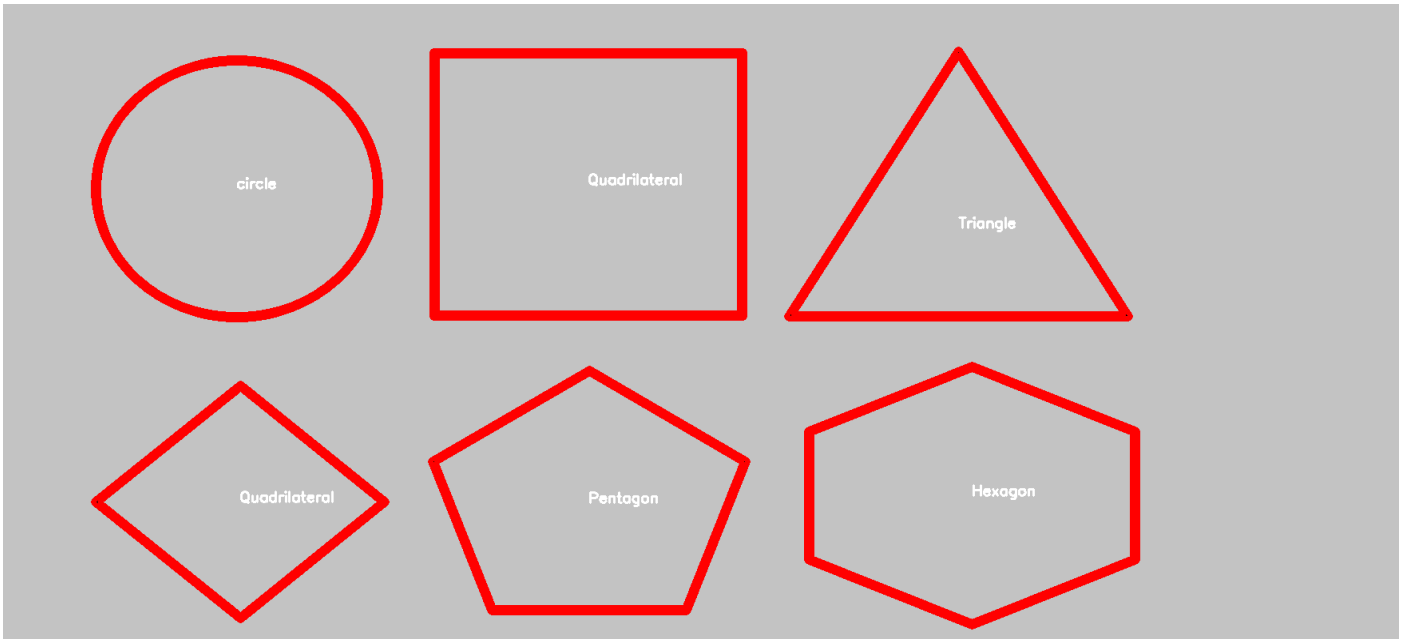
# displaying the image after drawing contours
cv2.imshow('shapes', img)

cv2.waitKey(0)
cv2.destroyAllWindows()
```

input:



output:


circle
Quadrilateral
Triangle
Quadrilateral
Pentagon
Hexagon