

Folder: Asphalt

File: color.py

Documented code for color.py:

```
import cv2
```

```
import numpy as np
```

```
cam = cv2.VideoCapture(0)
```

```
cv2.namedWindow('Color Detection')
```

```
def window(x):
```

```
    pass
```

```
cv2.createTrackbar('Hue', 'Color Detection' , 0, 179, window)
```

```
cv2.createTrackbar('Saturation','Color Detection', 0 ,255,window)
```

```
cv2.createTrackbar('Value','Color Detection', 0,255,window)
```

```
while True:
```

```
    ret ,img = cam.read()
```

```
    img = np.flip(img ,axis =1)
```

```
    img = cv2.resize(img ,(480 ,360))
```

```
    hsv = cv2.cvtColor(img ,cv2.COLOR_BGR2HSV)
```

```
    blurred = cv2.GaussianBlur(hsv, (11,11),0)
```

```
    h = cv2.getTrackbarPos('Hue', 'Color Detection')
```

```
    s = cv2.getTrackbarPos('Saturation', 'Color Detection')
```

```
    v = cv2.getTrackbarPos('Value', 'Color Detection')
```

```
    lower_color = np.array([h ,s, v])
```

```
    upper_color = np.array([100,255,255])
```

```
    mask = cv2.inRange(hsv , lower_color,upper_color)
```

```
    cv2.imshow ('Color Detection', cv2.bitwise_and(img ,img ,mask=mask))
```

```
    key = cv2.waitKey(1) & 0xFF
```

```
if key == ord("q"):
```

```
    break
```

```
cam.release()
```

```
cv2.destroyAllWindows()
```

```
#31 33 153
```

File: directkeys.py

Documented code for directkeys.py:

```
import ctypes
```

```
import time
```

```
SendInput = ctypes.windll.user32.SendInput
```

```
A = 0x1E
```

```
D = 0x20
```

```
Space = 0x39
```

```
# C struct redefinitions
```

```
PUL = ctypes.POINTER(ctypes.c_ulong)
```

```
class KeyBdInput(ctypes.Structure):
```

```
    _fields_ = [("wVk", ctypes.c_ushort),  
                ("wScan", ctypes.c_ushort),  
                ("dwFlags", ctypes.c_ulong),  
                ("time", ctypes.c_ulong),  
                ("dwExtraInfo", PUL)]
```

```
class HardwareInput(ctypes.Structure):
```

```
    _fields_ = [("uMsg", ctypes.c_ulong),  
                ("wParamL", ctypes.c_short),  
                ("wParamH", ctypes.c_ushort)]
```

```
class MouseInput(ctypes.Structure):
    _fields_ = [("dx", ctypes.c_long),
                ("dy", ctypes.c_long),
                ("mouseData", ctypes.c_ulong),
                ("dwFlags", ctypes.c_ulong),
                ("time", ctypes.c_ulong),
                ("dwExtraInfo", PUL)]
```

```
class Input_I(ctypes.Union):
    _fields_ = [("ki", KeyBdInput),
                ("mi", MouseInput),
                ("hi", HardwareInput)]
```

```
class Input(ctypes.Structure):
    _fields_ = [("type", ctypes.c_ulong),
                ("ii", Input_I)]
```

# Actuals Functions

```
def PressKey(hexKeyCode):
    extra = ctypes.c_ulong(0)
    ii_ = Input_I()
    ii_.ki = KeyBdInput( 0, hexKeyCode, 0x0008, 0, ctypes.pointer(extra) )
    x = Input( ctypes.c_ulong(1), ii_ )
    ctypes.windll.user32.SendInput(1, ctypes.pointer(x), ctypes.sizeof(x))
```

```
def ReleaseKey(hexKeyCode):
    extra = ctypes.c_ulong(0)
    ii_ = Input_I()
    ii_.ki = KeyBdInput( 0, hexKeyCode, 0x0008 | 0x0002, 0, ctypes.pointer(extra) )
    x = Input( ctypes.c_ulong(1), ii_ )
    ctypes.windll.user32.SendInput(1, ctypes.pointer(x), ctypes.sizeof(x))
```

```
if __name__ == '__main__':
```

```
    PressKey(0x11)
```

```
    time.sleep(1)
```

```
    ReleaseKey(0x11)
```

```
    time.sleep(1)
```

File: steering.py

Documented code for steering.py:

```
import cv2
```

```
import imutils
```

```
from imutils.video import VideoStream
```

```
import numpy as np
```

```
from directkeys import A,D,Space,ReleaseKey ,PressKey
```

```
cam = VideoStream(src = 0).start()
```

```
currentKey=list()
```

```
while True :
```

```
    key = False
```

```
    img = cam.read()
```

```
    img = np.flip(img , axis=1)
```

```
    img = np.array(img)
```

```
    hsv= cv2.cvtColor(img ,cv2.COLOR_BGR2HSV)
```

```
    blurred = cv2.GaussianBlur(hsv ,(11,11),0)
```

```
    colorLower = np.array([31,33 ,153])
```

```
    colorUpper = np.array([100,255,255])
```

```
    mask = cv2.inRange(blurred,colorLower , colorUpper)
```

```
    mask = cv2.morphologyEx(mask , cv2.MORPH_OPEN , np.ones((5,5),np.uint8))
```

```
mask = cv2.morphologyEx(mask , cv2.MORPH_CLOSE , np.ones((5,5),np.uint8))
```

```
width = img.shape[1]
```

```
height = img.shape[0]
```

```
upContour = mask[0:height//2, 0:width]
```

```
downContour = mask[3*height//4:height, 2*width//5:3*width//5 ]
```

```
cnts_up = cv2.findContours(upContour, cv2.RETR_EXTERNAL, cv2.CHAIN_APPROX_SIMPLE)
```

```
cnts_up = imutils.grab_contours(cnts_up)
```

```
                cnts_down      =      cv2.findContours(downContour,      cv2.RETR_EXTERNAL,  
cv2.CHAIN_APPROX_SIMPLE)
```

```
cnts_down = imutils.grab_contours(cnts_down)
```

```
if len(cnts_up) > 0:
```

```
    c = max(cnts_up ,key=cv2.contourArea)
```

```
    M = cv2.moments(c)
```

```
    cX = int(M["m10"]/M["m00"])
```

```
if cX < (width//2 -35):
```

```
    PressKey(A)
```

```
    key = True
```

```
    currentKey.append(A)
```

```
elif cX > (width//2 +35):
```

```
    PressKey(D)
```

```
    key = True
```

```
    currentKey.append(D)
```

```
if len(cnts_down) > 0:
```

```
    PressKey(Space)
```

```
    key = True
```

```
    currentKey.append(Space)
```

```

img = cv2.rectangle(img , (0,0),(width//2-35,height//2),(0,255,0),1)
cv2.putText(img ,"LEFT",(110,30),cv2.FONT_HERSHEY_COMPLEX,1,(139,0,0))


img = cv2.rectangle(img , (width//2+35,0),(width, height//2),(0,255,0),1)
cv2.putText(img ,"RIGHT",(440,30),cv2.FONT_HERSHEY_COMPLEX,1,(139,0,0))


img = cv2.rectangle(img , (2*(width//5),3*height//4),(3*width//5,height),(0,255,0),1)
cv2.putText(img ,"NITRO",(2*(width//5)+20,height-10),cv2.FONT_HERSHEY_COMPLEX,1,(139,0,0))


cv2.imshow("Steering Whele [HAWK-AI]", img)


if not key and len(currentKey)!=0:
    for current in currentKey:
        ReleaseKey(current)


Key = cv2.waitKey(1) & 0xFF
if Key == ord('q'):
    break


cv2.destroyAllWindows()

```

Folder: People Counter

Folder: \_\_pycache\_\_

File: centroidtracker.py

Documented code for centroidtracker.py:

```
# import the necessary packages
```

```
from scipy.spatial import distance as dist
```

```
from collections import OrderedDict
```

```
import numpy as np
```

```
class CentroidTracker:
```

```
    def __init__(self, maxDisappeared=50, maxDistance=50):  
        # initialize the next unique object ID along with two ordered  
        # dictionaries used to keep track of mapping a given object  
        # ID to its centroid and number of consecutive frames it has  
        # been marked as "disappeared", respectively  
        self.nextObjectID = 0  
        self.objects = OrderedDict()  
        self.disappeared = OrderedDict()  
        self.bbox = OrderedDict() # CHANGE  
  
        # store the number of maximum consecutive frames a given  
        # object is allowed to be marked as "disappeared" until we  
        # need to deregister the object from tracking  
        self.maxDisappeared = maxDisappeared  
  
        # store the maximum distance between centroids to associate  
        # an object -- if the distance is larger than this maximum  
        # distance we'll start to mark the object as "disappeared"  
        self.maxDistance = maxDistance
```

```
    def register(self, centroid, inputRect):  
        # when registering an object we use the next available object  
        # ID to store the centroid  
        self.objects[self.nextObjectID] = centroid  
        self.bbox[self.nextObjectID] = inputRect # CHANGE  
        self.disappeared[self.nextObjectID] = 0  
        self.nextObjectID += 1
```

```
    def deregister(self, objectID):  
        # to deregister an object ID we delete the object ID from
```

```
# both of our respective dictionaries
del self.objects[objectID]
del self.disappeared[objectID]
del self.bbox[objectID] # CHANGE
```

```
def update(self, rects):
    # check to see if the list of input bounding box rectangles
    # is empty
    if len(rects) == 0:
        # loop over any existing tracked objects and mark them
        # as disappeared
        for objectID in list(self.disappeared.keys()):
            self.disappeared[objectID] += 1

            # if we have reached a maximum number of consecutive
            # frames where a given object has been marked as
            # missing, deregister it
            if self.disappeared[objectID] > self.maxDisappeared:
                self.deregister(objectID)

        # return early as there are no centroids or tracking info
        # to update
        # return self.objects
        return self.bbox

    # initialize an array of input centroids for the current frame
    inputCentroids = np.zeros((len(rects), 2), dtype="int")
    inputRects = []
    # loop over the bounding box rectangles
    for (i, (startX, startY, endX, endY)) in enumerate(rects):
        # use the bounding box coordinates to derive the centroid
        cX = int((startX + endX) / 2.0)
        cY = int((startY + endY) / 2.0)
```



```

inputCentroids[i] = (cX, cY)
inputRects.append(rects[i]) # CHANGE

# if we are currently not tracking any objects take the input
# centroids and register each of them
if len(self.objects) == 0:
    for i in range(0, len(inputCentroids)):
        self.register(inputCentroids[i], inputRects[i]) # CHANGE

# otherwise, are are currently tracking objects so we need to
# try to match the input centroids to existing object
# centroids
else:
    # grab the set of object IDs and corresponding centroids
    objectIDs = list(self.objects.keys())
    objectCentroids = list(self.objects.values())

    # compute the distance between each pair of object
    # centroids and input centroids, respectively -- our
    # goal will be to match an input centroid to an existing
    # object centroid
    D = dist.cdist(np.array(objectCentroids), inputCentroids)

    # in order to perform this matching we must (1) find the
    # smallest value in each row and then (2) sort the row
    # indexes based on their minimum values so that the row
    # with the smallest value as at the *front* of the index
    # list
    rows = D.min(axis=1).argsort()

    # next, we perform a similar process on the columns by
    # finding the smallest value in each column and then
    # sorting using the previously computed row index list

```

```
cols = D.argmin(axis=1)[rows]
```

```
# in order to determine if we need to update, register,  
# or deregister an object we need to keep track of which  
# of the rows and column indexes we have already examined  
usedRows = set()  
usedCols = set()
```

```
# loop over the combination of the (row, column) index  
# tuples
```

```
for (row, col) in zip(rows, cols):
```

```
    # if we have already examined either the row or  
    # column value before, ignore it  
    if row in usedRows or col in usedCols:  
        continue
```

```
    # if the distance between centroids is greater than  
    # the maximum distance, do not associate the two  
    # centroids to the same object  
    if D[row, col] > self.maxDistance:  
        continue
```

```
    # otherwise, grab the object ID for the current row,  
    # set its new centroid, and reset the disappeared  
    # counter
```

```
    objectID = objectIDs[row]  
    self.objects[objectID] = inputCentroids[col]  
    self.bbox[objectID] = inputRects[col] # CHANGE  
    self.disappeared[objectID] = 0
```

```
# indicate that we have examined each of the row and  
# column indexes, respectively  
usedRows.add(row)
```

```
usedCols.add(col)
```

```
# compute both the row and column index we have NOT yet
```

```
# examined
```

```
unusedRows = set(range(0, D.shape[0])).difference(usedRows)
```

```
unusedCols = set(range(0, D.shape[1])).difference(usedCols)
```

```
# in the event that the number of object centroids is
```

```
# equal or greater than the number of input centroids
```

```
# we need to check and see if some of these objects have
```

```
# potentially disappeared
```

```
if D.shape[0] >= D.shape[1]:
```

```
    # loop over the unused row indexes
```

```
    for row in unusedRows:
```

```
        # grab the object ID for the corresponding row
```

```
        # index and increment the disappeared counter
```

```
        objectID = objectIDs[row]
```

```
        self.disappeared[objectID] += 1
```

```
        # check to see if the number of consecutive
```

```
        # frames the object has been marked "disappeared"
```

```
        # for warrants deregistering the object
```

```
        if self.disappeared[objectID] > self.maxDisappeared:
```

```
            self.deregister(objectID)
```

```
# otherwise, if the number of input centroids is greater
```

```
# than the number of existing object centroids we need to
```

```
# register each new input centroid as a trackable object
```

```
else:
```

```
    for col in unusedCols:
```

```
        self.register(inputCentroids[col], inputRects[col])
```

```
# return the set of trackable objects
```

```
# return self.objects  
return self.bbox
```

File: distance.py

Documented code for distance.py:

```
import cv2  
import datetime  
import imutils  
import numpy as np  
from centroidtracker import CentroidTracker  
from itertools import combinations  
import math  
  
protopath="MobileNetSSD_deploy.prototxt"  
modelpath="MobileNetSSD_deploy.caffemodel"  
detector=cv2.dnn.readNetFromCaffe(protopath,caffeModel=modelpath)  
  
tracker=CentroidTracker(maxDisappeared=80,maxDistance=90)  
  
CLASSES = ["background", "aeroplane", "bicycle", "bird", "boat",  
            "bottle", "bus", "car", "cat", "chair", "cow", "diningtable",  
            "dog", "horse", "motorbike", "person", "pottedplant", "sheep",  
            "sofa", "train", "tvmonitor"]  
  
def non_max_supression_fast(boxes,overlapThresh):  
    try:  
        if len(boxes)==0:  
            return[]  
        if boxes.dtype.kind=="i":  
            boxes=boxes.astype("float")
```

```

pick=[]
x1=boxes[:,0]
y1=boxes[:,1]
x2=boxes[:,2]
y2=boxes[:,3]

```

```

area=(x2-x1+1)*(y2-y1+1)
idxs=np.argsort(y2)

```

```

while len(idxs)>0:
    last=len(idxs)-1
    i=idxs[last]
    pick.append(i)
    xx1=np.maximum(x1[i],x1[idxs[:last]])
    yy1=np.maximum(y1[i],y1[idxs[:last]])
    xx2=np.minimum(x2[i],x2[idxs[:last]])
    yy2=np.minimum(y2[i],y2[idxs[:last]])

```

```

w=np.maximum(0,xx2-xx1+1)
h=np.maximum(0,yy2-yy1+1)

```

```

overlap=(w*h)/area[idxs[:last]]
idxs=np.delete(idxs,np.concatenate(([last],
                                     np.where(overlap>overlapThresh)[0])))

```

```

return boxes[pick].astype("int")

```

```

except Exception as e:

```

```

    print("Exception occurred in non_max_suppression:{}".format(e))

```

```

def main () :

```

```

    cap=cv2.VideoCapture("videos/testvideo2.mp4")

```

```

    fps_start=datetime.datetime.now()

```

```
fps=0
```

```
total_frames=0
```

```
centroid_dict=dict()
```

```
while True:
```

```
    ret, frame= cap.read()
```

```
    frame=imutils.resize(frame,width=600)
```

```
    total_frames=total_frames+1
```

```
    (H,W)=frame.shape[:2]
```

```
    blob=cv2.dnn.blobFromImage(frame,0.007843,(W,H),127.5)
```

```
    detector.setInput(blob)
```

```
    person_detections=detector.forward()
```

```
    rects=[]
```

```
    for i in np.arange(0,person_detections.shape[2]):
```

```
        confidence=person_detections[0,0,i,2]
```

```
        if confidence>0.5:
```

```
            idx=int(person_detections[0,0,i,1])
```

```
            if CLASSES[idx] != "person":
```

```
                continue
```

```
            person_box= person_detections[0,0,i,3:7] * np.array([W,H,W,H])
```

```
            (startX,startY,endX,endY)=person_box.astype("int")
```

```
            rects.append(person_box)
```

```
    boundingboxes=np.array(rects)
```

```
    boundingboxes=boundingboxes.astype(int)
```

```
    rects=non_max_supression_fast(boundingboxes,0.3)
```

```

objects = tracker.update(rects)
for (objectId,bbox) in objects.items():
    x1,y1,x2,y2=bbox
    x1=int(x1)
    y1=int(y1)
    x2=int(x2)
    y2=int(y2)
    cX=int((x1+x2)/2.0)
    cY=int((y1+y2)/2.0)

    centroid_dict[objectId]=(cX,cY,x1,y1,x2,y2)

    #text="ID:{}".format(objectId)
    #cv2.putText(frame,text,(x1,y1-5),cv2.FONT_HERSHEY_COMPLEX,1,(0,255,0),1)

red_zone_list=[]
for (id1,p1),(id2,p2) in combinations(centroid_dict.items(),2):
    dx,dy=p1[0]-p2[0],p1[1]-p2[1]
    distance=math.sqrt(dx*dx+dy*dy)
    if distance<75.0:
        if id1 not in red_zone_list:
            red_zone_list.append(id1)
        if id2 not in red_zone_list:
            red_zone_list.append(id2)

for id,box in centroid_dict.items():
    if id in red_zone_list:
        cv2.rectangle(frame,(box[2],box[3]),(box[4],box[5]),(0,0,255),2)
    else:
        cv2.rectangle(frame,(box[2],box[3]),(box[4],box[5]),(0,255,0),2)

```

```

fps_and_time=datetime.datetime.now()
time_diff=fps_and_time - fps_start
if time_diff.seconds==0:
    fps=0.0
else:
    fps=(total_frames/time_diff.seconds)

fps_text="FPS:{:.2f}".format(fps)

cv2.putText(frame,fps_text,(5,30),cv2.FONT_HERSHEY_COMPLEX,1,(0,0,255),2)
cv2.imshow("FPS",frame)
key=cv2.waitKey(1)
if key==ord('q'):
    break
cv2.destroyAllWindows()
main()

```

File: final.py

Documented code for final.py:

```

import cv2
import datetime
import imutils
import numpy as np
from centroidtracker import CentroidTracker
import psycopg2
import psycopg2.extras

```

```

#initialize database connection

```

```

hostname = 'localhost'
database='postgres'
username='postgres'

```



```
pwd='password'
```

```
port_id=5432
```

```
conn=None
```

```
cur=None
```

```
#importing module files
```

```
protopath="MobileNetSSD_deploy.prototxt"
```

```
modelpath="MobileNetSSD_deploy.caffemodel"
```

```
detector=cv2.dnn.readNetFromCaffe(protopath,caffeModel=modelpath)
```

```
tracker=CentroidTracker(maxDisappeared=80,maxDistance=90)
```

```
CLASSES = ["background", "aeroplane", "bicycle", "bird", "boat",  
            "bottle", "bus", "car", "cat", "chair", "cow", "diningtable",  
            "dog", "horse", "motorbike", "person", "pottedplant", "sheep",  
            "sofa", "train", "tvmonitor"]
```

```
#function for generating unique ID's
```

```
def non_max_supression_fast(boxes,overlapThresh):
```

```
    try:
```

```
        if len(boxes)==0:
```

```
            return[]
```

```
        if boxes.dtype.kind=="i":
```

```
            boxes=boxes.astype("float")
```

```
        pick=[]
```

```
        x1=boxes[:,0]
```

```
        y1=boxes[:,1]
```

```
x2=boxes[:,2]
```

```
y2=boxes[:,3]
```

```
area=(x2-x1+1)*(y2-y1+1)
```

```
idxs=np.argsort(y2)
```

```
while len(idxs)>0:
```

```
    last=len(idxs)-1
```

```
    i=idxs[last]
```

```
    pick.append(i)
```

```
    xx1=np.maximum(x1[i],x1[idxs[:last]])
```

```
    yy1=np.maximum(y1[i],y1[idxs[:last]])
```

```
    xx2=np.minimum(x2[i],y2[idxs[:last]])
```

```
    yy2=np.minimum(y2[i],y2[idxs[:last]])
```

```
    w=np.maximum(0,xx2-xx1+1)
```

```
    h=np.maximum(0,yy2-yy1+1)
```

```
    overlap=(w*h)/area[idxs[:last]]
```

```
    idxs=np.delete(idxs,np.concatenate(([last],  
                                        np.where(overlap>overlapThresh)[0])))
```

```
    return boxes[pick].astype("int")
```

```
except Exception as e:
```

```
    print("Exception occurred in non_max_suppression:{}".format(e))
```

```
def main() :
```

```
    cap=cv2.VideoCapture(0) #give any video input or use cap=cv2.VideoCaputer(0) to detect using  
    webcam
```

```
    fps_start=datetime.datetime.now()
```

```
    fps=0
```

```
    total_frames=0
```

```
lpc_count=0
```

```
opc_count=0
```

```
object_id_list=[]
```

```
while True:
```

```
    ret, frame= cap.read()
```

```
    frame=imutils.resize(frame,width=600)
```

```
    total_frames=total_frames+1
```

```
    (H,W)=frame.shape[:2]
```

```
    blob=cv2.dnn.blobFromImage(frame,0.007843,(W,H),127.5)
```

```
    detector.setInput(blob)
```

```
    person_detections=detector.forward()
```

```
    rects=[]
```

```
    for i in np.arange(0,person_detections.shape[2]):
```

```
        confidence=person_detections[0,0,i,2]
```

```
        if confidence>0.5:
```

```
            idx=int(person_detections[0,0,i,1])
```

```
            if CLASSES[idx] != "person":
```

```
                continue
```

```
            person_box= person_detections[0,0,i,3:7] * np.array([W,H,W,H])
```

```
            (startX,startY,endX,endY)=person_box.astype("int")
```

```
            rects.append(person_box)
```

```
    boundingboxes=np.array(rects)
```

```
    boundingboxes=boundingboxes.astype(int)
```

```
    rects=non_max_supression_fast(boundingboxes,0.3)
```

```

objects = tracker.update(rects)
for (objectId,bbox) in objects.items():
    x1,y1,x2,y2=bbox
    x1=int(x1)
    y1=int(y1)
    x2=int(x2)
    y2=int(y2)

    cv2.rectangle(frame,(x1,y1),(x2,y2),(0,255,0),2)
    text="ID:{}".format(objectId)
    cv2.putText(frame,text,(x1,y1-5),cv2.FONT_HERSHEY_COMPLEX,1,(0,255,0),1)

    if objectId not in object_id_list:
        object_id_list.append(objectId)

#displaying overall and live person count

lpc_count=len(objects)
opc_count=len(object_id_list)
lpc_txt="LIVE COUNT: {}".format(lpc_count)
opc_txt="TOTAL COUNT:{}".format(opc_count)

#Send Live and total count data to Database realtime
try:

    with psycopg2.connect(
        host=hostname,
        dbname=database,
        user=username,
        password=pwd,

```

```
port=port_id) as conn:
```

```
with conn.cursor(cursor_factory=psycopg2.extras.DictCursor) as cur:
```

```
    insert_script='INSERT INTO analytics (count,id) VALUES (%s, %s)'
```

```
    insert_values=[(opc_txt,objectId)]
```

```
    for record in insert_values:
```

```
        cur.execute(insert_script,record)
```

```
    cur.execute('SELECT * FROM analytics')
```

```
    conn.commit()
```

```
except Exception as error:
```

```
    print(error)
```

```
finally:
```

```
    if conn is not None:
```

```
        conn.close()
```

```
cv2.putText(frame,lpc_txt,(5,60),cv2.FONT_HERSHEY_SIMPLEX,1,(0,0,255),2)
```

```
cv2.putText(frame,opc_txt,(5,90),cv2.FONT_HERSHEY_SIMPLEX,1,(0,0,255),2)
```

```
cv2.imshow("Frame",frame)
```

```
key=cv2.waitKey(1)
```

```
if key==ord('q'):
```

```
    break
```

```
cv2.destroyAllWindows()
```

```
main()
```

Folder: Vehicle Count

File: vehicle.py

Documented code for vehicle.py:

```
import cv2
```

```
import numpy as np
```

```
import psycopg2
```

```
#Web Camera
```

```
cap=cv2.VideoCapture('video.mp4')
```

```
min_width_rect = 80 #minimum width of rectangle
```

```
min_height_rect = 80 #minimum height of rectangle
```

```
count_line_position=550
```

```
#Initialize Substructor
```

```
algo=cv2.bgsegm.createBackgroundSubtractorMOG()
```

```
def center(x,y,w,h):
```

```
    x1=int(w/2)
```

```
    y1=int(h/2)
```

```
    cx = x+x1
```

```
    cy = y+y1
```

```
    return cx,cy
```

```
detect = []
```

```
offset= 6 #allowing error between pixel
```

```
counter=0
```

```
while True:
```

```

ret,frame1=cap.read()
grey = cv2.cvtColor(frame1,cv2.COLOR_BGR2GRAY)
blur = cv2.GaussianBlur(grey,(3,3),5)
#applying on each fram

img_sub = algo.apply(blur)
dilat = cv2.dilate(img_sub, np.ones((5,5)))
kernel = cv2.getStructuringElement(cv2.MORPH_ELLIPSE,(5,5))
dilate=cv2.morphologyEx(dilat,cv2.MORPH_CLOSE,kernel)
dilate=cv2.morphologyEx(dilate,cv2.MORPH_CLOSE,kernel)
contour,h=cv2.findContours(dilate,cv2.RETR_TREE,cv2.CHAIN_APPROX_SIMPLE)

cv2.line(frame1,(25,count_line_position),(1200,count_line_position),(255,255,255),3)

for (i,c) in enumerate(contour):
    (x,y,w,h)=cv2.boundingRect(c)
    validate_counter=(w>=min_width_rect) and (h>=min_height_rect)
    if not validate_counter:
        continue

    cv2.rectangle(frame1,(x,y),(x+w,y+h),(0,255,0),2)

cv2.putText(frame1,"Vehicle"+str(counter),(x,y-20),cv2.FONT_HERSHEY_COMPLEX,1,(255,0,0),2)

counter1=center(x,y,w,h)
detect.append(counter1)
cv2.circle(frame1,counter1,4,(0,0,255),-1)

for (x,y) in detect:
    if y<(count_line_position+offset) and y>(count_line_position-offset):
        counter+=1
        cv2.line(frame1,(25,count_line_position),(1200,count_line_position),(0,0,255),3)

```

```
detect.remove((x,y))
count=str(counter)
print("Vehicle Counting:"+str(counter))
```

```
# establish a connection to the database
```

```
conn = psycopg2.connect(
    host= 'localhost',
    database='postgres',
    user='postgres',
    password='yourpassword',

)
```

```
# create a cursor object
```

```
cur = conn.cursor()
```

```
# insert data into the table
```

```
cur.execute("INSERT INTO vehiclecounter (VehicleCount) VALUES (%s)", (count,))
```

```
# commit the changes
```

```
conn.commit()
```

```
# close the cursor and connection
```

```
cur.close()
```

```
conn.close()
```

```
cv2.putText(frame1, "Vehicle
Counter:"+str(counter),(450,70),cv2.FONT_HERSHEY_COMPLEX,2,(0,0,255),5)
#cv2.imshow("Detector",dilate)
cv2.imshow("frame",frame1)
```



```
    if cv2.waitKey(0) ==13:
        break
cap.release()
cv2.destroyAllWindows()
```

Folder: Virtual Keyboard

File: main.py

Documented code for main.py:

```
import cvzone
import cv2
from cvzone.HandTrackingModule import HandDetector
from time import sleep
import numpy as np
from pynput.keyboard import Controller , Key
```

```
cap= cv2.VideoCapture(0)
```

```
#Window size
```

```
cap.set(3,1280)
```

```
cap.set(4,720)
```

```
detector = HandDetector(detectionCon=0.8 , maxHands=2)
```

```
keys = [ ["Q", "W", "E", "R", "T", "Y", "U", "I", "O", "P"],
          ["A", "S", "D", "F", "G", "H", "J", "K", "L", ";"],
          ["Z", "X", "C", "V", "B", "N ", "M"]]
```

```
finaltext = ""
```

```
keyboard = Controller()
```

#Handles Drawing of all the buttons :

#Instead of writing one by one button make a list

```
def drawALL( img , buttonList):
```

```
    imgNew = np.zeros_like(img,np.uint8)
```

```
    for button in buttonList:
```

```
        x,y = button.pos
```

```
        cvzone.cornerRect(imgNew,(button.pos[0], button.pos[1],button.size[0], button.size[1]),20 ,rt=0)
```

```
            cv2.rectangle(imgNew ,button.pos,(x + button.size[0], y + button.size[1]),(155,15,0),
```

```
cv2.FILLED )
```

```
            cv2.putText(imgNew, button.text, (x+40,
```

```
                y+60), cv2.FONT_HERSHEY_PLAIN,2, (255,255,255),3)
```

```
    out = img.copy()
```

```
    alpha = -0.5
```

```
    mask = imgNew.astype(bool)
```

```
    out[mask] = cv2.addWeighted(img , alpha, imgNew ,1 - alpha , 0)[mask]
```

```
    return out
```

```
class Button():
```

```
    def __init__(self , pos , text , size=[85,85]):
```

```
        self.pos=pos
```

```
        self.size=size
```

```
        self.text=text
```

```
buttonList = []
```

```
for i in range(len(keys)):
```

```
    for j,key in enumerate(keys[i]):
```

```
        buttonList.append(Button([100 * j + 50 , 100*i+50],key))
```

```
while True :
```

```
    success, img = cap.read()
```

```
    #Find hands
```

```
    hands, img = detector.findHands(img)
```

```
    bboxInfo= detector.findHands(img , draw=False)
```

```
    lmList= detector.findHands(img , draw=False)
```

```
    img = drawALL(img,buttonList)
```

```
    #Check whether hand or not:
```

```
    if hands:
```

```
        # Hand 1
```

```
        hand = hands[0]
```

```
        lmList = hand["lmList"] # List of 21 Landmarks points
```

```
        bbox = hand["bbox"] # Bounding Box info x,y,w,h
```

```
        centerPoint = hand["center"] # center of the hand cx,cy
```

```
        handType = hand["type"] # Hand Type Left or Right
```

```
    if len(hands) == 2:
```

```
        hand2 = hands[1]
```

```
        lmList2 = hand2["lmList"] # List of 21 Landmarks points
```

```
        bbox2 = hand2["bbox"] # Bounding Box info x,y,w,h
```

```
        centerPoint2 = hand2["center"] # center of the hand cx,cy
```

```
        handType2 = hand2["type"] # Hand Type Left or Right
```

```
    if lmList:
```

```
        for button in buttonList:
```

```
            x,y = button.pos
```

```
            w,h = button.size
```

#Tip of finger is point no.8(index finger)

if  $x < \text{lmList}[8][0] < x+w$  and  $y < \text{lmList}[8][1] < y+h$ :

cv2.rectangle(img ,button.pos,(x + w, y + h),(175,0,175), cv2.FILLED )

cv2.putText(img , button.text, (x+20,y+65), cv2.FONT\_HERSHEY\_PLAIN,4,  
(255,255,255),4)

l, \_ , \_= detector.findDistance(centerPoint,centerPoint2, img)

if  $l < 1000$ :

# keyboard.press(button.text)

keyboard.press(button.text.lower() if len(button.text)==1 else Key.space) # Press  
lowercase letter or space

cv2.rectangle(img ,button.pos,(x + w, y + h),(0,255,0), cv2.FILLED )

cv2.putText(img , button.text, (x+20, y+65), cv2.FONT\_HERSHEY\_PLAIN,4,  
(255,255,255),4)

finaltext += button.text

sleep(1)

# ...

cv2.rectangle(img ,(50,350),(700,450),(0,0,0), cv2.FILLED )

cv2.putText(img , finaltext, (60,430), cv2.FONT\_HERSHEY\_PLAIN,4, (255,255,255),4)

cv2.imshow("image",img)

cv2.waitKey(1)==27

