

임베디드 과제

## 11주차. 과제 보고서

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## 1-1 실습문제

- 1) 1m내외의 코스에서 직진 및 좌/우회전 라인트레이싱이 가능하도록 코딩하시오.
- 노란선/흰색선 트레이싱 관계없음
  - 도로를 완전히 벗어나는 경우가 없도록 함
  - 선을 밟거나 넘는 경우는 상관 없음
  - 제출 : 1) 소스 코드, 2) 제어화면, 3) 자율주행차 라인트레이싱 동영상

## 1-2. 소스코드

```
import cv2 as cv
import numpy as np
import threading, time
import SDcar
speed = 50
epsilon = 0.0001
def func_thread():
    i = 0
    while True:
        print("alive!!")
        time.sleep(1)
        i = i+1
        if is_running is False:
            break

def key_cmd(which_key):
    print('which_key', which_key)
    is_exit = False
    global enable_linetracing

    if which_key & 0xFF == 119:
        print('up')
        car.motor_go(100)
    elif which_key & 0xFF == 120:
        print('down')
        car.motor_back(100)
    elif which_key & 0xFF == 97:
        print('left')
        car.motor_left(100)
    elif which_key & 0xFF == 100:
        print('right')
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        car.motor_right(100)
    elif which_key & 0xFF == 115:
        car.motor_stop()
        print('stop')
    elif which_key & 0xFF == ord('q'):
        car.motor_stop()
        print('exit')
        is_exit = True
    elif which_key & 0xFF == 101:
        enable_linetracing = True
        print('enable_linetracing: ', enable_linetracing)
    elif which_key & 0xFF == ord('w'):
        enable_linetracing = False
        car.motor_stop()
        print('enable_linetracing 2: ', enable_linetracing)

    return is_exit
def detect_maskY_BRG(frame):
    B = frame[:, :, 0]
    G = frame[:, :, 1]
    R = frame[:, :, 2]
    Y = np.zeros_like(G, np.uint8)
    # need to tune params
    Y = G*0.5 + R*0.5 + B*0.7 # 연산 수행 시 float64로 바뀜
    Y = Y.astype(np.uint8)
    Y = cv.GaussianBlur(Y, (5, 5), cv.BORDER_DEFAULT)
    # need to tune params
    _, mask_Y = cv.threshold(Y, 100, 255, cv.THRESH_BINARY)
    return mask_Y

def detect_maskY_HSV(frame):
    crop_hsv = cv.cvtColor(frame, cv.COLOR_BGR2HSV)
    crop_hsv = cv.GaussianBlur(crop_hsv, (5, 5), cv.BORDER_DEFAULT)
    # need to tune params
    mask_Y = cv.inRange(crop_hsv, (25, 80, 150), (35, 255, 255))
    return mask_Y

def show_grid(img):
    h, _, _ = img.shape

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for x in v_x_grid:
    #print('show_grid', x)
    cv.line(img, (x, 0), (x, h), (0,255,0), 1, cv.LINE_4)

def line_tracing(cx):
    #print('cx, ', cx)
    #print('v_x_grid', v_x_grid)
    global moment
    global v_x
    #global v_x_grid
    tolerance = 0.1
    diff = 0

    if moment[0] != 0 and moment[1] != 0 and moment[2] != 0:
        avg_m = np.mean(moment)
        diff = np.abs(avg_m - cx) / v_x

    print('diff ={: .4f}'.format(diff))

    if diff <= tolerance:
        moment[0] = moment[1]
        moment[1] = moment[2]
        moment[2] = cx

        if v_x_grid[2] <= cx < v_x_grid[3]:
            car.motor_go(speed)
            print('go')
        elif v_x_grid[3] >= cx:
            car.motor_left(speed)
            print('turn left')
        elif v_x_grid[1] <= cx:
            car.motor_right(speed)
            print('turn right')
    else:
        car.motor_go(speed)
        print('go')
        moment = [0,0,0]

```

```

def main():

    camera = cv.VideoCapture(0)
    camera.set(cv.CAP_PROP_FRAME_WIDTH,v_x)
    camera.set(cv.CAP_PROP_FRAME_HEIGHT,v_y)

    try:
        while( camera.isOpened() ):
            ret, frame = camera.read()
            frame = cv.flip(frame,-1)
            cv.imshow('camera',frame)

            # image processing start here
            crop_img = frame[180,:,:]
            #maskY = detect_maskY_BRG(crop_img)
            maskY = detect_maskY_HSV(crop_img)

            contours, _ = cv.findContours(maskY, cv.RETR_TREE, cv.CHAIN_APPROX_SIMPLE)
            print('len(contours)', len(contours))

            if len(contours) > 0:
                c = max(contours, key=cv.contourArea)
                m = cv.moments(c)

                cx = int(m['m10']/(m['m00']+epsilon))
                cy = int(m['m01']/(m['m00']+epsilon))
                cv.circle(crop_img, (cx,cy), 3, (0,0,255), -1)
                cv.drawContours(crop_img, contours, -1, (0,255,0), 3)

                cv.putText(crop_img, str(cx), (10, 10), cv.FONT_HERSHEY_DUPLEX, 0.5, (0,
255, 0))
                print('enable_linetracing', enable_linetracing)

            if enable_linetracing == True:
                line_tracing(cx)

```

```

show_grid(crop_img)

#cv.imshow('maskY ', maskY)
cv.imshow('crop_img ', cv.resize(crop_img, dsize=(0,0), fx=2, fy=2))

# image processing end here

is_exit = False
which_key = cv.waitKey(20)
if which_key > 0:
    is_exit = key_cmd(which_key)
if is_exit is True:
    cv.destroyAllWindows()
    break
except Exception as e:
    print(e)
    global is_running
    is_running = False

if __name__ == '__main__':
    v_x = 320
    v_y = 240
    v_x_grid = [int(v_x*i/10) for i in range(1, 10)]

    moment = np.array([0, 0, 0])

    print(v_x_grid)

    t_task1 = threading.Thread(target = func_thread)
    t_task1.start()

    car = SDcar.Drive()

    is_running = True
    enable_linetracing = False
    main()

    is_running = False

```

```
car.clean_GPIO()  
print('end vis')
```