임베디드시스템 설계 기말 프로젝트

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1. 회로 netlist

netlist
1. MG90s - 1 (pan) RPi 5V ---------- MS90S VCC RPi GND ---------- MS90S GND RPi GPIO22 ---------- MS90S SCL 2. MG90s - 2 (tilt) RPi 5V ---------- MS90S VCC RPi GND ---------- MS90S GND RPi GPIO25 ---------- MS90S SCL 3. Laser RPi GPIO6 ---------- MS90S SCL RPi GND ---------- MS90S GND

2. 소스코드

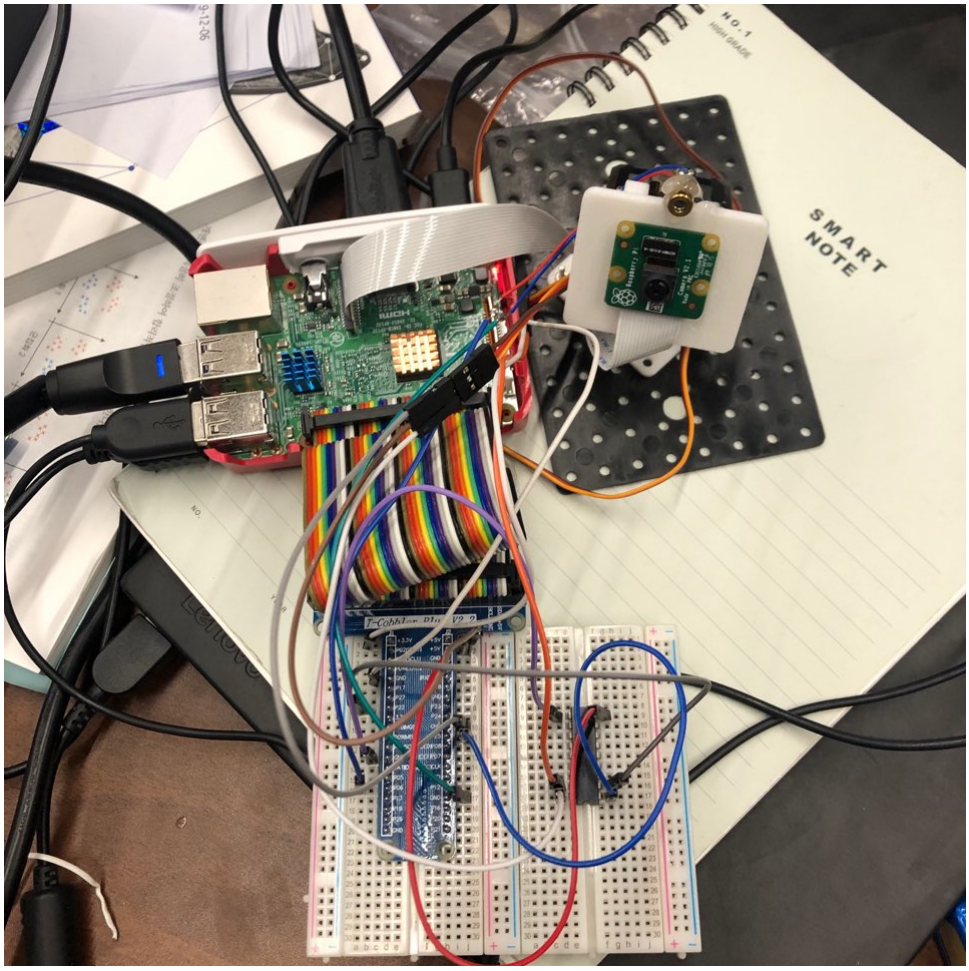
```
import cv2 as cv
import numpy as np
from time import sleep
import RPi.GPIO as GPIO

GPIO.setmode(GPIO.BCM)
GPIO.setwarnings(False)

pan = 22
tilt = 25
GPIO.setup(tilt, GPIO.OUT) # white => TILT
GPIO.setup(pan, GPIO.OUT) # gray ==> PAN

LaserGPIO = 6
GPIO.setup(LaserGPIO, GPIO.OUT)

def getBinImage(frame):
    img_lab = cv.cvtColor(frame, cv.COLOR_BGR2LAB)
    lab_img = cv.inRange(img_lab, (85, 114, 45), (225, 142, 112))
    return lab_img

cap = cv.VideoCapture(0)

def setServoAngle(servo, angle):
    assert angle >=30 and angle <= 150
    pwm = GPIO.PWM(servo, 50)
```

```
    pwm.start(8)
    dutyCycle = angle / 18. + 3.
    pwm.ChangeDutyCycle(dutyCycle)
    sleep(0.04)
    pwm.stop()

def destroy():
    GPIO.output(LaserGPIO, GPIO.LOW)
    GPIO.cleanup()

# default dir
setServoAngle(pan, 100)
setServoAngle(tilt, 90)

x_angle = 90 # 30 : right 45 degree, 120 : left
y_angle = 90

setServoAngle(pan, x_angle) # pan : X
setServoAngle(tilt, y_angle) # tilt : y

cap.set(cv.CAP_PROP_BUFFERSIZE, 1)
cap.set(cv.CAP_PROP_FRAME_WIDTH, 480)
cap.set(cv.CAP_PROP_FRAME_HEIGHT, 320)
g_width, g_height = 480, 320

while (True):
    ret, img_color = cap.read()
    #print("h: ", height, "w: ", width)
    img_lab = getBinImage(img_color)
    kernel = np.ones((11, 11), np.uint8)
    img_lab = cv.morphologyEx(img_lab, cv.MORPH_OPEN, kernel)
    img_lab = cv.morphologyEx(img_lab, cv.MORPH_CLOSE, kernel)
    img_result = cv.bitwise_and(img_color, img_color, mask=img_lab)
    numOfLabels, img_label, stats, centroids =
cv.connectedComponentsWithStats(img_lab)

    r_center_x = 0
    r_center_y = 0
    r_width = 0
    r_height = 0
    r_x = 0
    r_y = 0
    min = 0
    check = 0

    for idx, centroid in enumerate(centroids):
        if stats[idx][0] == 0 and stats[idx][1] == 0:
            continue
        if np.any(np.isnan(centroid)):
            continue

        x, y, width, height, area = stats[idx]
        centerX, centerY = int(centroid[0]), int(centroid[1])

        if area > min:
            r_center_x = centerX
            r_center_y = centerY
            r_width = width
```

```
            r_height = height
            r_x = x
            r_y = y
            min = area
            check = 1

    if check:
        cv.circle(img_color, (r_center_x, r_center_y), 10, (0, 0, 255), 10)
        cv.rectangle(img_color, (r_x, r_y), (r_x + r_width, r_y + r_height), (0,
0, 255))

        dir_x = 0
        dir_y = 0
        print('r',r_center_x)
        print('w',g_width//2)

        if abs(r_center_x - g_width//2) < 30:
            dir_x = 0 # don't move
        elif r_center_x > g_width//2:
            dir_x = -1 # turn right
        else:
            dir_x = 1 # turn left

        if abs(r_center_y - g_height//2) < 30:
            dir_y = 0 # don't move
        elif r_center_y > g_height//2:
            dir_y = 1 # turn up
        else:
            dir_y = -1 # turn down

        if abs(r_center_x - g_width//2) < 30 and abs(r_center_y - g_height//2) <
30:
            GPIO.output(LaserGPIO, GPIO.HIGH)
            sleep(0.2)
            GPIO.output(LaserGPIO, GPIO.LOW)

        x_angle += dir_x
        y_angle += dir_y

        if x_angle < 30:
            x_angle = 30
        elif x_angle > 150:
            x_angle = 150
        #print(x_angle)

        if y_angle < 30:
            y_angle = 30
        elif y_angle > 150:
            y_angle = 150

        setServoAngle(pan, x_angle) # pan : X
        setServoAngle(tilt, y_angle) # tilt : y

    cv.imshow('img_color', img_color)

    # ESC 키누르면 종료
    if cv.waitKey(1) & 0xFF == 27:
        break
```

```
cv.destroyAllWindows()
GPIO.cleanup()
destroy()
```

3. 구현결과물 사진



4. 시연 동영상 링크

링크 주소 :

https://youtu.be/DTb8vX3nitc

5. 구현결과물 공개 동의여부

```
본인은 2019년도 2학기 임베디드시스템설계 교과목 기말프로젝트 구현 결과물(코드, 시연 동영상 포함)을 다음과 같은 목적으로 공개하는데 동의합니다. (    o    )  동의하지 않습니다. (        )

차기 연도 수업 참고자료 & 교안개발 활용
소프트웨어학부 수행 교육사업(SW중심대학 사업, 4차산업혁신선도대학 사업 등)의 성과 홍보자료 활용
```