# Face Mask

## 1. Experimental Purpose

Drive the car to recognize the face and put a mask on the face, and make corresponding movements according to the position of the face on the screen

## 2. Experimental Path Source Code

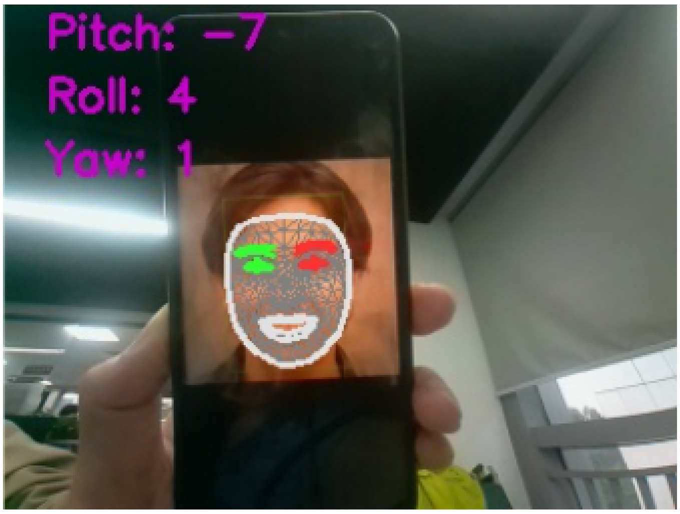
Enter the car system, end the car program, enter "ip (ip is the car's ip): 8888" in the browser, enter the password "yahboom"

Then log in
Enter the path of **Rider-pi_class/5.AI Visual Recognition Course/6. Facial Mask** and run **face_mask.ipynb**.
You can also enter commands in the terminal to directly start the python script

```
python3 face_mask.py
```

## 3. Experimental phenomenon

After running the source code, you can see that the car can recognize the face, put a mask on the face, and perform corresponding movements.



## 4. Main source code analysis

```
# For webcam input:
drawing_spec = mp_drawing.DrawingSpec(thickness=1, circle_radius=1)
cap=cv2.VideoCapture(0)
cap.set(3,320)
cap.set(4,240)
with mp_face_mesh.FaceMesh(
    max_num_faces=1,
    refine_landmarks=True,
    min_detection_confidence=0.5,
    min_tracking_confidence=0.5) as face_mesh:
  while cap.isOpened():
    face_coordination_in_real_world = np.array([
        [285, 528, 200],
        [285, 371, 152],
        [197, 574, 128],
        [173, 425, 108],
        [360, 574, 128],
        [391, 425, 108]
    ], dtype=np.float64)

    h=240
    w=320
    face_coordination_in_image = []
    text=''
    success, image = cap.read()
    if not success:
      print("Ignoring empty camera frame.")
      # If loading a video, use 'break' instead of 'continue'.
      continue

    # To improve performance, optionally mark the image as not writeable to
    # pass by reference.
    image.flags.writeable = False
    image = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)
    results = face_mesh.process(image)

    # Draw the face mesh annotations on the image.
    image.flags.writeable = True
    image = cv2.cvtColor(image, cv2.COLOR_RGB2BGR)
    direction=0
    if results.multi_face_landmarks:
      for face_landmarks in results.multi_face_landmarks:
        mp_drawing.draw_landmarks(
            image=image,
            landmark_list=face_landmarks,
            connections=mp_face_mesh.FACEMESH_TESSELATION,
            landmark_drawing_spec=None,
            connection_drawing_spec=mp_drawing_styles
            .get_default_face_mesh_tesselation_style())
        mp_drawing.draw_landmarks(
            image=image,
            landmark_list=face_landmarks,
            connections=mp_face_mesh.FACEMESH_CONTOURS,
            landmark_drawing_spec=None,
            connection_drawing_spec=mp_drawing_styles
            .get_default_face_mesh_contours_style())
        mp_drawing.draw_landmarks(
            image=image,
            landmark_list=face_landmarks,
            connections=mp_face_mesh.FACEMESH_IRISES,
            landmark_drawing_spec=None,
            connection_drawing_spec=mp_drawing_styles
            .get_default_face_mesh_iris_connections_style())

        for idx, lm in enumerate(face_landmarks.landmark):
          if idx in [1, 9, 57, 130, 287, 359]:
            x, y = int(lm.x * w), int(lm.y * h)
            face_coordination_in_image.append([x, y])
        face_coordination_in_image =
np.array(face_coordination_in_image,dtype=np.float64)
        # The camera matrix
        focal_length = 1 * w
        cam_matrix = np.array([[focal_length, 0, w / 2],
                               [0, focal_length, h / 2],
                               [0, 0, 1]])
        # The Distance Matrix
        dist_matrix = np.zeros((4, 1), dtype=np.float64)
        success, rotation_vec, transition_vec =
cv2.solvePnP(face_coordination_in_real_world,
face_coordination_in_image,cam_matrix, dist_matrix)
        # Use Rodrigues function to convert rotation vector to matrix
        rotation_matrix, jacobian = cv2.Rodrigues(rotation_vec)
        result = rotation_matrix_to_angles(rotation_matrix)
        print(result)
        pitch=round(-result[0]/100*20)
        yaw=round(result[1]/80*15)
        roll=round(result[2]/80*15)
        if abs(yaw)<= 4:
            if abs(pitch)<3:
                pitch = round( pitch * 7 )
                print("pitch11",pitch)
                if pitch < -7:
                    print("hello")
                    pitch = -3
                    print("pitch",pitch)
                elif pitch > 7:
                    pitch = 3
                    print("picth",pitch)
            else:
                pitch = pitch
                print("pitch",pitch)
                yaw = 0
                roll = 0
        else:
            pitch = -3
            yaw = yaw
            if abs(roll) >29:
                roll = round(roll/6)
            else:
                roll = roll
        print("pitch,yaw,roll",pitch,yaw,roll)
        if car_type!="R":
          car.attitude(['p','y','r'],[pitch,yaw,roll])
        else:
          print('rider')
          car.attitude(['p','y','r'],[pitch,yaw,roll])
          #car.attitude(['p','y','r'],[int(pitch/4),int(yaw/4),int(roll/4)])
        time.sleep(0.1)
    else:
      pass
    # Flip the image horizontally for a selfie-view mydisplay.
    b,g,r = cv2.split(image)
    image = cv2.merge((r,g,b))
    image = cv2.flip(image, 1)
    try:
      for i, info in enumerate(zip(('Pitch', 'Roll', 'Yaw'), result)):
        k, v = info
        text = f'{k}: {int(v)}'
        cv2.putText(image, text, (20, i*30 + 20),cv2.FONT_HERSHEY_SIMPLEX, 0.7,
(200, 0, 200), 2)
    except:
      pass
    imgok = Image.fromarray(image)
    mydisplay.ShowImage(imgok)

    #Display the results on the screen
    r,g,b = cv2.split(image)
    image1 = cv2.merge((b,g,r))
    image_widget.value = bgr8_to_jpeg(image1)
    # cv2.imshow("image",image1)

    if cv2.waitKey(5) & 0xFF == 27:
      break
    if button.press_b():
      break
```

The main function turns on the camera and covers the face recognized by the camera with a mask, and performs corresponding movements based on the IMU data and the position of the face on the screen.