

即時人臉追蹤系統：基於 ESP32cam 之人臉偵測 與伺服馬達控制

Real-Time Face Tracking System: Face Detection and Servo Motor Control Based on ESP32-CAM

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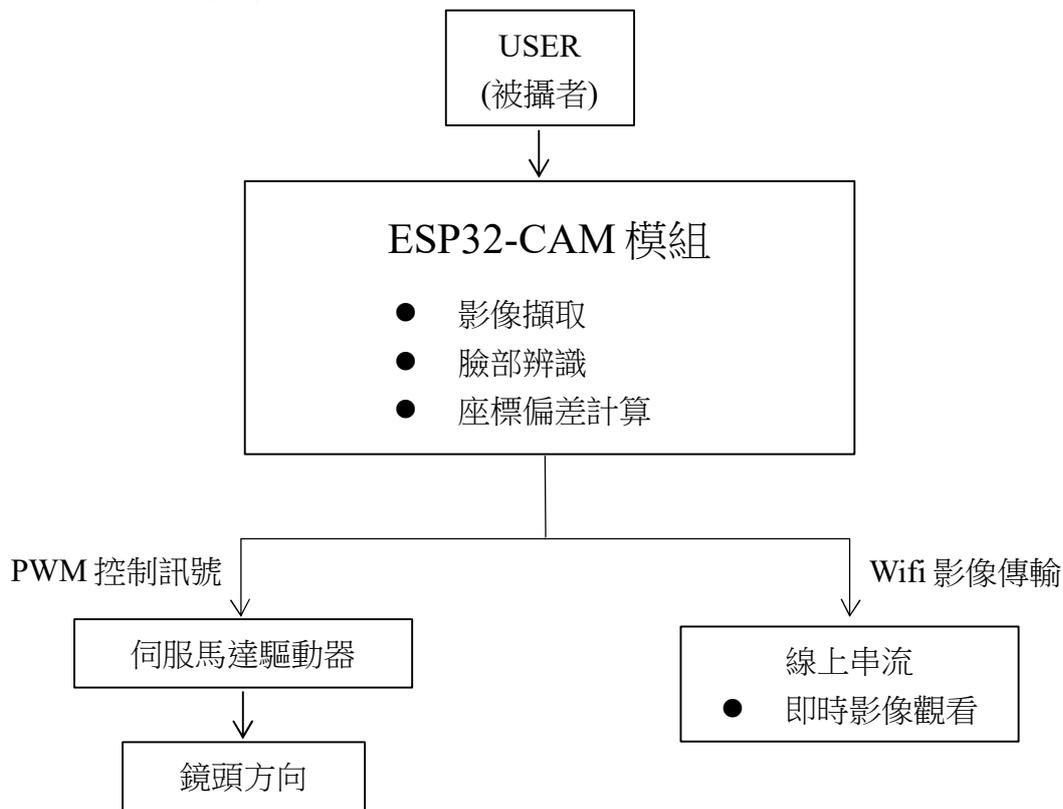
開發工具：VSCode + ESP-IDF v4.4.8

測試環境：ESP32-CAM + OV5640鏡頭、MG995伺服馬達、2.4GHz Wi-Fi

一、簡介：

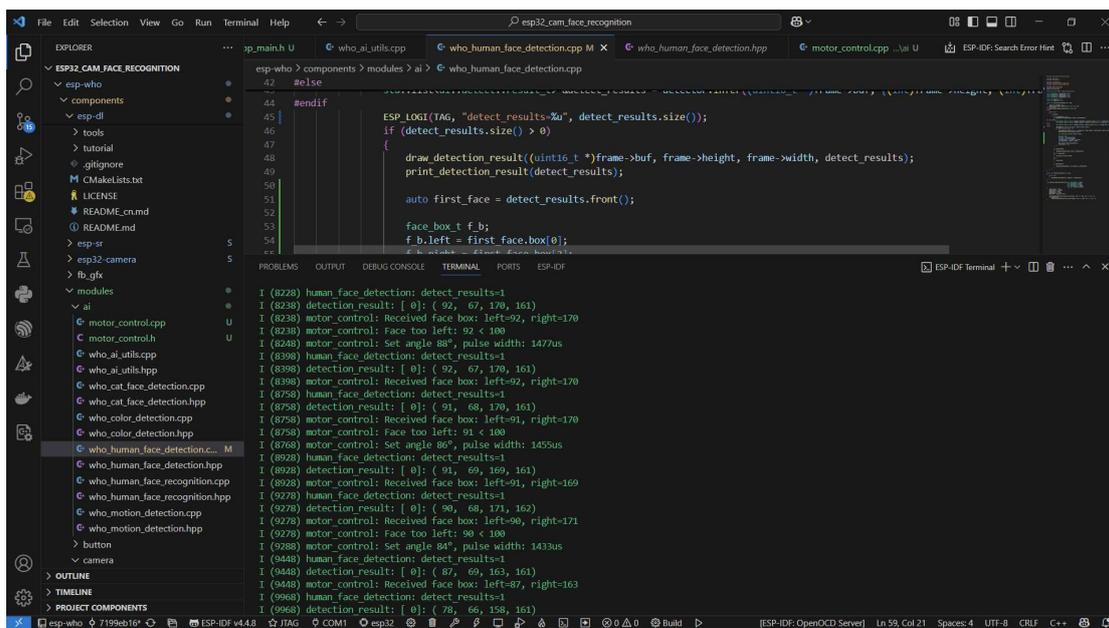
隨著直播串流的興起與社群媒體的蓬勃發展，自媒體創作者的數量日益增加。為使自媒體創作者在沒有他人可協助攝影的情況下也能自由錄製，本專題旨在提升個人拍攝的便利性與自主性。系統設計以 ESP32-CAM 為核心，進行即時人臉偵測，並藉由分析人臉位置驅動伺服馬達旋轉，實現自動追蹤拍攝。

以下為系統架構圖：



二、測試結果：

人臉偵測系統獲取的方框超過指定範圍時，系統會控制馬達轉動，每次轉動2度，直到人臉方框維持在指定範圍內。



```
ESP_LOGI(TAG, "detect_results-%u", detect_results.size());
if (detect_results.size() > 0)
{
    draw_detection_result((uint16_t *)frame->buf, frame->height, frame->width, detect_results);
    print_detection_result(detect_results);

    auto first_face = detect_results.front();

    face_box_t f_b;
    f_b.left = first_face.box[0];
```

```
I (8228) human_face_detection: detect_results-1
I (8238) detection_result: [ 0]: ( 92, 67, 170, 161)
I (8238) motor_control: Received face box: left=92, right=170
I (8238) motor_control: Face too left: 92 < 100
I (8248) motor_control: Set angle 88°, pulse width: 1477us
I (8398) human_face_detection: detect_results-1
I (8398) detection_result: [ 0]: ( 92, 67, 170, 161)
I (8398) motor_control: Received face box: left=92, right=170
I (8758) human_face_detection: detect_results-1
I (8758) detection_result: [ 0]: ( 91, 68, 170, 161)
I (8758) motor_control: Received face box: left=91, right=170
I (8758) motor_control: Face too left: 91 < 100
I (8768) motor_control: set angle 88°, pulse width: 1455us
I (8928) human_face_detection: detect_results-1
I (8928) detection_result: [ 0]: ( 91, 69, 169, 161)
I (8928) motor_control: Received face box: left=91, right=169
I (9278) human_face_detection: detect_results-1
I (9278) detection_result: [ 0]: ( 89, 68, 171, 162)
I (9278) motor_control: Received face box: left=90, right=171
I (9278) motor_control: Face too left: 90 < 100
I (9288) motor_control: set angle 84°, pulse width: 1433us
I (9448) human_face_detection: detect_results-1
I (9448) detection_result: [ 0]: ( 87, 69, 163, 161)
I (9448) motor_control: Received face box: left=87, right=163
I (9968) human_face_detection: detect_results-1
I (9968) detection_result: [ 0]: ( 78, 66, 158, 161)
```

圖二：系統執行畫面