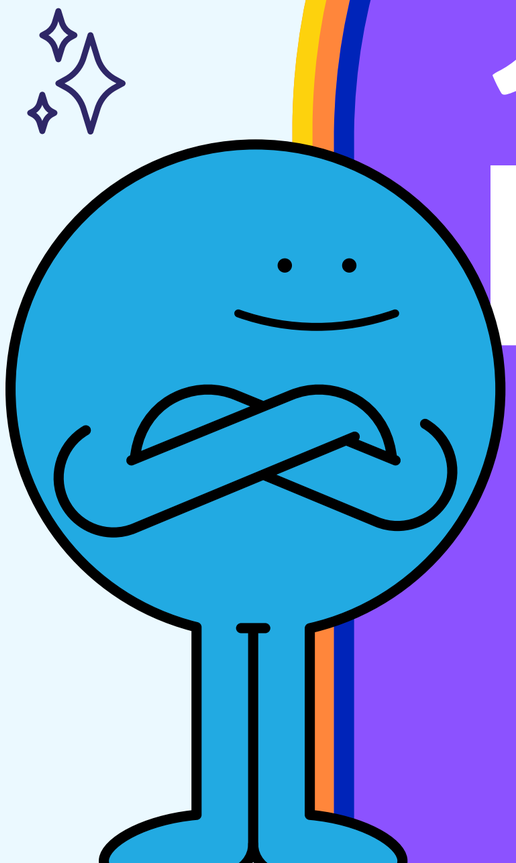
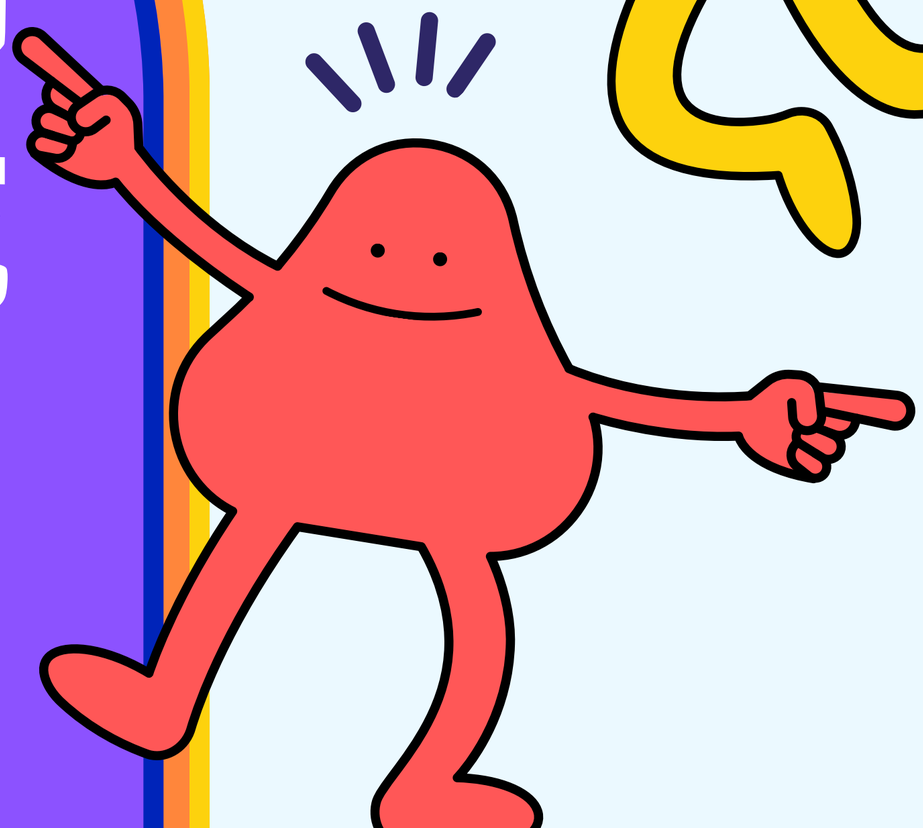
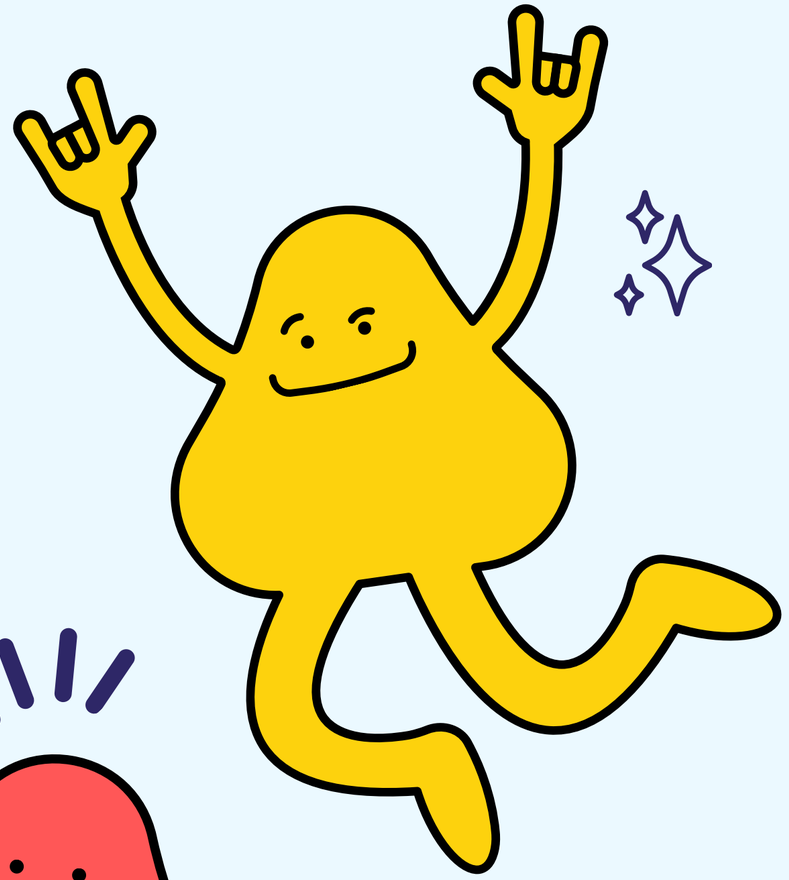
THE

人臉識別門禁系統







第9組

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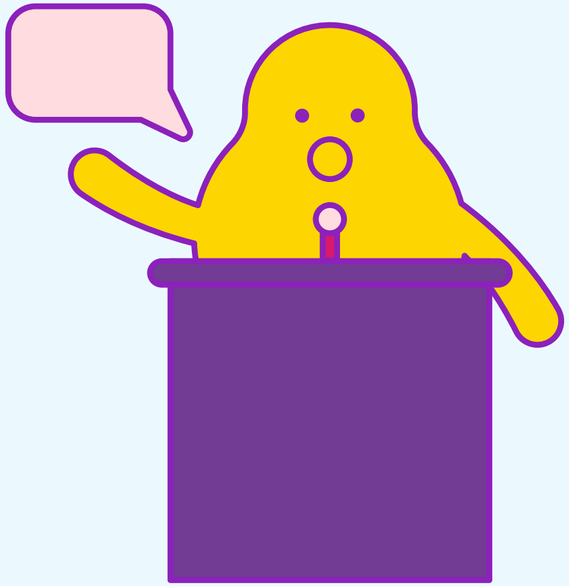
113522082 謝昀彤

前言

傳統門禁系統價格昂貴，難以普及至中小型住宅和企業。為解決這一問題，本專案基於低成本的ESP32-CAM 開發板，設計了一套智慧門禁系統。

該系統利用內建攝像頭進行人臉辨識，並支持使用者通過瀏覽器遠程控制與監控，無需額外硬體或服務支援。系統以低成本、高效能為特色。



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- 系統架構
- 系統架構設計
- 離散事件建模&高階語言合成
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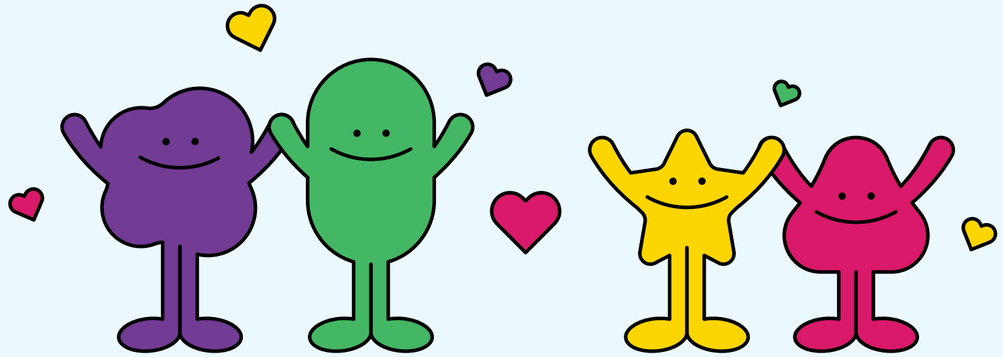
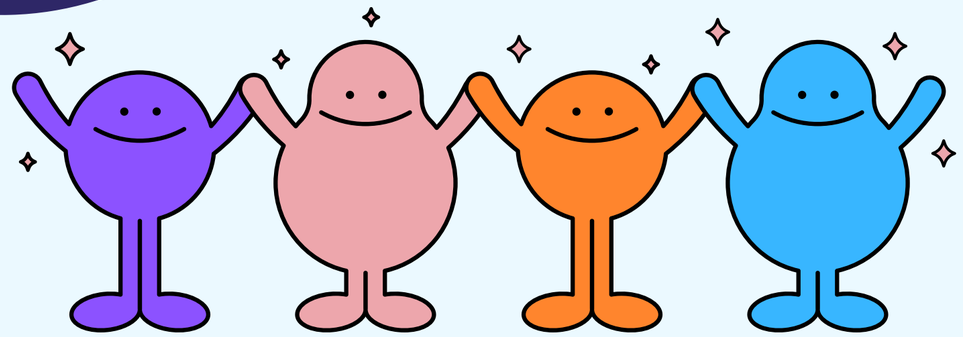
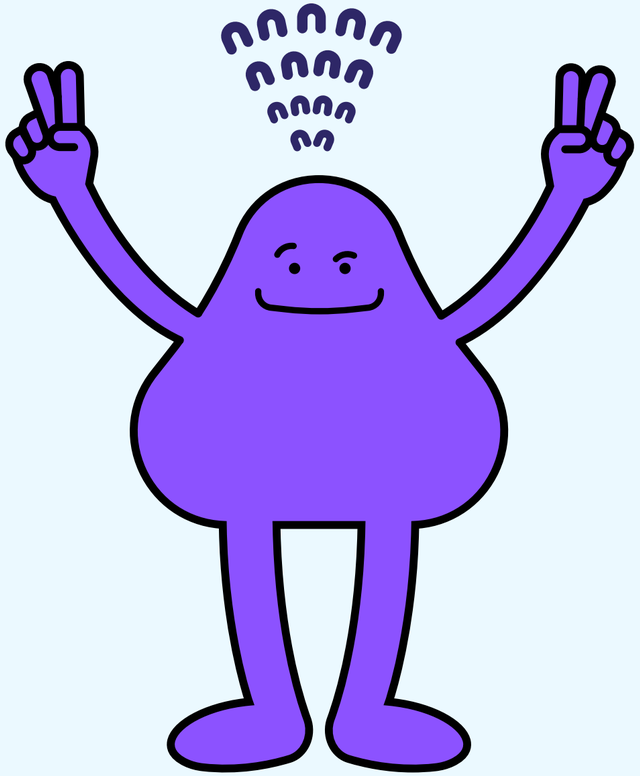
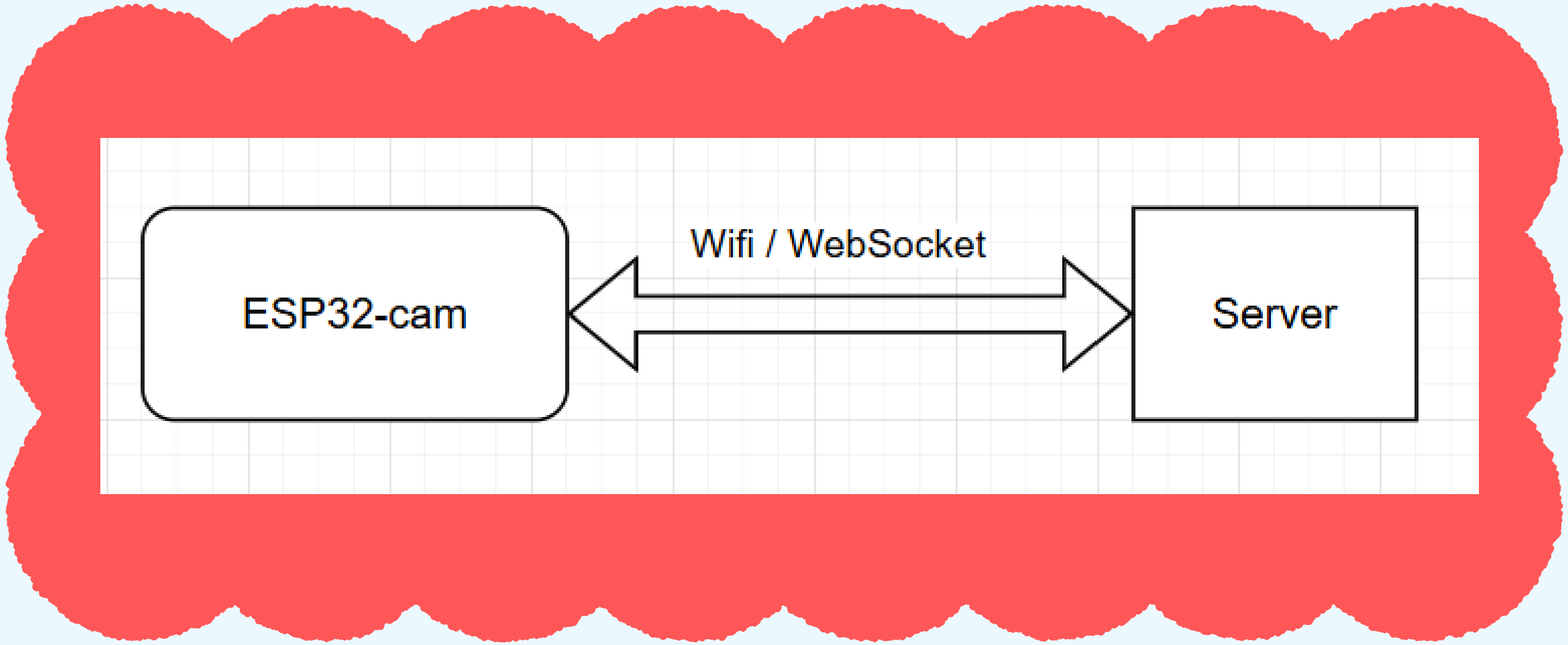


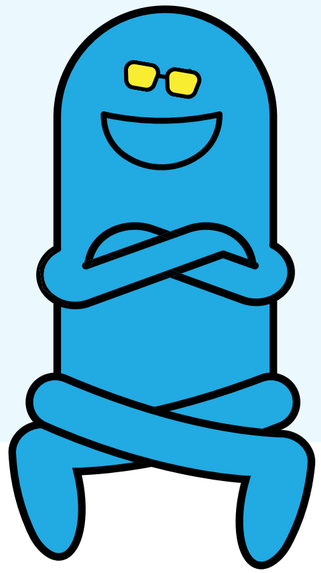


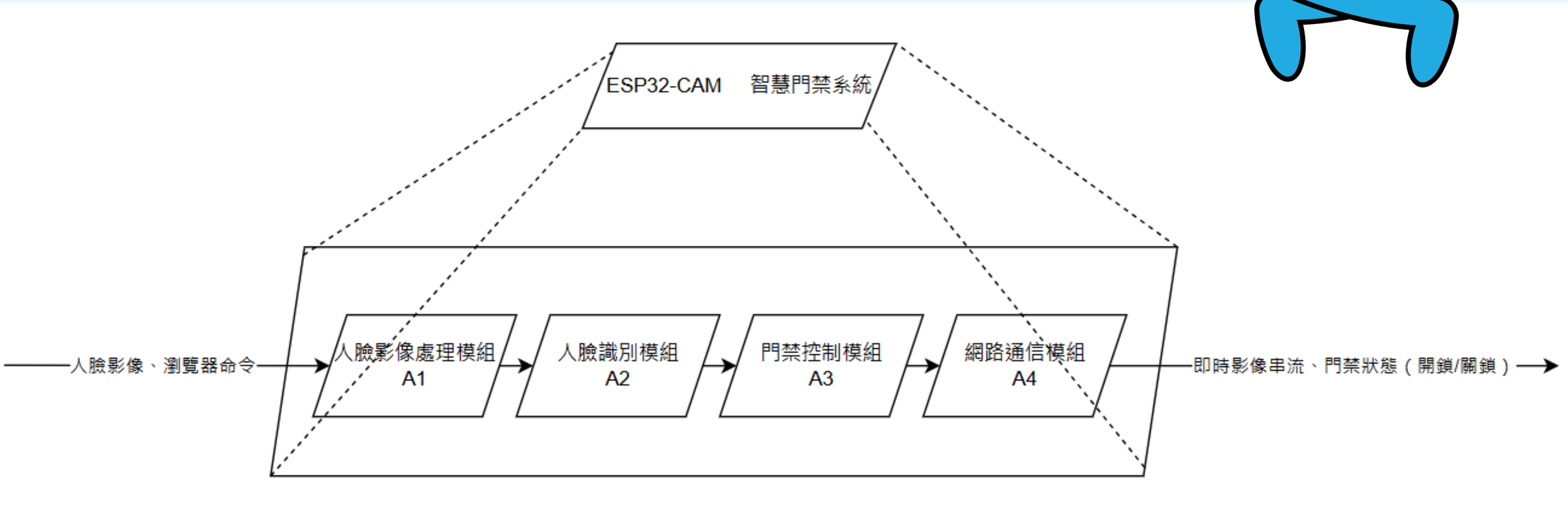
系統架構





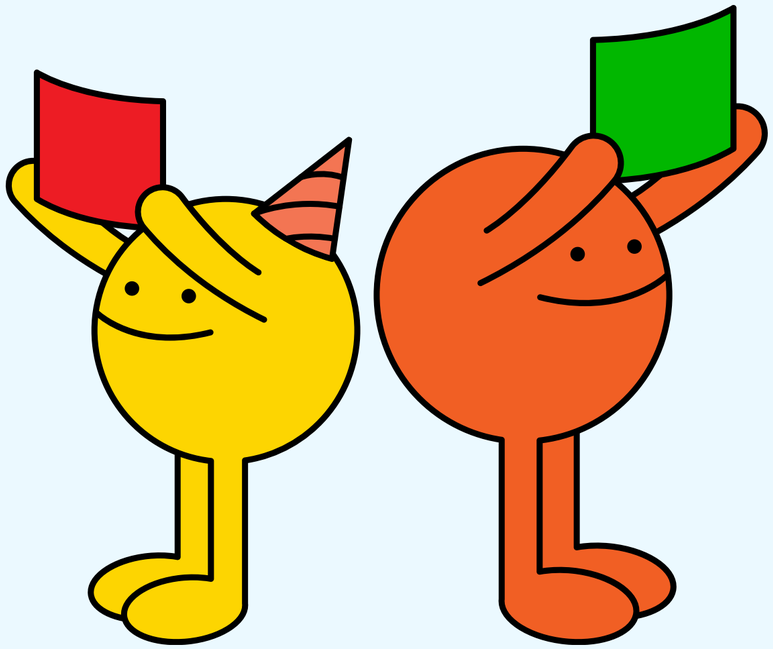
系統架構設計

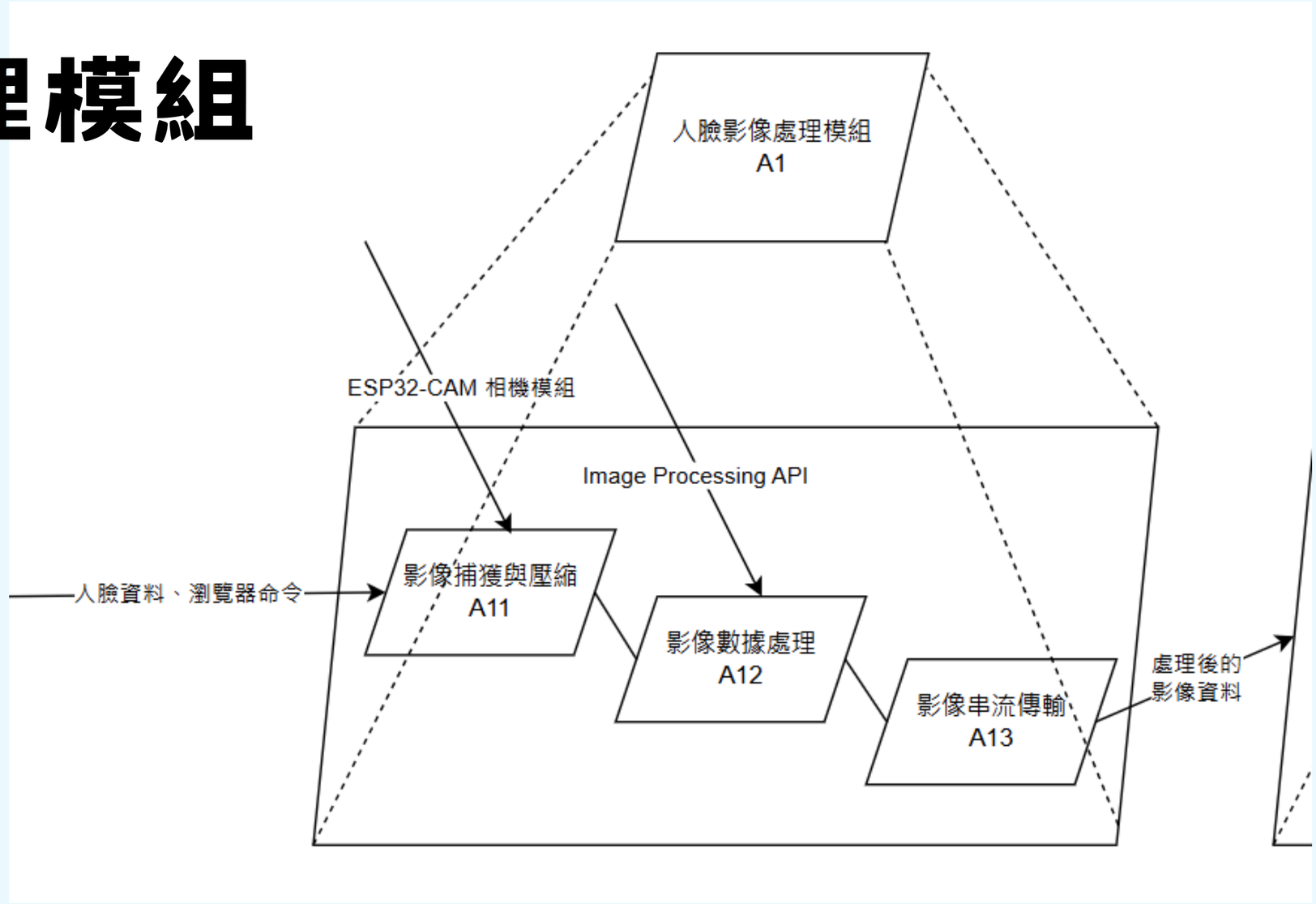



ESP32-CAM 智慧門禁系統
人臉影像、瀏覽器命令
人臉影像處理模組
A1
人臉識別模組
A2
門禁控制模組
A3
網路通信模組
A4
即時影像串流、門禁狀態（開鎖/關鎖）

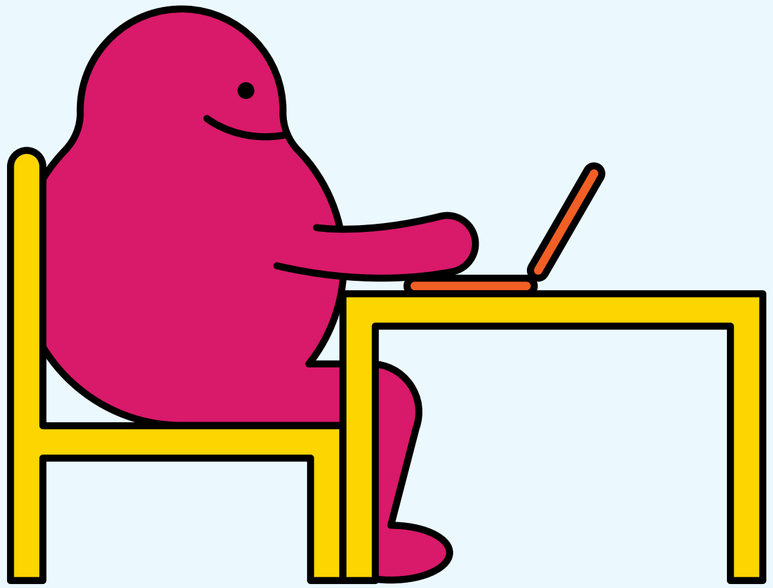
系統架構設計-

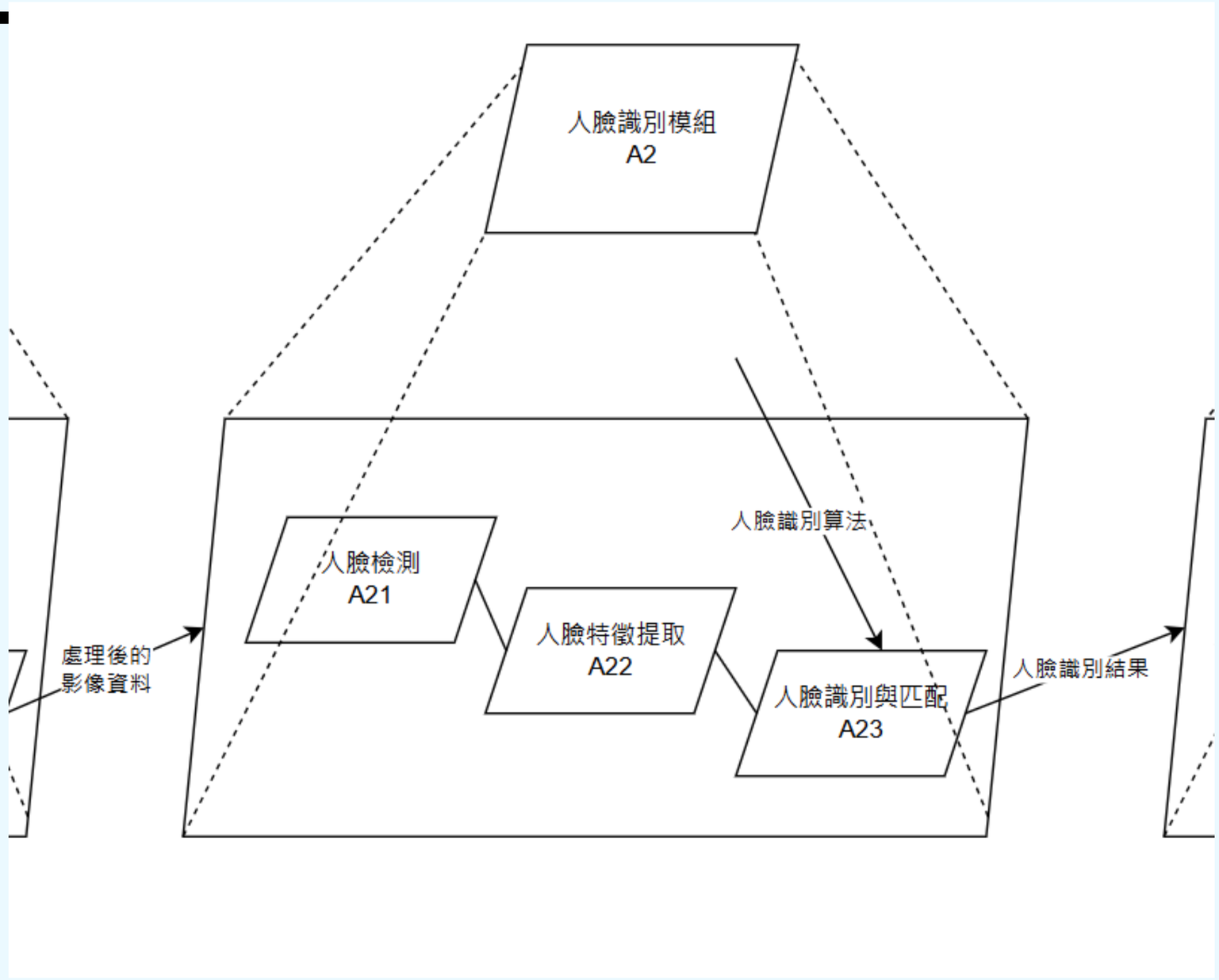
人臉影像處理模組



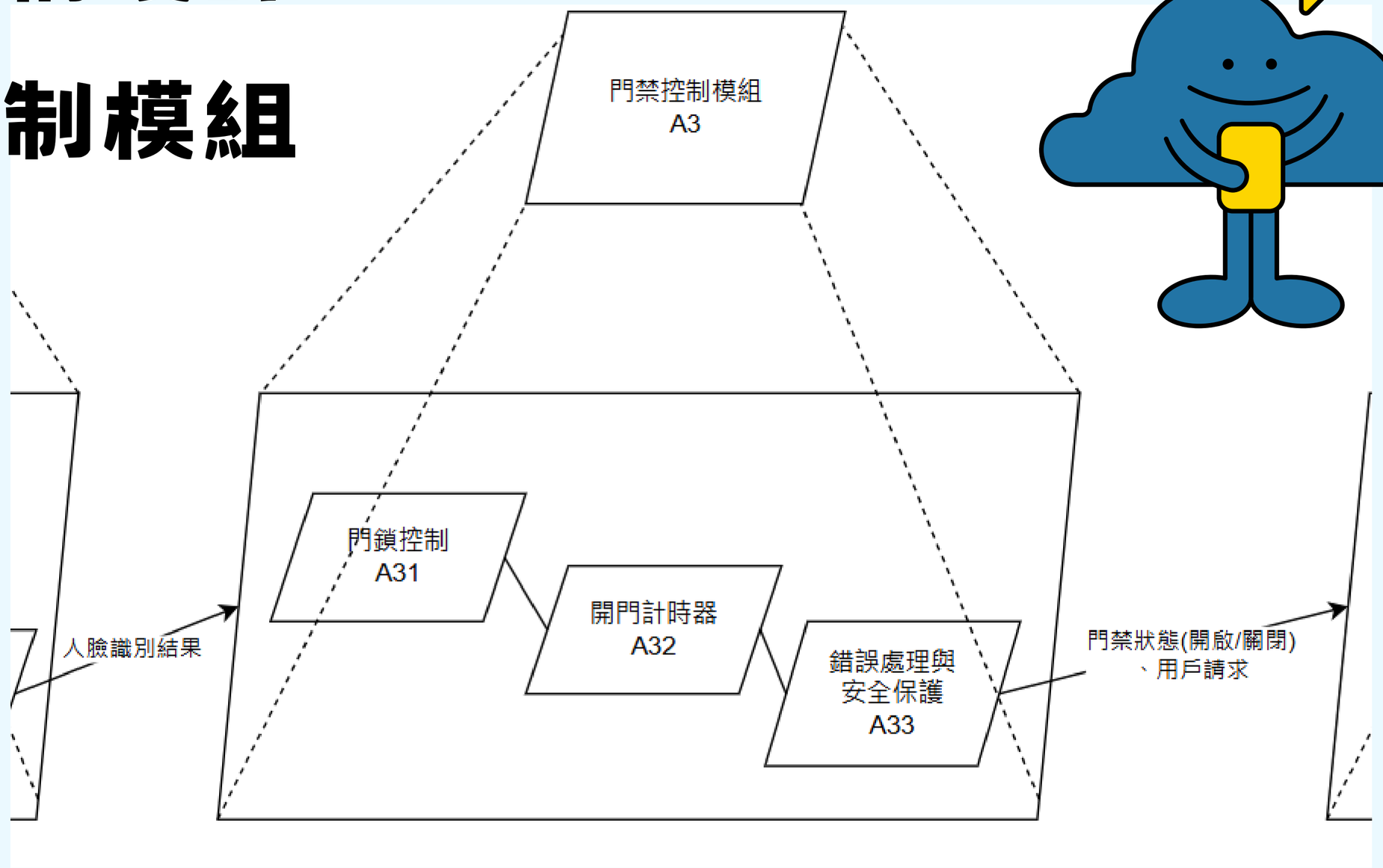


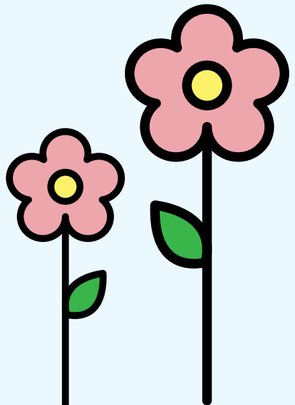
系統架構設計-
人臉識別模組



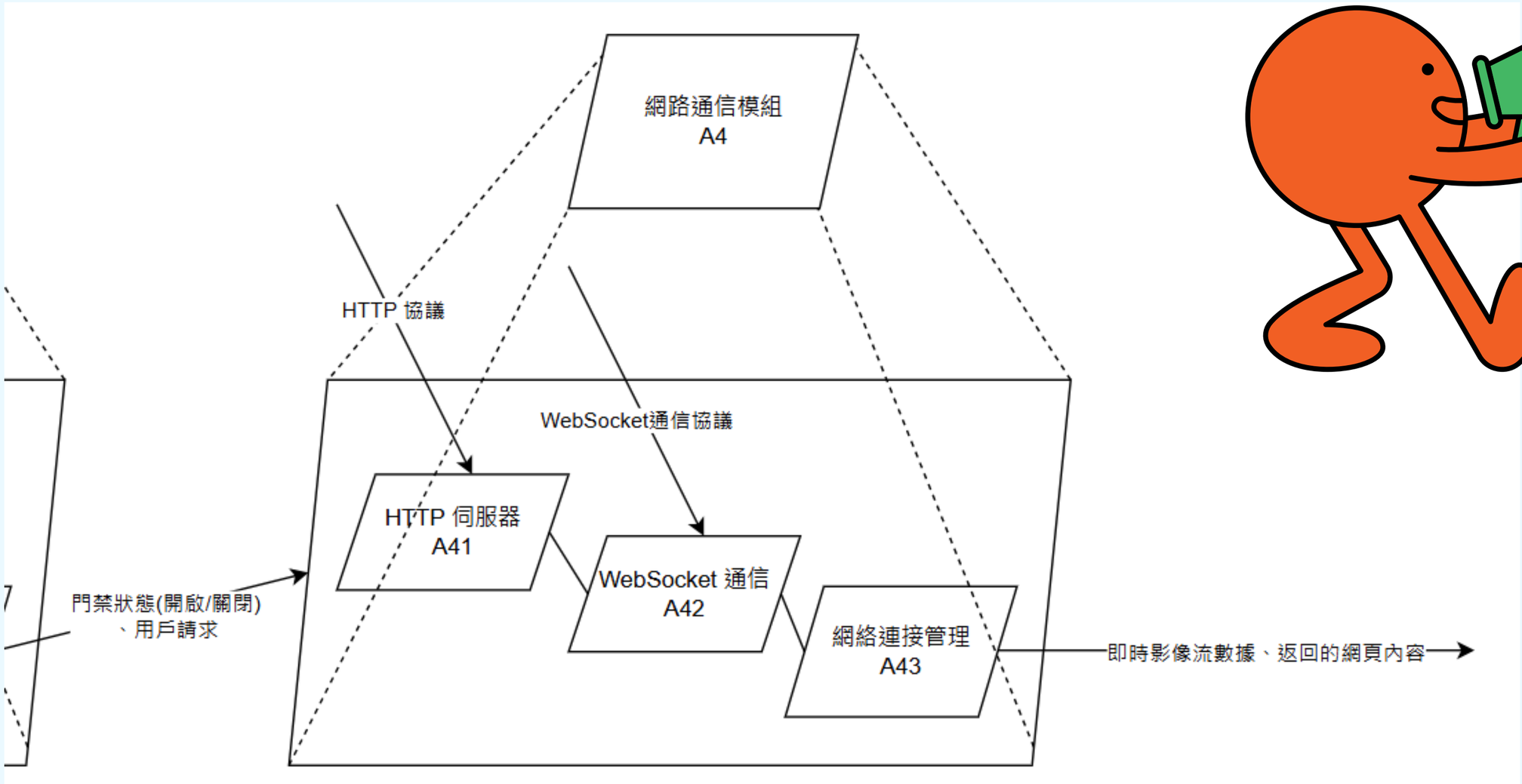


系統架構設計-
門禁控制模組

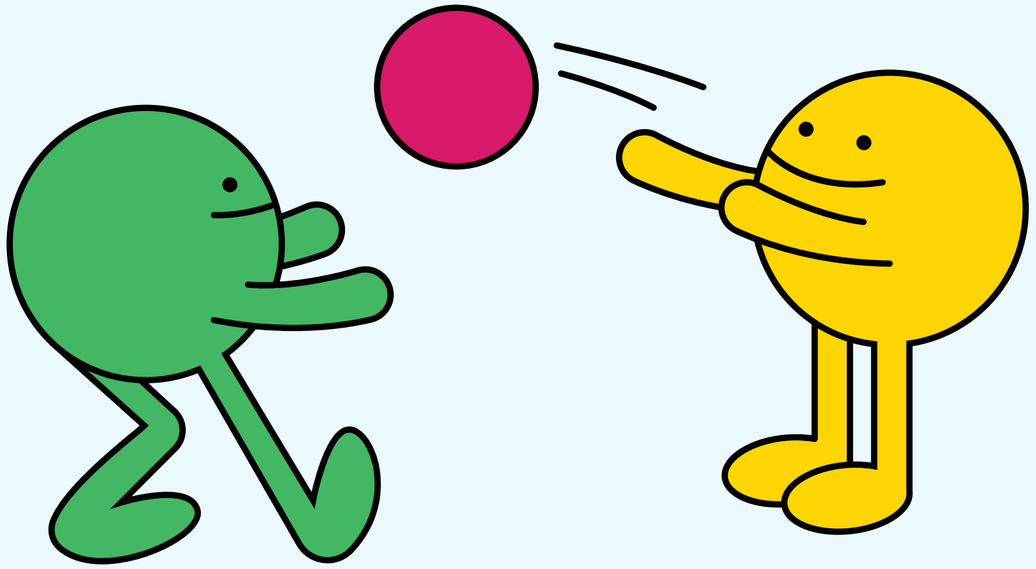




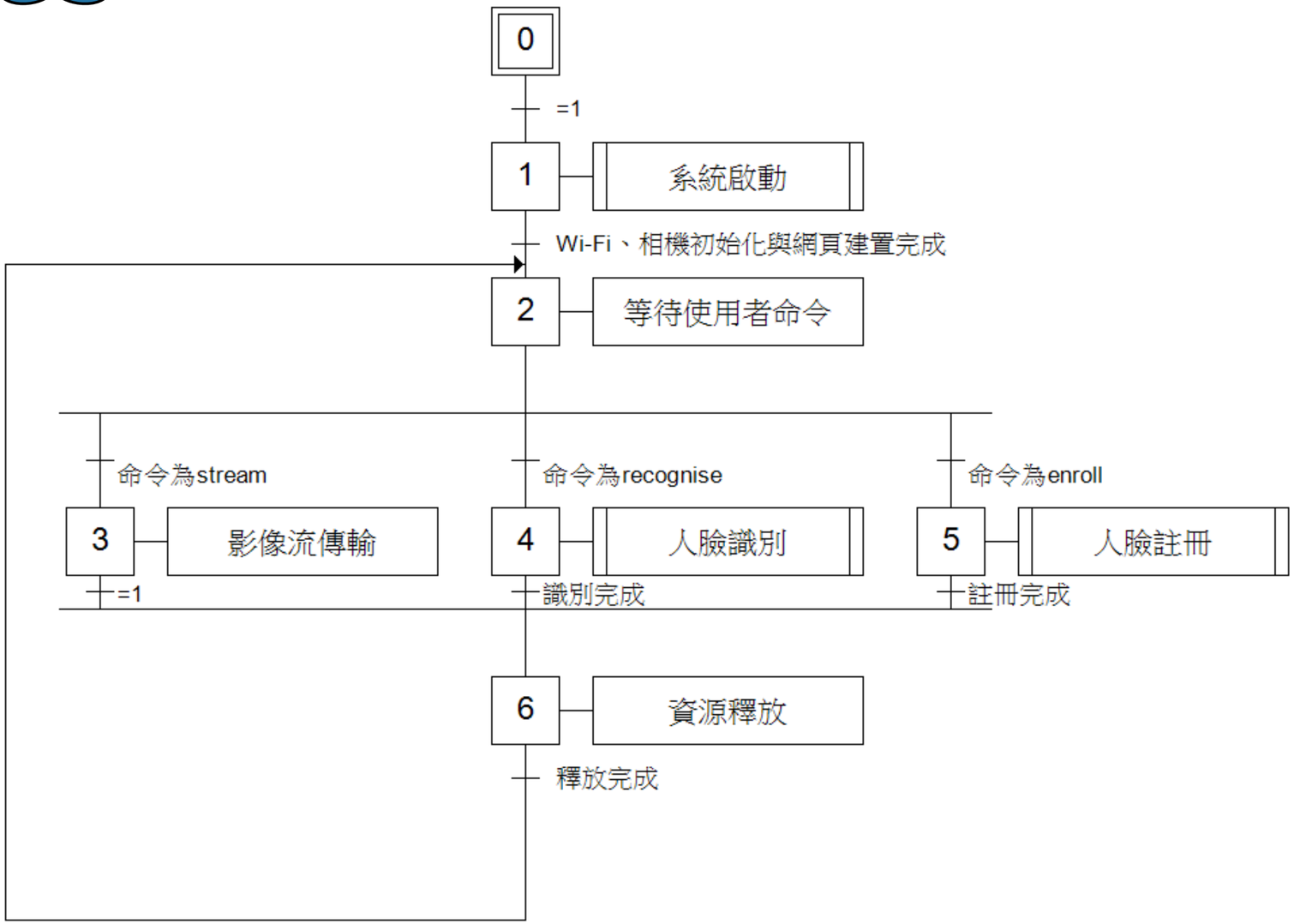
系統架構設計-網路通信模組



離散事件建模
&高階語言合成

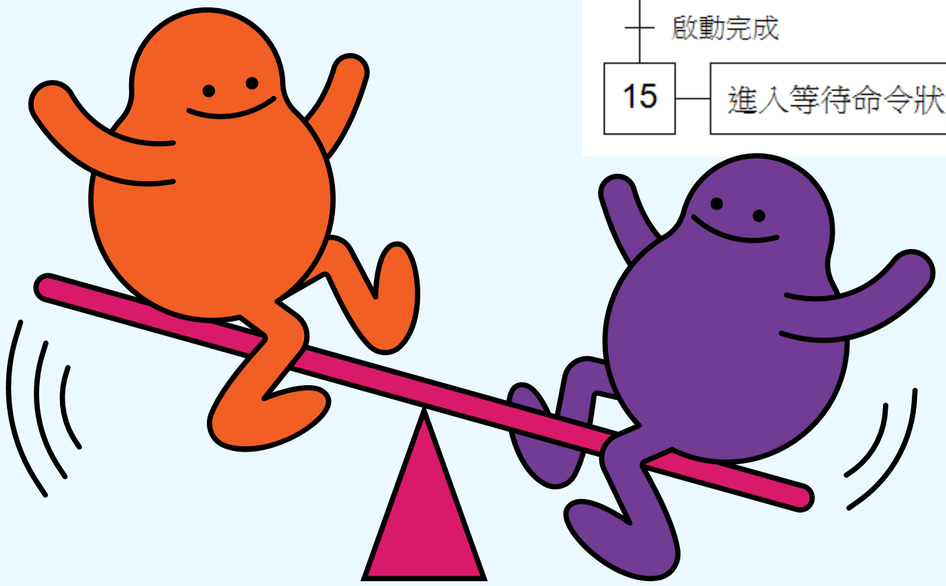


系統總圖




```
void grafcet0()
{
        if((X0 == 1) && (=1))
        {
                X0 = 0;
                X1 = 1;
                return;
        }
        if((X1 == 1) && (Wi-Fi、相機初始化與網頁建置完成))
        {
                X1 = 0;
                X2 = 1;
                return;
        }
        if(X2 == 1)
        {
                if(命令為stream)
                {
                        X2 = 0;
                        X3 = 1;
                }
                else if(命令為recognise)
                {
                        X2 = 0;
                        X4 = 1;
                }
                else if(命令為enroll)
                {
                        X2 = 0;
                        X5 = 1;
                }
                return;
        }
        if(X3 == 1 && (=1))
        {
                X3 = 0;
                X6 = 1;
                return;
        }
        if(X4 == 1 && (識別完成))
        {
                X4 = 0;
                X6 = 1;
                return;
        }
        if(X5 == 1 && (註冊完成))
        {
                X5 = 0;
                X6 = 1;
                return;
        }
        if((X6 == 1) && (釋放完成))
        {
                X6 = 0;
                X2 = 1;
                return;
        }
}
```

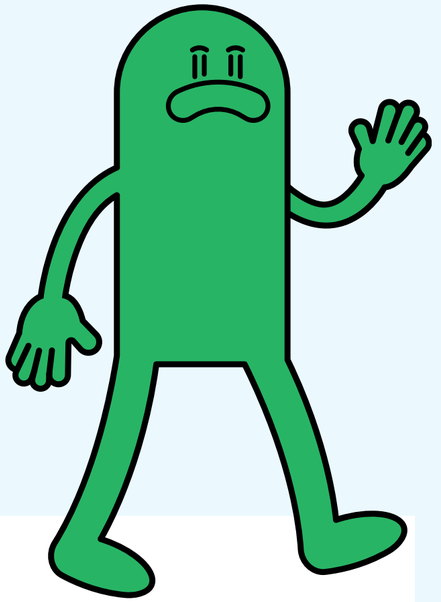
啟動子圖

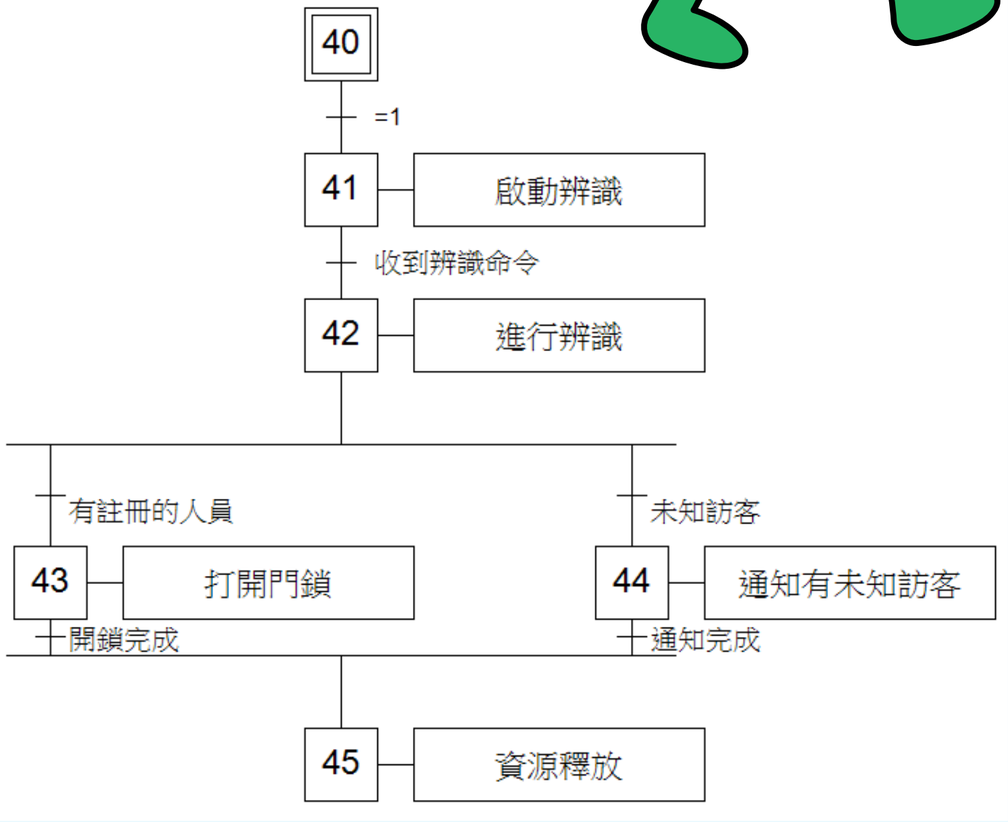


```
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected");

// camera init
esp_err_t err = esp_camera_init(&config);
if (err != ESP_OK) {
  Serial.printf("Camera init failed with error 0x%x", err);
  return;
}

sensor_t * s = esp_camera_sensor_get();
s->set_framesize(s, FRAMESIZE_QVGA);
app_httpserver_init();
app_facenet_main();
socket_server.listen(82);

Serial.print("Camera Ready! Use 'http://");
Serial.print(WiFi.localIP());
Serial.println("' to connect");
```

人臉辨識子圖

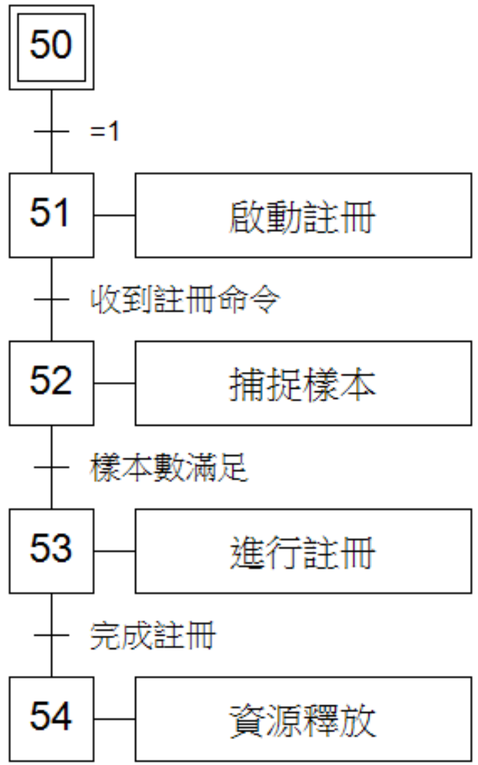
```
if (g_state == START_RECOGNITION  && (st_face_list.count > 0))
{
  face_id_node *f = recognize_face_with_name(&st_face_list, out_res.face_id);
  if (f)
  {
    char recognised_message[64];
    sprintf(recognised_message, "DOOR OPEN FOR %s", f->id_name);
    open_door(client);
    client.send(recognised_message);
  }
  else
  {
    client.send("FACE NOT RECOGNISED");
  }
}
```

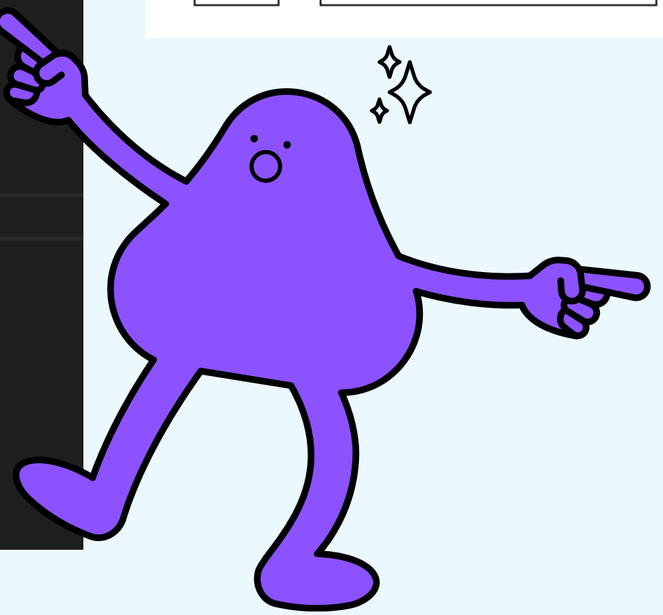


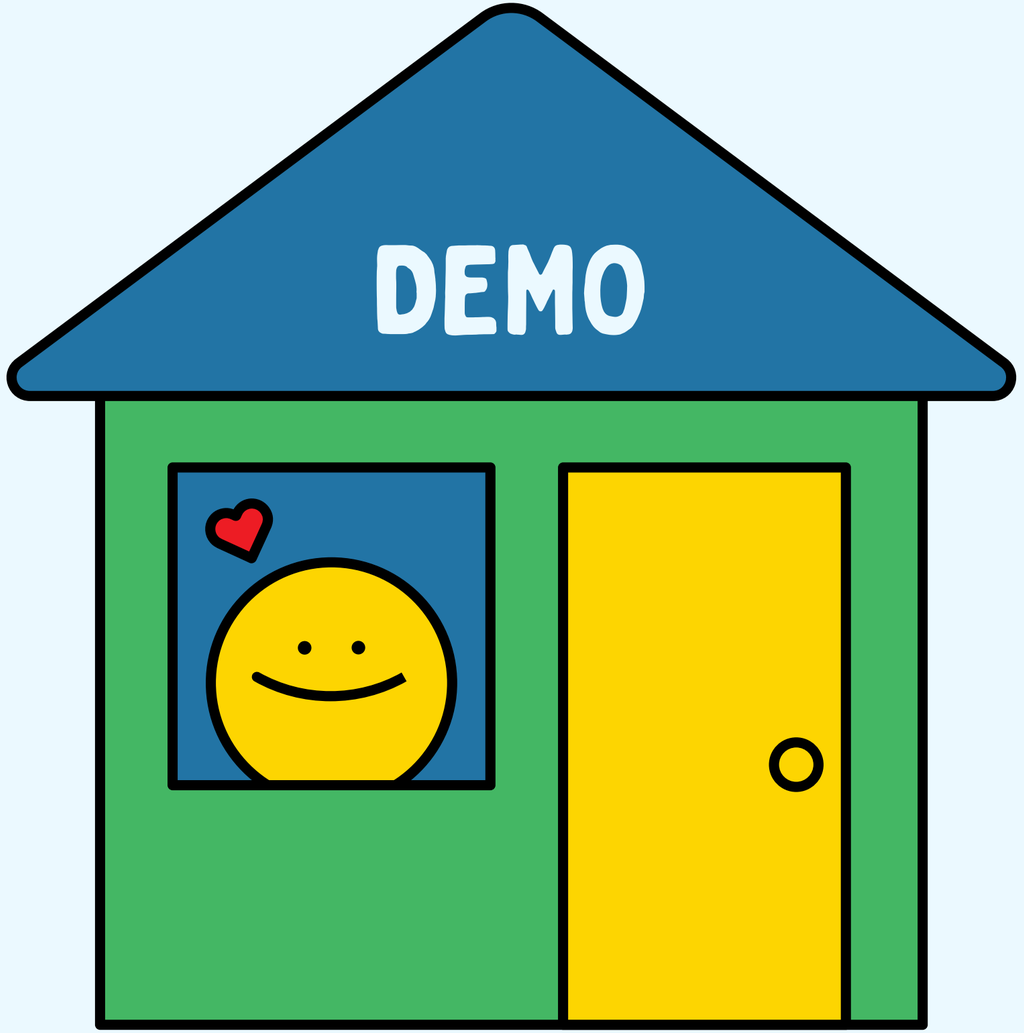


人臉註冊子圖

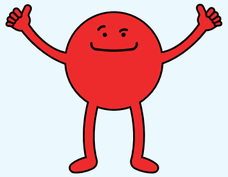
```
if (g_state == START_ENROLL)
{
  int left_sample_face = do_enrollment(&st_face_list, out_res.face_id);
  char enrolling_message[64];
  sprintf(enrolling_message,
  "SAMPLE NUMBER %d FOR %s", ENROLL_CONFIRM_TIMES - left_sample_face, st_name.enroll_name);
  client.send(enrolling_message);
  if (left_sample_face == 0)
  {
    ESP_LOGI(TAG, "Enrolled Face ID: %s", st_face_list.tail->id_name);
    g_state = START_STREAM;
    char captured_message[64];
    sprintf(captured_message, "FACE CAPTURED FOR %s", st_face_list.tail->id_name);
    client.send(captured_message);
    send_face_list(client);

  }
}
```






DEMO

未來展望



- 紅外攝像頭支援： 加入紅外線攝像頭，改善低光或無光環境下的辨識效果，實現全天候運行。
- 雙因素驗證： 除了人臉辨識，結合 PIN 碼、指紋等雙重驗證方式提升安全性。
- 提升使用者UI：將HTML更美觀易操作，
  或是製作APP連動，讓使用者更輕易操作。