**電通二乙微處理器實驗 實驗結報**

|  |  |  |  |
| --- | --- | --- | --- |
| **實驗名稱** | **4x4鍵盤** | | |
| **組別** |  | **組員** | **洪維澤01050852** |

1. **實驗目的**

* 如何使 Arduino 發出特定旋律的聲音?
  1. Arduino 接喇叭如何接線?
  2. 如何使用 tone library?
  3. 如何演奏一段音樂?
  4. 如何使用 4x4 鍵盤演奏音樂?
  5. 如何發報摩斯電碼?

**1.實驗步驟**

* **Arduino 演奏一段特定的音樂, 旋律不得是小蜜蜂**

**程式碼**

**nt speakerPin = 11; //設定無源蜂鳴器使用的Pin腳**

**int t1\_8 = 60; // 8分音符(1/8拍時間長度)，單位 毫秒 ms**

**int t1\_4 = t1\_8 \* 2; // 4分音符(1/4拍時間長度)**

**int t1\_2 = t1\_8 \* 4; // 2分音符(半拍時間長度)**

**int t1\_1 = t1\_8 \* 8; // 全音符(一拍時間長度)**

**int t\_pause = 10; // 設定音符之間，斷音的時間長，單位 毫秒 ms**

**void setup() {**

**pinMode(speakerPin, OUTPUT);**

**}**

**void loop() {**

**//依照簡譜的順序，填入代表的音符 C, D, E, F, G, A, B**

**//例如C(1,300)，代表低音C演奏時間為300毫秒，C(2,100)，代表中音C演奏時間為100毫秒，**

**//生日快樂歌**

**G(1, t1\_2); G(1, t1\_2); A(1, t1\_1); G(1, t1\_1); C(2, t1\_1); B(1, t1\_1 \* 2);**

**G(1, t1\_2); G(1, t1\_2); A(1, t1\_1); G(1, t1\_1); D(2, t1\_1); C(2, t1\_1 \* 2);**

**G(1, t1\_2); G(1, t1\_2); G(2, t1\_1); E(2, t1\_1); C(2, t1\_1); B(1, t1\_1); A(1, t1\_1);**

**Fn(2, t1\_2+t1\_4); Fn(2, t1\_4); E(2, t1\_1); C(2, t1\_1); D(2, t1\_1); C(2, t1\_1 \* 2);**

**//生日快樂歌-結束**

**delay(1000);**

**}**

**void C(unsigned int pitch, unsigned long duration)**

**{**

**int f = 261;**

**switch (pitch) {**

**case 1:**

**tone(speakerPin, f, duration);**

**break;**

**case 2:**

**tone(speakerPin, f \* 2, duration);**

**break;**

**case 3:**

**default:**

**tone(speakerPin, f \* 4, duration);**

**}**

**delay(duration);**

**noTone(speakerPin);**

**delay(t\_pause);**

**}**

**void D(unsigned int pitch, unsigned long duration)**

**{**

**int f = 294;**

**switch (pitch) {**

**case 1:**

**tone(speakerPin, f, duration);**

**break;**

**case 2:**

**tone(speakerPin, f \* 2, duration);**

**break;**

**case 3:**

**default:**

**tone(speakerPin, f \* 4, duration);**

**}**

**delay(duration);**

**noTone(speakerPin);**

**delay(t\_pause);**

**}**

**void E(unsigned int pitch, unsigned long duration)**

**{**

**int f = 330;**

**switch (pitch) {**

**case 1:**

**tone(speakerPin, f, duration);**

**break;**

**case 2:**

**tone(speakerPin, f \* 2, duration);**

**break;**

**case 3:**

**default:**

**tone(speakerPin, f \* 4, duration);**

**}**

**delay(duration);**

**noTone(speakerPin);**

**delay(t\_pause);**

**}**

**//不知為何函數名稱不能用F，所以改用Fn**

**void Fn(unsigned int pitch, unsigned long duration)**

**{**

**int f = 349;**

**switch (pitch) {**

**case 1:**

**tone(speakerPin, f, duration);**

**break;**

**case 2:**

**tone(speakerPin, f \* 2, duration);**

**break;**

**case 3:**

**default:**

**tone(speakerPin, f \* 4, duration);**

**}**

**delay(duration);**

**noTone(speakerPin);**

**delay(t\_pause);**

**}**

**void G(unsigned int pitch, unsigned long duration)**

**{**

**int f = 392;**

**switch (pitch) {**

**case 1:**

**tone(speakerPin, f, duration);**

**break;**

**case 2:**

**tone(speakerPin, f \* 2, duration);**

**break;**

**case 3:**

**default:**

**tone(speakerPin, f \* 4, duration);**

**}**

**delay(duration);**

**noTone(speakerPin);**

**delay(t\_pause);**

**}**

**void A(unsigned int pitch, unsigned long duration)**

**{**

**int f = 440;**

**switch (pitch) {**

**case 1:**

**tone(speakerPin, f, duration);**

**break;**

**case 2:**

**tone(speakerPin, f \* 2, duration);**

**break;**

**case 3:**

**default:**

**tone(speakerPin, f \* 4, duration);**

**}**

**delay(duration);**

**noTone(speakerPin);**

**delay(t\_pause);**

**}**

**void B(unsigned int pitch, unsigned long duration)**

**{**

**int f = 494;**

**switch (pitch) {**

**case 1:**

**tone(speakerPin, f, duration);**

**break;**

**case 2:**

**tone(speakerPin, f \* 2, duration);**

**break;**

**case 3:**

**default:**

**tone(speakerPin, f \* 4, duration);**

**}**

**delay(duration);**

**noTone(speakerPin);**

**delay(t\_pause);**

**}**

**實驗結果及分析**

**2.實驗步驟**

* **使用 4x4 鍵盤演奏音樂**

**程式碼**

**#define NOTE\_B0 31**

**#define NOTE\_C1 33**

**#define NOTE\_CS1 35**

**#define NOTE\_D1 37**

**#define NOTE\_DS1 39**

**#define NOTE\_E1 41**

**#define NOTE\_F1 44**

**#define NOTE\_FS1 46**

**#define NOTE\_G1 49**

**#define NOTE\_GS1 52**

**#define NOTE\_A1 55**

**#define NOTE\_AS1 58**

**#define NOTE\_B1 62**

**#define NOTE\_C2 65**

**#define NOTE\_CS2 69**

**#define NOTE\_D2 73**

**#define NOTE\_DS2 78**

**#define NOTE\_E2 82**

**#define NOTE\_F2 87**

**#define NOTE\_FS2 93**

**#define NOTE\_G2 98**

**#define NOTE\_GS2 104**

**#define NOTE\_A2 110**

**#define NOTE\_AS2 117**

**#define NOTE\_B2 123**

**#define NOTE\_C3 131**

**#define NOTE\_CS3 139**

**#define NOTE\_D3 147**

**#define NOTE\_DS3 156**

**#define NOTE\_E3 165**

**#define NOTE\_F3 175**

**#define NOTE\_FS3 185**

**#define NOTE\_G3 196**

**#define NOTE\_GS3 208**

**#define NOTE\_A3 220**

**#define NOTE\_AS3 233**

**#define NOTE\_B3 247**

**#define NOTE\_C4 262**

**#define NOTE\_CS4 277**

**#define NOTE\_D4 294**

**#define NOTE\_DS4 311**

**#define NOTE\_E4 330**

**#define NOTE\_F4 349**

**#define NOTE\_FS4 370**

**#define NOTE\_G4 392**

**#define NOTE\_GS4 415**

**#define NOTE\_A4 440**

**#define NOTE\_AS4 466**

**#define NOTE\_B4 494**

**#define NOTE\_C5 523**

**#define NOTE\_CS5 554**

**#define NOTE\_D5 587**

**#define NOTE\_DS5 622**

**#define NOTE\_E5 659**

**#define NOTE\_F5 698**

**#define NOTE\_FS5 740**

**#define NOTE\_G5 784**

**#define NOTE\_GS5 831**

**#define NOTE\_A5 880**

**#define NOTE\_AS5 932**

**#define NOTE\_B5 988**

**#define NOTE\_C6 1047**

**#define NOTE\_CS6 1109**

**#define NOTE\_D6 1175**

**#define NOTE\_DS6 1245**

**#define NOTE\_E6 1319**

**#define NOTE\_F6 1397**

**#define NOTE\_FS6 1480**

**#define NOTE\_G6 1568**

**#define NOTE\_GS6 1661**

**#define NOTE\_A6 1760**

**#define NOTE\_AS6 1865**

**#define NOTE\_B6 1976**

**#define NOTE\_C7 2093**

**#define NOTE\_CS7 2217**

**#define NOTE\_D7 2349**

**#define NOTE\_DS7 2489**

**#define NOTE\_E7 2637**

**#define NOTE\_F7 2794**

**#define NOTE\_FS7 2960**

**#define NOTE\_G7 3136**

**#define NOTE\_GS7 3322**

**#define NOTE\_A7 3520**

**#define NOTE\_AS7 3729**

**#define NOTE\_B7 3951**

**#define NOTE\_C8 4186**

**#define NOTE\_CS8 4435**

**#define NOTE\_D8 4699**

**#define NOTE\_DS8 4978**

**#include <Keypad.h>**

**const byte ROWS = 4; // 4 Rows**

**const byte COLS = 4; // 4 Columns**

**int duration = 500;**

**// 定義 Keypad 的按鍵**

**char keys[ROWS][COLS] = {**

**{'7', '8', '9', 'C'},**

**{'4', '5', '6', 'D'},**

**{'1', '2', '3', 'E'},**

**{'0', 'A', 'B', 'F'}};**

**// 定義 Keypad 連到 Arduino 的接腳**

**byte rowPins[ROWS] = {10,11,12,13};**

**// 連到 Keypad 的 4 個 Rows**

**byte colPins[COLS] = {6,7,8,9};**

**// 連到 Keypad 的 4 個 Columns**

**// 建立 Keypad 物件**

**Keypad keypad = Keypad( makeKeymap(keys), rowPins,colPins, ROWS, COLS );**

**void setup(){**

**Serial.begin(9600);**

**}**

**void loop(){**

**// 讀取 Keypad 的輸入**

**char key = keypad.getKey();**

**// NO\_KEY 代表沒有按鍵被按下**

**if (key != NO\_KEY){ // 假如有按鍵被按下，就印出按鍵對應的字元**

**switch (key) {**

**case '1':**

**tone(4, NOTE\_C5, duration);**

**break;**

**case '2':**

**tone(4, NOTE\_D5, duration);**

**break;**

**case '3':**

**tone(4, NOTE\_E5, duration);**

**break;**

**case '4':**

**tone(4, NOTE\_F5, duration);**

**break;**

**case '5':**

**tone(4, NOTE\_G5, duration);**

**break;**

**case '6':**

**tone(4, NOTE\_A5, duration);**

**break;**

**case '7':**

**tone(4, NOTE\_B5, duration);**

**break;**

**case '8':**

**tone(4, NOTE\_C6, duration);**

**break;**

**case '9':**

**tone(4, NOTE\_D6, duration);**

**break;**

**case 'C':**

**tone(4, NOTE\_E6, duration);**

**break;**

**default:**

**tone(4, NOTE\_C2, duration);**

**}**

**Serial.println(key);**

**}**

**}**

**3.實驗步驟**

**發報摩斯電碼**

**程式碼**

**#define Do 440**

**const byte audio11 = 11;**

**int dotLen = 150;**

**int dashLen = 700;**

**int incomingByte = 0; // 用來儲存收進來的 data byte**

**void setup() {**

**Serial.begin(9600);**

**}**

**void loop() {**

**// 檢查是否有資料可供讀取**

**if (Serial.available() > 0) {**

**// 讀取進來的 byte**

**incomingByte = Serial.read();**

**// 印出收到的資料**

**Serial.println(incomingByte, DEC);**

**GetChar(incomingByte);**

**delay(800);**

**}**

**}**

**void MorseDot() {**

**tone(audio11, Do, dotLen); // start playing a tone**

**delay(500); // hold in this position**

**}**

**// DASH**

**void MorseDash() {**

**tone(audio11, Do, dashLen); // start playing a tone**

**delay(800); // hold in this position**

**}**

**void GetChar(char tmpChar) {**

**switch (tmpChar) {**

**case 'a':**

**MorseDot();**

**MorseDash();**

**break;**

**case 'b':**

**MorseDash();**

**MorseDot();**

**MorseDot();**

**MorseDot();**

**break;**

**case 'c':**

**MorseDash();**

**MorseDot();**

**MorseDash();**

**MorseDot();**

**break;**

**case 'd':**

**MorseDash();**

**MorseDash();**

**MorseDot();**

**break;**

**case 'e':**

**MorseDot();**

**break;**

**case 'f':**

**MorseDot();**

**MorseDot();**

**MorseDash();**

**MorseDot();**

**break;**

**case 'g':**

**MorseDash();**

**MorseDash();**

**MorseDot();**

**break;**

**case 'h':**

**MorseDot();**

**MorseDot();**

**MorseDot();**

**MorseDot();**

**break;**

**case 'i':**

**MorseDot();**

**MorseDot();**

**break;**

**case 'j':**

**MorseDot();**

**MorseDash();**

**MorseDash();**

**MorseDash();**

**break;**

**case 'k':**

**MorseDash();**

**MorseDot();**

**MorseDash();**

**break;**

**case 'l':**

**MorseDot();**

**MorseDash();**

**MorseDot();**

**MorseDot();**

**break;**

**case 'm':**

**MorseDash();**

**MorseDash();**

**break;**

**case 'n':**

**MorseDash();**

**MorseDot();**

**break;**

**case 'o':**

**MorseDash();**

**MorseDash();**

**MorseDash();**

**break;**

**case 'p':**

**MorseDot();**

**MorseDash();**

**MorseDash();**

**MorseDot();**

**break;**

**case 'q':**

**MorseDash();**

**MorseDash();**

**MorseDot();**

**MorseDash();**

**break;**

**case 'r':**

**MorseDot();**

**MorseDash();**

**MorseDot();**

**break;**

**case 's':**

**MorseDot();**

**MorseDot();**

**MorseDot();**

**break;**

**case 't':**

**MorseDash();**

**break;**

**case 'u':**

**MorseDot();**

**MorseDot();**

**MorseDash();**

**break;**

**case 'v':**

**MorseDot();**

**MorseDot();**

**MorseDot();**

**MorseDash();**

**break;**

**case 'w':**

**MorseDot();**

**MorseDash();**

**MorseDash();**

**break;**

**case 'x':**

**MorseDash();**

**MorseDot();**

**MorseDot();**

**MorseDash();**

**break;**

**case 'y':**

**MorseDash();**

**MorseDot();**

**MorseDash();**

**MorseDash();**

**break;**

**case 'z':**

**MorseDash();**

**MorseDash();**

**MorseDot();**

**MorseDot();**

**break;**

**case '0':**

**MorseDash();**

**MorseDash();**

**MorseDash();**

**MorseDash();**

**MorseDash();**

**break;**

**case '1':**

**MorseDot();**

**MorseDash();**

**MorseDash();**

**MorseDash();**

**MorseDash();**

**break;**

**case '2':**

**MorseDot();**

**MorseDot();**

**MorseDash();**

**MorseDash();**

**MorseDash();**

**break;**

**case '3':**

**MorseDot();**

**MorseDot();**

**MorseDot();**

**MorseDash();**

**MorseDash();**

**break;**

**case '4':**

**MorseDot();**

**MorseDot();**

**MorseDot();**

**MorseDot();**

**MorseDash();**

**break;**

**case '5':**

**MorseDot();**

**MorseDot();**

**MorseDot();**

**MorseDot();**

**MorseDot();**

**break;**

**case '6':**

**MorseDash();**

**MorseDot();**

**MorseDot();**

**MorseDot();**

**MorseDot();**

**break;**

**case '7':**

**MorseDash();**

**MorseDash();**

**MorseDot();**

**MorseDot();**

**MorseDot();**

**break;**

**case '8':**

**MorseDash();**

**MorseDash();**

**MorseDash();**

**MorseDot();**

**MorseDot();**

**break;**

**case '9':**

**MorseDash();**

**MorseDash();**

**MorseDash();**

**MorseDash();**

**MorseDot();**

**break;**

**default:**

**break;**

**}**

**}**

1. **心得討論**

不知道為什麼用其他PIN腳有問題，會發不出聲音，只有這樣接才能正常發出DO，RE…等音色。