

綠能積體電路期末報告

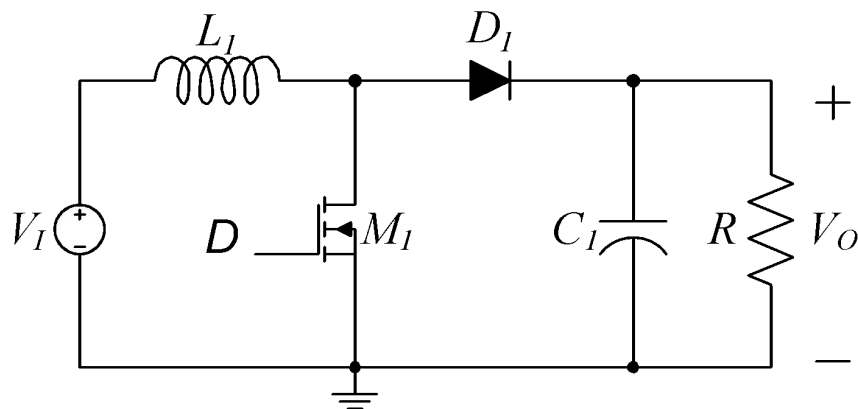
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一、綠能積體電路設計－ Buck頻率補償

描述：設計一個 Buck－Converter 電路，並做頻率補償，且在 8 毫秒時抽載 1A

V_{in}	V_{out}	I_o	f_s	L	C	R
10V	5V	1A	200k	3.125×10^{-6}	12.5×10^{-6}	5 ohm



Converter	G_{g0}	G_{d0}	ω_0	Q	ω_z
buck	D	$\frac{V}{D}$	$\frac{1}{\sqrt{LC}}$	$R\sqrt{\frac{C}{L}}$	∞

AV(gain) T(s)

$$\begin{aligned}
 G_{vg}(s) \frac{\hat{v}_o(s)}{\hat{v}_{in}(s)} &= V_g \frac{\left(R \parallel \frac{1}{sC}\right)}{sL + \left(R \parallel \frac{1}{sC}\right)} \\
 &= V_g \frac{1}{s^2LC + \frac{sL}{R} + 1} \\
 &= \frac{0.5}{3.90625 \times 10^{-11} s^2 + 6.25 \times 10^{-7} s + 1}
 \end{aligned}$$

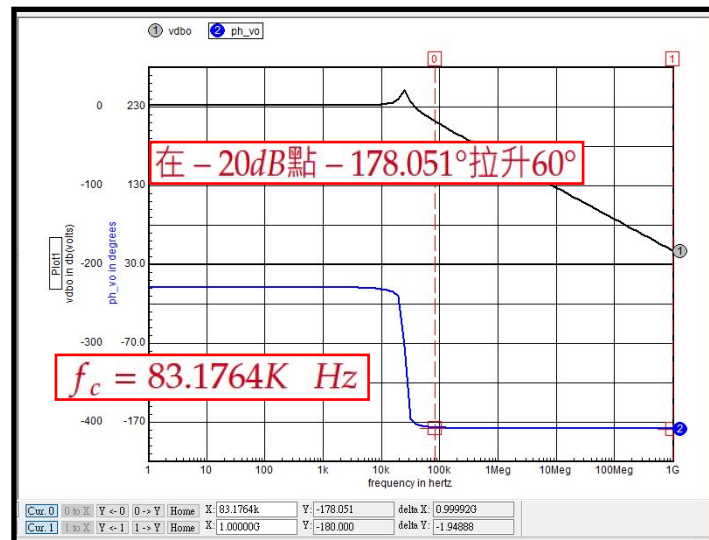
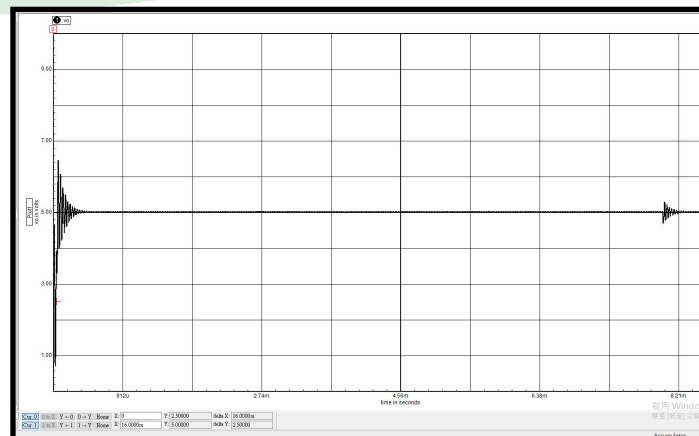
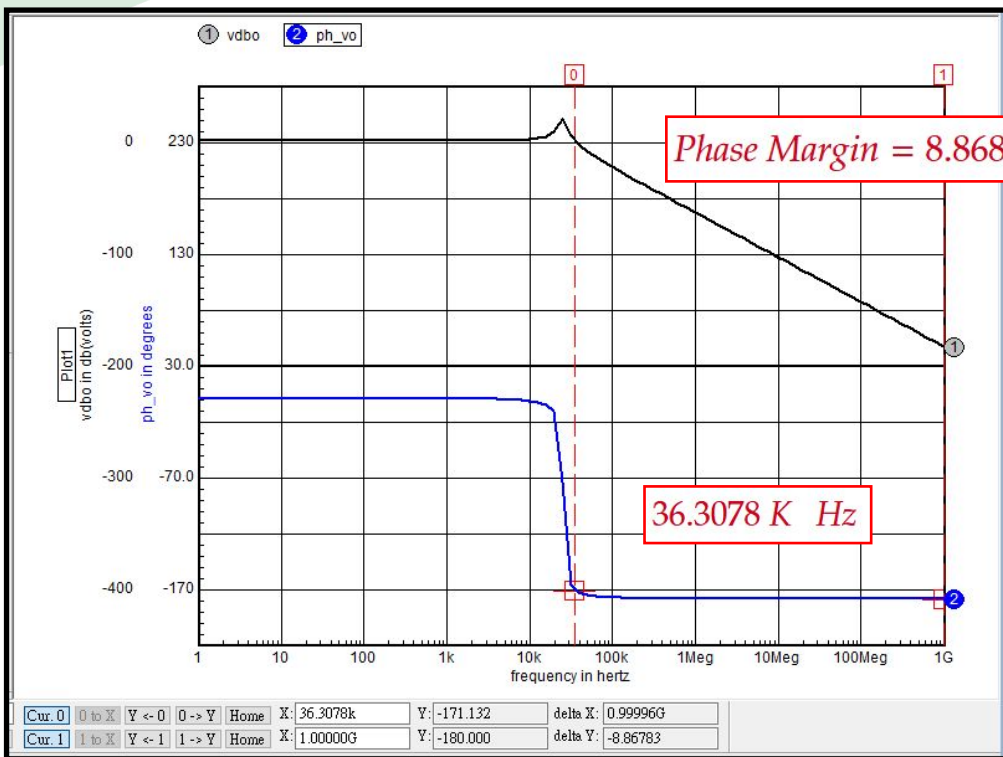
Duty Ratio T(s)

$$\begin{aligned}
 G_{vd}(s) = \frac{\hat{v}_o(s)}{\hat{d}(s)} &= D \frac{\left(R \parallel \frac{1}{sC}\right)}{sL + \left(R \parallel \frac{1}{sC}\right)} \\
 &= D \frac{\frac{R}{1 + sCR}}{sL + \frac{R}{1 + sCR}} \\
 &= D \frac{1}{s^2LC + \frac{sL}{R} + 1} \\
 &= \frac{10}{3.90625 \times 10^{-11} s^2 + 6.25 \times 10^{-7} s + 1}
 \end{aligned}$$

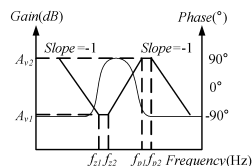
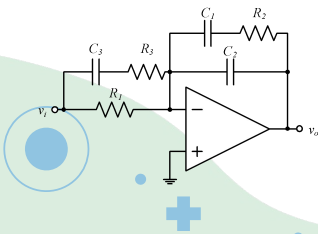
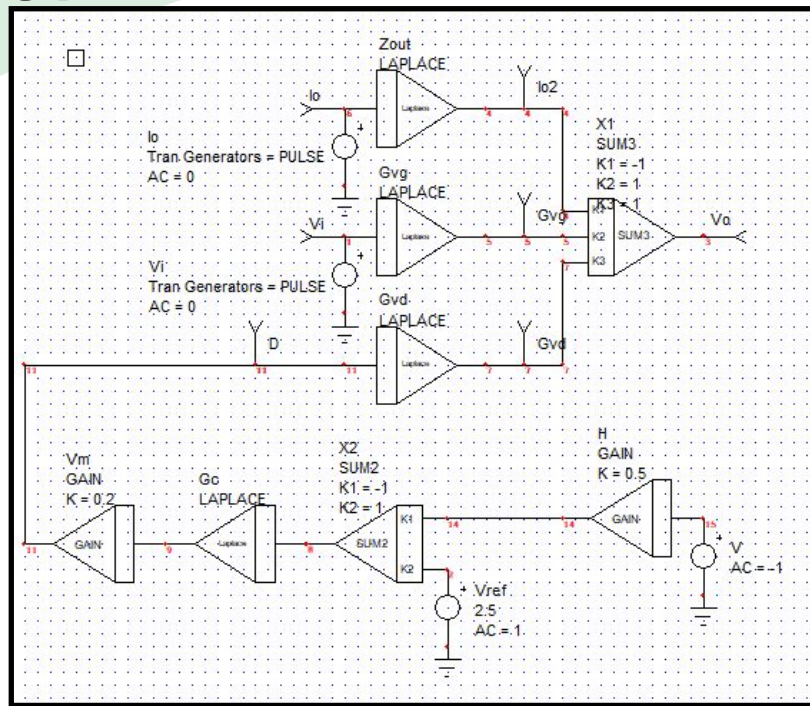
Zout

$$\begin{aligned}
 Z_{out}(s) &= \frac{\hat{v}_o(s)}{\hat{i}_o(s)} = R \parallel \frac{1}{sC} \parallel sL \\
 &= \frac{sL}{s^2LC + \frac{sL}{R} + 1} \\
 &= \frac{3.125 \times 10^{-6} s}{3.90625 \times 10^{-11} s^2 + 6.25 \times 10^{-7} s + 1}
 \end{aligned}$$

波德圖(未補償)



Type III補償器改善



設計Type III補償器

使T(s)的Phase Margin提高至60°

$$f_c = 83.1764 \text{ kHz}, \quad G \div 20 \text{ dB} = 10$$

$$P = 60^\circ - (-178.051^\circ) - 90^\circ = 148.051^\circ$$

$$\frac{v_o(s)}{v_i(s)} \approx \frac{(1 + sR_2C_1)(1 + sR_1C_3)}{sR_1C_1(1 + sR_2C_2)(1 + sR_3C_3)}$$

$$K = \left(\tan \left[\left(\frac{P}{4} \right) + 45^\circ \right] \right)^2$$

$$\omega_0 = 2 \times \pi \times f = 522612.73$$

$$K = 50.792$$

$$R_1 = 1000 \quad \Omega$$

$$R_2 = 1431.32 \quad \Omega$$

$$R_3 = 20.083 \quad \Omega$$

$$C_1 = 9.53 \times 10^{-9} \quad F$$

$$C_2 = 1.91 \times 10^{-10} \quad F$$

$$C_3 = 1.34 \times 10^{-8} \quad F$$

$$C_1 = C_2(K - 1)$$

$$R_1 = 1000 \Omega$$

$$C_2 = \frac{1}{\omega_c R_1 G}$$

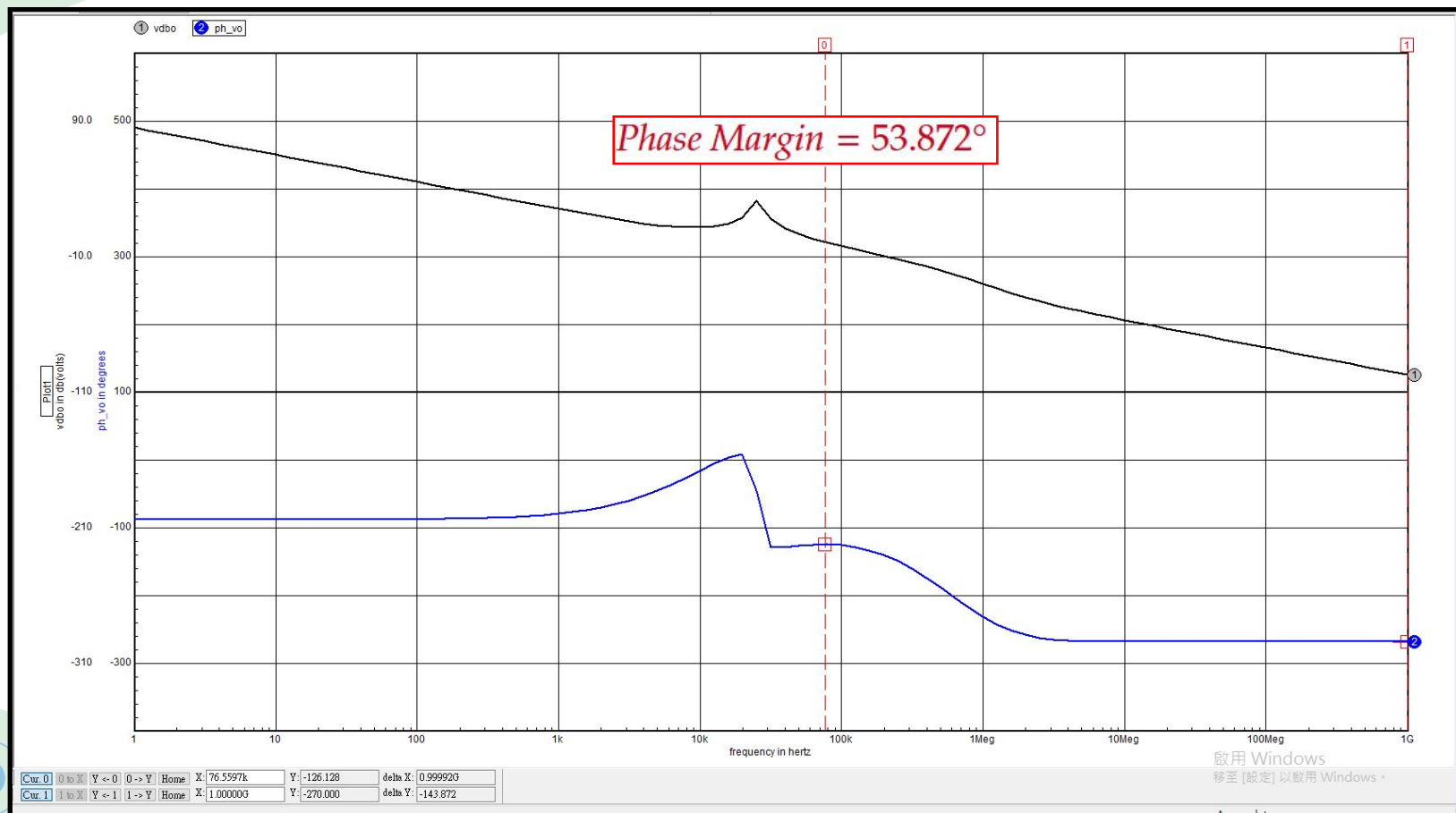
$$R_2 = \frac{\sqrt{K}}{\omega_c C_1}$$

$$C_3 = \frac{1}{\omega_c R_3 \sqrt{K}}$$

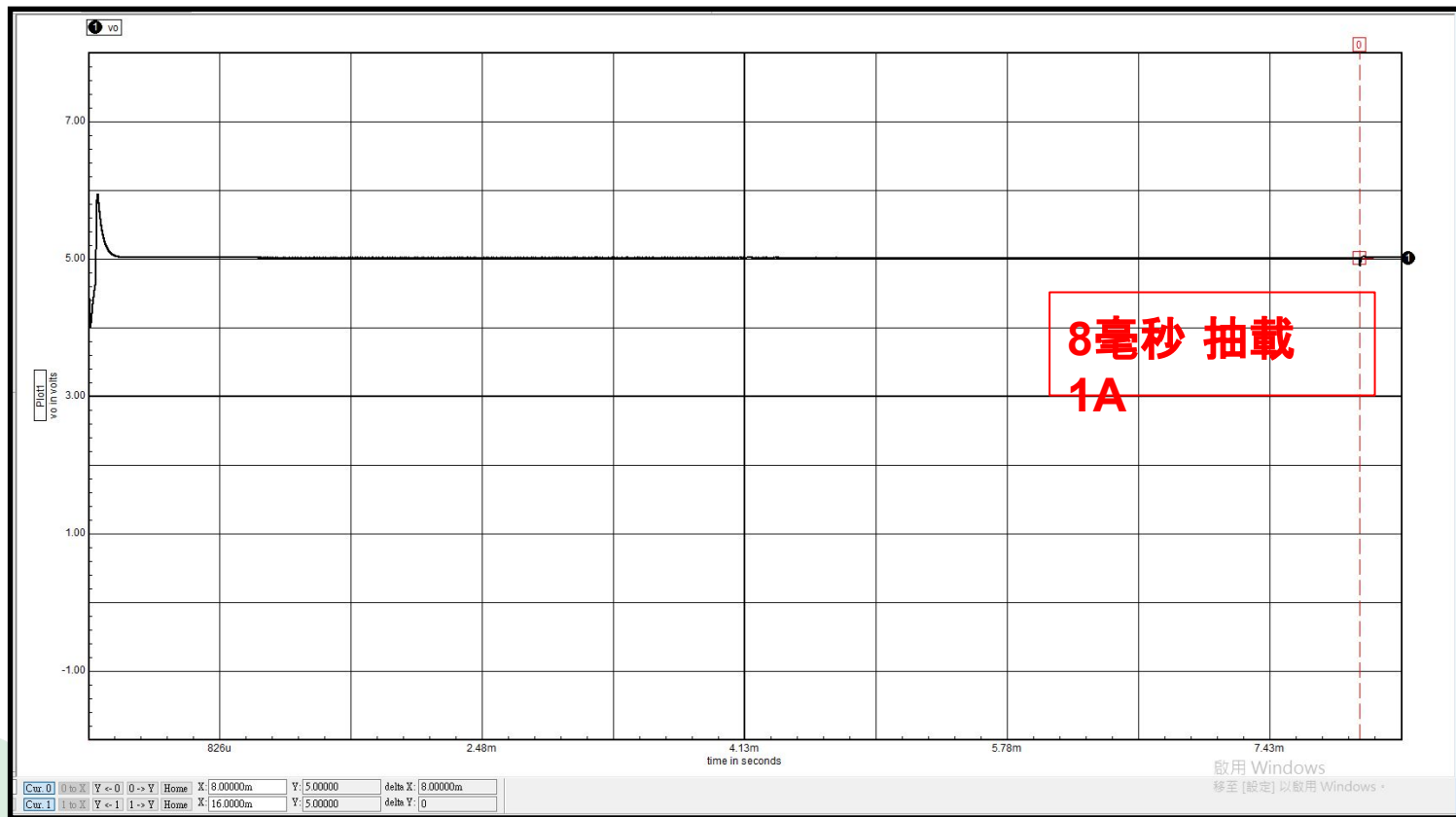
$$R_3 = \frac{R_1}{K - 1}$$

$$\frac{V_o(s)}{V_i(s)} \cong \frac{1.82 \times 10^{-10} S^2 + 2.7 \times 10^{-5} S + 1}{7.01 \times 10^{-19} S^3 + 5.17 \times 10^{-12} S^2 + 5.17 \times 10^{-6} S}$$

波德圖(補償後)



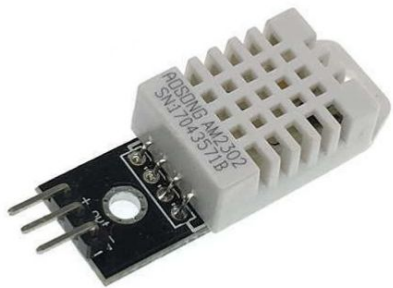
啟用 Windows
移至 [設定] 以啟用 Windows。



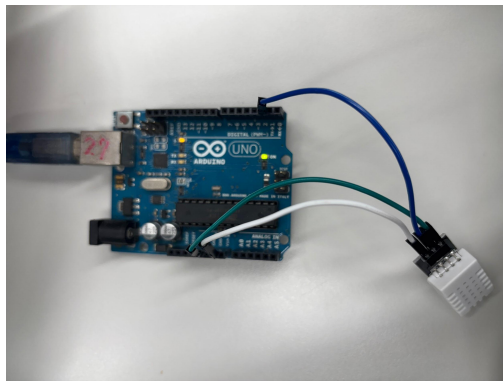
二、Arduino溫濕照 sensors + VB

使用VB讀取Arduino溫濕照sensors結果

實作DEMO



sensor:RTH22溫濕度感測器



Arduino實體接線圖

Arduino程式碼

```
#include "DHT.h"

#define DHTPIN 2      // 定義連接 DHT22 的引腳
#define DHTTYPE DHT22 // 使用 DHT22 感測器

DHT dht(DHTPIN, DHTTYPE); // 初始化 DHT22 感測器
bool firstReading = true; // 用於標記是否為第一次讀取數據

void setup() {
  Serial.begin(9600); // 開啟序列埠，設置波特率為 9600
  dht.begin();        // 啟動 DHT22 感測器
}

void loop() {
  // 第一次讀取時，固定輸出 "00.00,00.00"
  if (firstReading) {
    Serial.println("00.00,00.00");
    firstReading = false; // 設定為 false，後續將正常讀取數據
    delay(2000);          // 等待 DHT22 感測器穩定
    return;
  }

  // 讀取溫度和濕度
  float h = dht.readHumidity(); // 讀取濕度
  float t = dht.readTemperature(); // 讀取溫度 (攝氏)

  // 檢查數據是否正確
  if (isnan(h) || isnan(t)) {
    Serial.println("無法讀取數據!");
    return;
  }

  // 輸出讀取到的數據 (以逗號分隔)
  Serial.print(t, 2); // 保留兩位小數
  Serial.print(",");
  Serial.print(h, 2); // 保留兩位小數
  Serial.print("\n");

  // 等待 DHT22 感測器的讀取時間
  delay(2000); // 每 2 秒讀取一次數據
}
```



溫度

濕度

visual basic程式碼

```
teach1
Imports System.IO.Ports
Imports System.Windows.Forms

Public Class Form1
    Dim buffer As String
    Dim temperature As Single
    Dim humidity As Single

    Private Sub Form1_Load(sender As Object, e As EventArgs) Handles MyBase.Load
        ' 抓取所有可用的串口
        Dim myport As Array
        myport = IO.Ports.SerialPort.GetPortNames
        ComboBox1.Items.AddRange(myport) ' 顯示可用端口
    End Sub

    Private Sub Button1_Click(sender As Object, e As EventArgs) Handles Button1.Click
        ' 設定 COM 埠與速率
        SerialPort1.PortName = ComboBox1.Text
        SerialPort1.BaudRate = 9600 ' 這裡固定設為9600
        SerialPort1.Open() ' 開啟通訊
        Timer1.Enabled = True ' 開啟計時器以定期更新
    End Sub

    Private Sub Button2_Click(sender As Object, e As EventArgs) Handles Button2.Click
        ' 關閉 COM 埠連接與計時器
        SerialPort1.Close()
        Timer1.Enabled = False
    End Sub

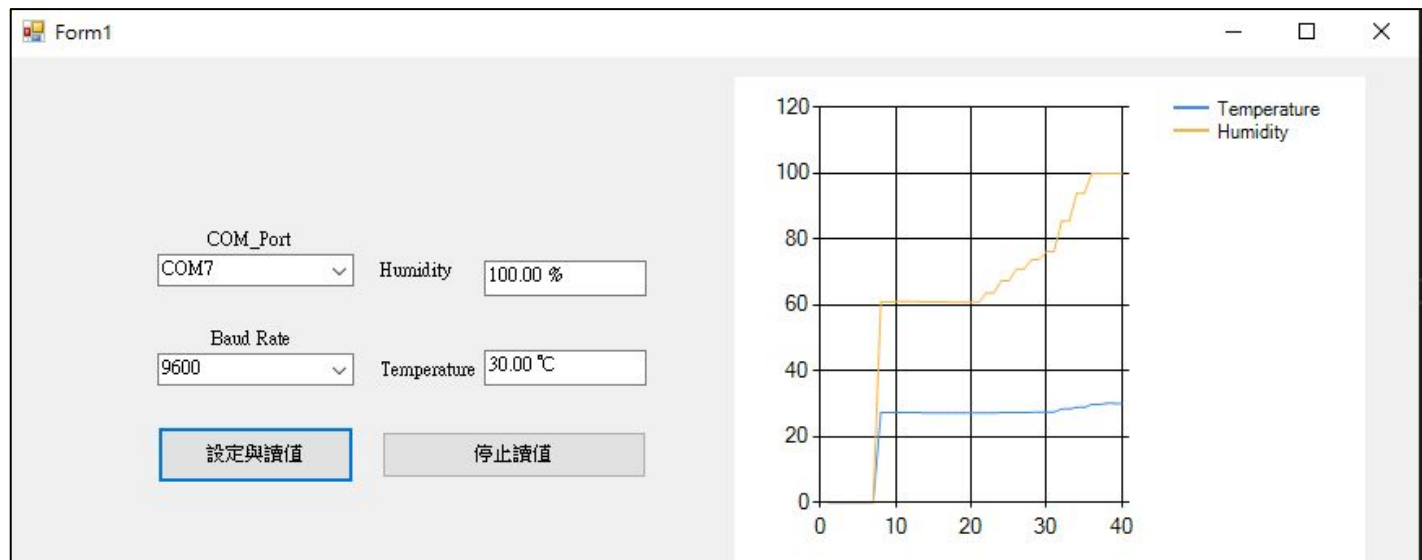
    Private Sub SerialPort1_DataReceived(sender As Object, e As SerialDataReceivedEventArgs) Handles SerialPort1.DataReceived
        Dim data As String = SerialPort1.ReadLine()
        buffer = data.Trim() ' 去除換行符並儲存接收的數據
    End Sub
End Class
```

```
0 個參考
Private Sub Timer1_Tick(sender As Object, e As EventArgs) Handles Timer1.Tick
    ' 檢查是否有逗號，並嘗試分割數據
    If buffer <> "" Then
        Try
            Dim parts As String() = buffer.Split(",")
            If parts.Length >= 2 Then
                Try
                    ' 嘗試將數據轉換為浮點數
                    temperature = Convert.ToSingle(parts(0).Trim())
                    humidity = Convert.ToSingle(parts(1).Trim())
                Catch ex As Exception
                    ' 如果轉換失敗，則顯示錯誤
                    MessageBox.Show("數據解析錯誤：" & ex.Message)
                End Try
            End If
        Catch ex As Exception
            ' 如果轉換失敗，則顯示錯誤
            MessageBox.Show("數據解析錯誤：" & ex.Message)
        End Try
    End If

    ' 更新顯示溫度與濕度
    TextBox2.Text = temperature.ToString("0.00") & " °C" ' 顯示溫度
    TextBox1.Text = humidity.ToString("0.00") & " %" ' 顯示濕度

    ' 更新圖表，溫度與濕度分開繪製
    Me.Chart1.Series("Humidity").Points.AddY(humidity)
    Me.Chart1.Series("Temperature").Points.AddY(temperature)
End Sub
End Class
```

介面結果



Thank you for your attention!