Microclimate Station Coding Workshop

Date: 18 August 2018 (Sat) Time: 13:00 – 18:00

Venue: Hong Kong Observatory Headquarters (134A, Nathan Road, Tsim Sha Tsui, Kowloon)

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What is Co-WIN?

The Community Weather Information Network (Co-WIN) is a joint public education initiative between

- -> The Hong Kong Observatory (HKO)
- -> The Hong Kong Polytechnic University (PolyU)
- -> The Chinese University of Hong Kong (CUHK)

It was established in 2007 to serve as a platform for providing real-time weather information to the public via the internet. In 2017, a phase 2 public education was commenced in promoting meteorology and climate change to public citizens with more multi-disciplinary interactions and public engagements.



Ideas on Automatic Weather Stations (AWS)





Measure atmospheric conditions to provide information for:

Weather forecasts
 Weather and climate studies

Available weather parameters:



Objectives

After the workshop, we hope you would learnt:

- Simple electronic circuitry
- Programming techniques
- Application on turning real-time weather parameters into digital observations





Part I: Basics on Arduino Nano Board and Sensors



Part I: Basics on Arduino Nano Board and Sensors







DHT22

Temperature and Humidity

| Model | DHT22 |
|---------------------------|--|
| Power supply | 3.3-6V DC |
| Output signal | digital signal via single-bus |
| Sensing element | Polymer capacitor |
| Operating range | humidity 0-100%RH; temperature -40~80Celsius |
| Accuracy | humidity +-2%RH(Max +-5%RH); temperature <+-0.5Celsius |
| Resolution or sensitivity | humidity 0.1%RH; temperature 0.1Celsius |
| Repeatability | humidity +-1%RH; temperature +-0.2Celsius |
| Humidity hysteresis | +-0.3%RH |
| Long-term Stability | +-0.5%RH/year |
| Sensing period | Average: 2s |
| Interchangeability | fully interchangeable |
| Dimensions | small size 14*18*5.5mm; big size 22*28*5mm |

BMP280 Pressure and Altitude

| Parameter | Condition | Min | Max | Unit |
|------------------------------|---|------|-------------------------|------|
| Voltage at any supply pin | $V_{\mbox{\tiny DD}}$ and $V_{\mbox{\tiny DDIO}}$ Pin | -0.3 | 4.25 | V |
| Voltage at any interface pin | | -0.3 | V _{DDIO} + 0.3 | V |
| Storage Temperature | ≤ 65% rel. H. | -45 | +85 | °C |
| Pressure | | 0 | 20 000 | hPa |
| | HBM, at any Pin | | ±2 | kV |
| ESD | CDM | | ±500 | V |
| | Machine model | | ±200 | V |

DS1307 RTC Real-time Clock

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|--|---------------------|--------------|-----|-----|------|-------|
| SCL Clock Frequency | f _{SCL} | | 0 | | 100 | kHz |
| Bus Free Time Between a STOP and START Condition | t _{BUF} | | 4.7 | | | μs |
| Hold Time (Repeated) START Condition | t _{HD:STA} | (Note 4) | 4.0 | | | μs |
| LOW Period of SCL Clock | t _{LOW} | | 4.7 | | | μs |
| HIGH Period of SCL Clock | t _{HIGH} | | 4.0 | | | μs |
| Setup Time for a Repeated START Condition | t _{su:sta} | | 4.7 | | | μs |
| Data Hold Time | t _{HD:DAT} | | 0 | | | μs |
| Data Setup Time | t _{SU:DAT} | (Notes 5, 6) | 250 | | | ns |
| Rise Time of Both SDA and SCL Signals | t _R | | | | 1000 | ns |
| Fall Time of Both SDA and SCL Signals | t _F | | | | 300 | ns |
| Setup Time for STOP Condition | t _{su:sто} | | 4.7 | | | μS |

Part I: Basics on Arduino Nano Board and Sensors



Liquid Crystal Display Monitor 2004A Display information acquired

| PIN NO | SYMBOL | FUNCTION |
|--------|----------|---|
| 1 | VSS | Power Ground |
| 2 | VDD | Power supply for logic circuit(+5V) |
| 3 | VO | For LCD drive voltage (variable) |
| 4 | RS (C/D) | H: Display Data, L:Display Instruction |
| 5 | R/W | H: Data Read (LCM to MPU) ; L: Data Write (MPU to LCM) |
| 6 | Е | Enable signal. |
| | | Write mode (R/W = L) data of DB<0:7> is latched at |
| | | the |
| | | falling edge of E. |
| | | Read mode (R/W = H) $DB < 0:7$ > appears the reading data |
| | | while E is at high level |
| 7-14 | DB0-DB7 | Data bus. There state I/O common terminal. |
| 15 | А | Power for LED Backlight (+5V) |
| 16 | K | Power for LED Backlight (Ground) |

Part II: Electronic Circuitry





Simple Closed Circuit



Part II: Electronic Circuitry



Wiring with sensors STEP BY STEP !!!

Running the Arduino IDE and Selecting a proper Arduino board

| | | | | | ^ |
|---|--|--|---|-----------|---------|
| File Edit Sketch Tr My_AWS void setup() { // put your se | Auto Format Archive Sketch Fix Encoding & Reload Serial Monitor Serial Plotter WiFi101 Firmware Updater | Ctrl+T Ctrl+Shift+M Ctrl+Shift+L | | | |
| } | Board: "Arduino Nano" | 2 | Boards Manager | | |
| <pre>void loop() { // put your ma }</pre> | Processor: "ATmega328P" Port Get Board Info | > | Arduino AVR Boards Arduino Yún Arduino/Genuino Uno Arduino Duemilanove or Diecimila | | |
| | Burn Bootloader | | Arduino Kano Arduino Kano Arduino Mega ADK Arduino Leonardo Arduino Leonardo ETH Arduino/Genuino Micro Arduino Esplora Arduino Mini Arduino Ethernet Arduino Fio Arduino BT | | |
| | | | Arduino Bi LilyPad Arduino USB LilyPad Arduino Arduino Pro or Pro Mini Arduino NG or older Arduino Robot Control Arduino Robot Motor | ega328P (| on COM5 |
| | a constant | × | Arduino Gemma Adafruit Circuit Playground Arduino Yún Mini Arduino Industrial 101 Linino One Arduino Uno WiFi | | |

| My_AWS Ar | duino 1.8.5 | | _ | |
|----------------|--------------|-----------------|---|---|
| le Edit Sketch | Tools Help | | | |
| New | Ctrl+N | | | |
| Open | Ctrl+O | | | ĥ |
| Open Recent | > | | | |
| Sketchbook | > | | | |
| Examples | > | | | |
| Close | Ctrl+W | Tun once. | | |
| Save | Ctrl+S | | | |
| Save As | Ctrl+Shift+S | | | |
| Page Setup | Ctrl+Shift+P | | | |
| Print | Ctrl+P | run repeatedly: | | |
| Preferences | Ctrl+Comma | | | |
| Ouit | Ctrl+Q | | | |

Setting up an appropriate Communication Port

| 💿 My_AWS Arduino 1.8.5 | - 🗆 × | Opens up the USB port for serial |
|--|----------|--|
| File Edit Sketch Tools Help | | opens up the obb port for send |
| | <u>P</u> | to 9600 bps |
| My_AWS § | X | |
| <pre>void setup() {</pre> | ^ | |
| // put your setup code here, to run once: | | Prints the value nassed into the |
| <pre>Serial.begin(9600);</pre> | | |
| <pre>Serial-print("This is my first AWS program !");</pre> | | brackets ("") on to the Serial Monitor |
| } | | |
| | | |
| void loop() { | | |
| // put your main code here, to run repeatedly: | | |
| } | | |
| | | |
| | | |
| | | |
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Basic structure of a new project file

Using the loop() function

Part IV: Download Your Libraries

| 📕 🛃 📕 = Downloaded_Arduin | o_library | | - | |
|--|--|-----------------------------------|---|--|
| 檔案 常用 共用 檢視 | | | | ~ 🕐 |
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| 🗸 🐚 本機 | ^ 名稱 | ^ | 修改日期 | 類型 |
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| > 🖡 下載 | ADS1X15-ma | ster | 20/2/2018 12:02 | 檔案資料夾 |
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| > 屬影片 | | | | |
| > 💺 Windows (C:) | | | | |
| > 🧅 Recovery Image (D:) | | | | |
| > 🔮 網路 | ~ < | | | > |
| 6 個項目 | | | | |

Download Libraries Here: https://goo.gl/95EQqS

Part V: Enjoy Your Time !!!

Stage 1: Installing a temperature and humidity sensor DHT22 module

Stage 2: Installing a Pressure sensor BMP280 module

Stage 3: Installing a Real-Time Clock module

Stage 4: Installing a LCD Display

If you have any question during your work

PLEASE ASK !!! 🙂

Part VI: Recommendation

最新天氣資訊: www.hko.gov.hk fb.me/hk.observatory

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| facebook | Email or Phone Sign Up | Password Log In Forgotten account? | facebook | Email or I | Phone Password Forgotten account? |
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| Instagram | a 搜尋 | 登入 | Notes | 生於南海的熱帶氣旋,先天條件往往不及西北太平洋的同類般優越,可能 兩三天便煙浴雪散,是名副其實的輪在起胸緯。然而這次,「目碧裏,卻 | Community |
| | | | Info and ads | 不甘默默無聞,頑強地在南海兜兜轉轉,不但成功爭取日本氣象廳賜予名 份,還在海洋上書下美妙的蝴蝶結。 | 65,431 people like this |
| | | | Create a Page | 讓我們走進「貝碧嘉」的內心世界,回望一星期以來的心路歷程。 | 71,101 people follow this |
| | hk.observatory 🔗 💷 | | | 天氣隨筆《為生命旅程鄉個蝴蝶結》:http://url.hko.hk/3VoA8vvL See more | About |
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