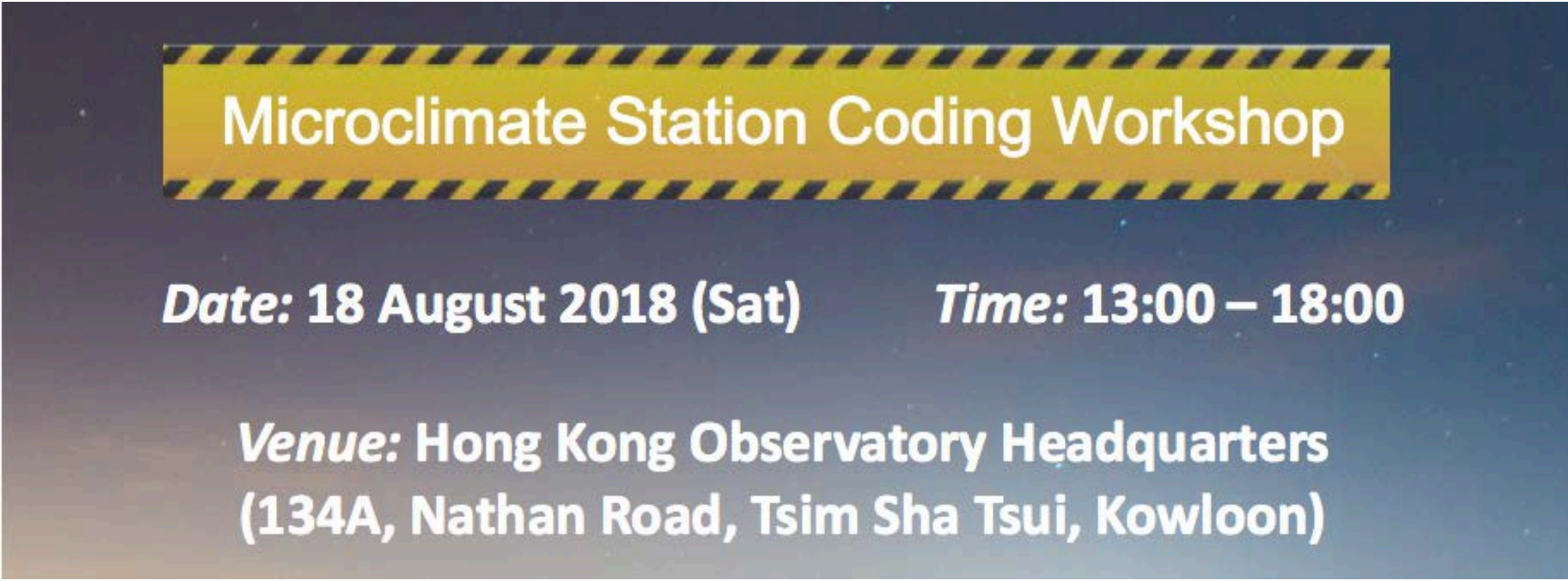


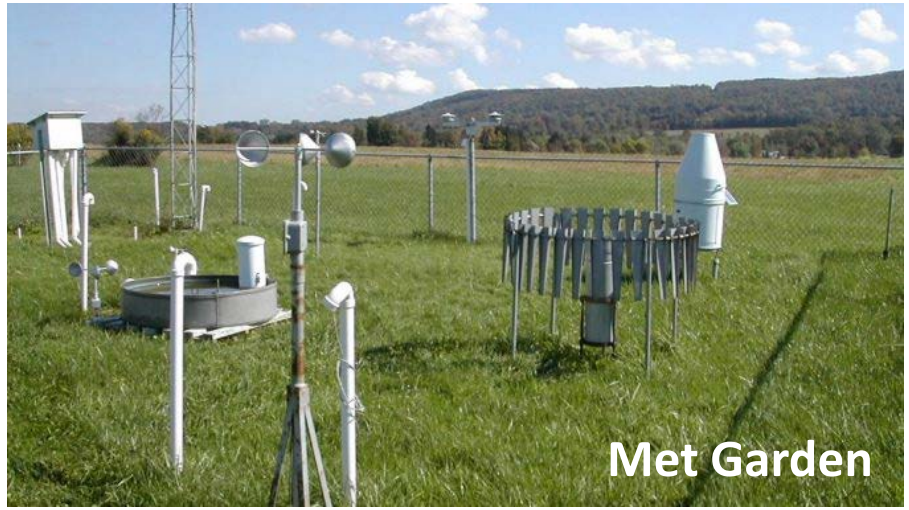
Jeffrey Chang
Weather and Radiation Observation Networks Division
Hong Kong Observatory

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.

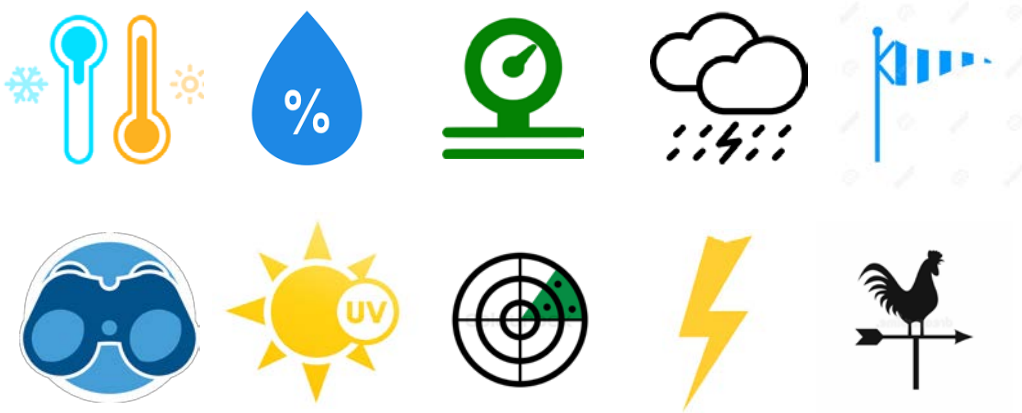
Ideas on Automatic Weather Stations (AWS)



Measure atmospheric conditions to provide information for:

1. Weather forecasts
2. Weather and climate studies

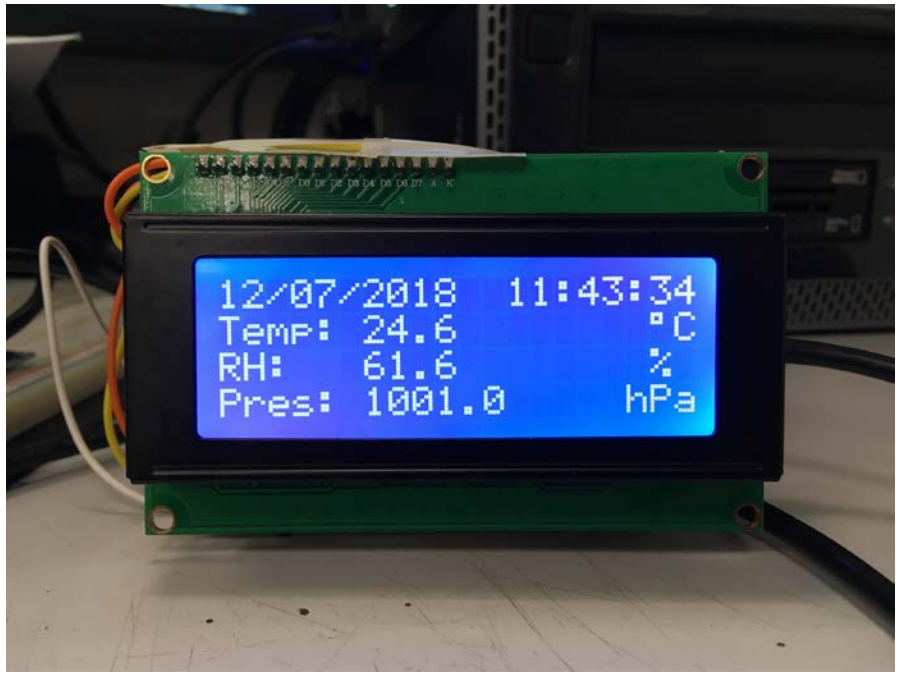
Available weather parameters:



Objectives

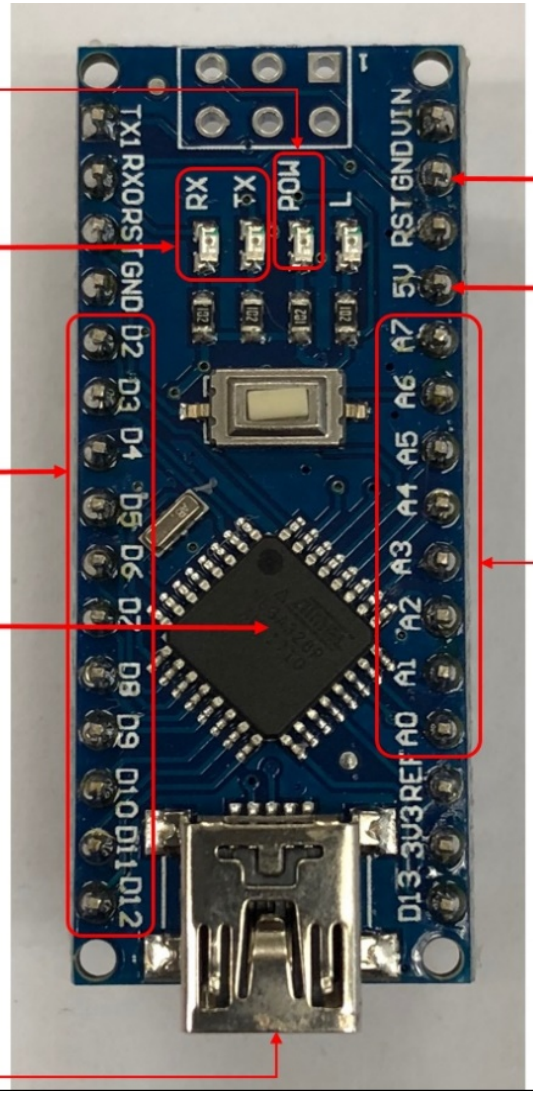
After the workshop, we hope you would learnt:

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



Today's Target

Part I: Basics on Arduino Nano Board and Sensors



Power LED

Rx/Tx LEDs
These LEDS indicate communication between your Arduino and your computer. Expect them to flicker rapidly during sketch upload as well as during serial communication. Useful for debugging.

Digital Pins

Microcontroller

Mini-USB port
Used for powering your Arduino Nano, uploading your sketches (project programs) to your Arduino, and for communicating with your Arduino sketch (via Serial.print(), etc.

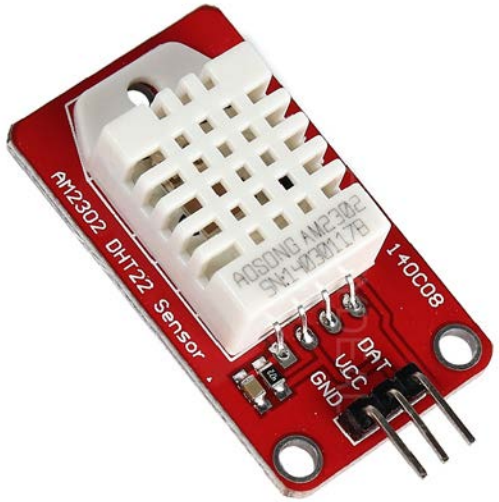
Ground Pin

5V Pin

Use these pins to provide +5V power and ground to your circuits

Analog Input Pins
By default, they measure analog signals from ground to 5 volts. In this project, only **A0**, **A4** and **A5** will be used. For I2C communication with the sensors, A4 will be connected to SDA and A5 will be connected to SCL.

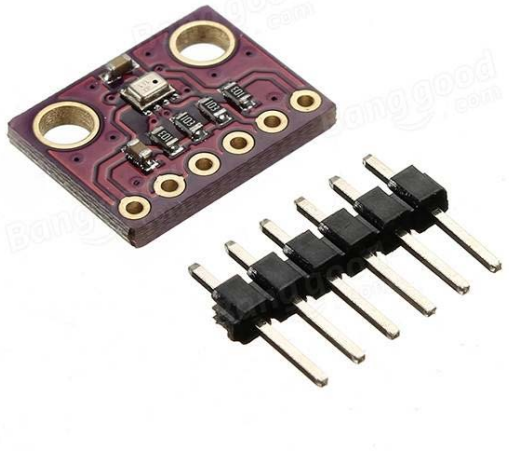
Part I: Basics on Arduino Nano Board and Sensors



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_{DD} and V_{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
ESD	HBM, at any Pin		±2	kV
	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	$t_{SU:STO}$		4.7			µs

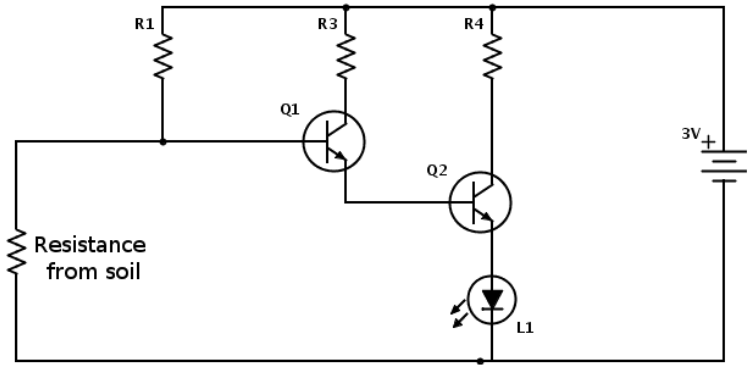
Part I: Basics on Arduino Nano Board and Sensors

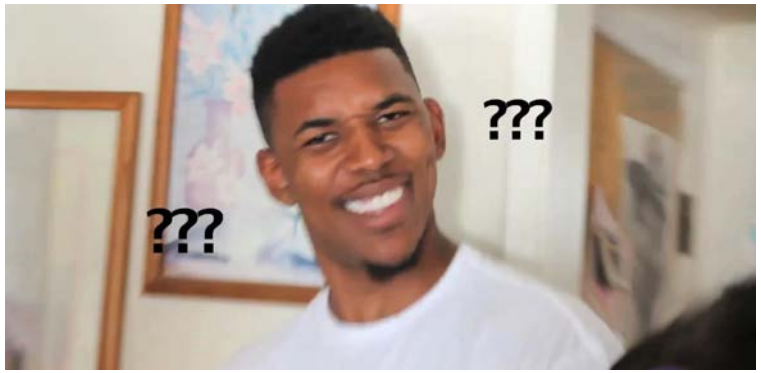
Liquid Crystal Display Monitor 2004A

Display information acquired

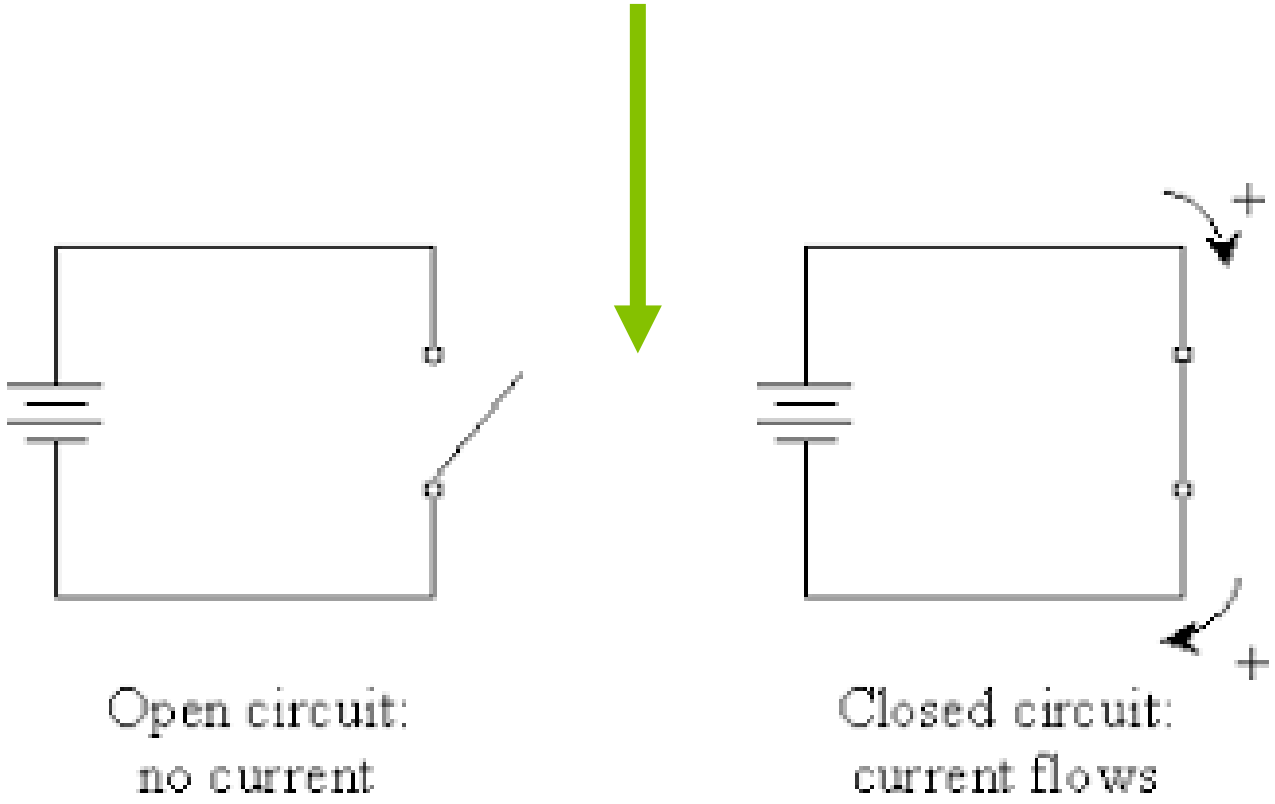
PIN NO	SYMBOL	FUNCTION
1	VSS	Power Ground
2	VDD	Power supply for logic circuit(+5V)
3	VO	For LCD drive voltage (variable)
4	RS(C/D)	H: Display Data, L:Display Instruction
5	R/W	H: Data Read (LCM to MPU) ; L: Data Write (MPU to LCM)
6	E	Enable signal. Write mode (R/W = L) data of DB<0:7> is latched at 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	A	Power for LED Backlight (+5V)
16	K	Power for LED Backlight (Ground)

Part II: Electronic Circuitry

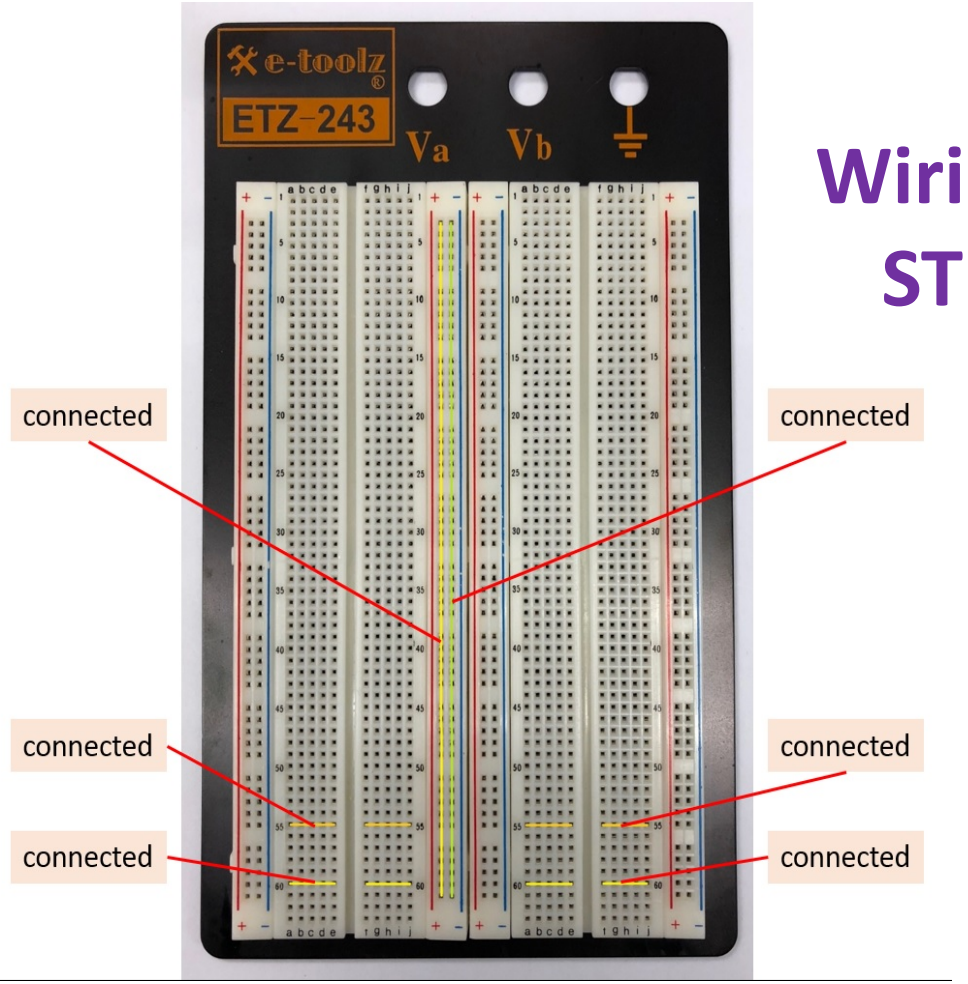




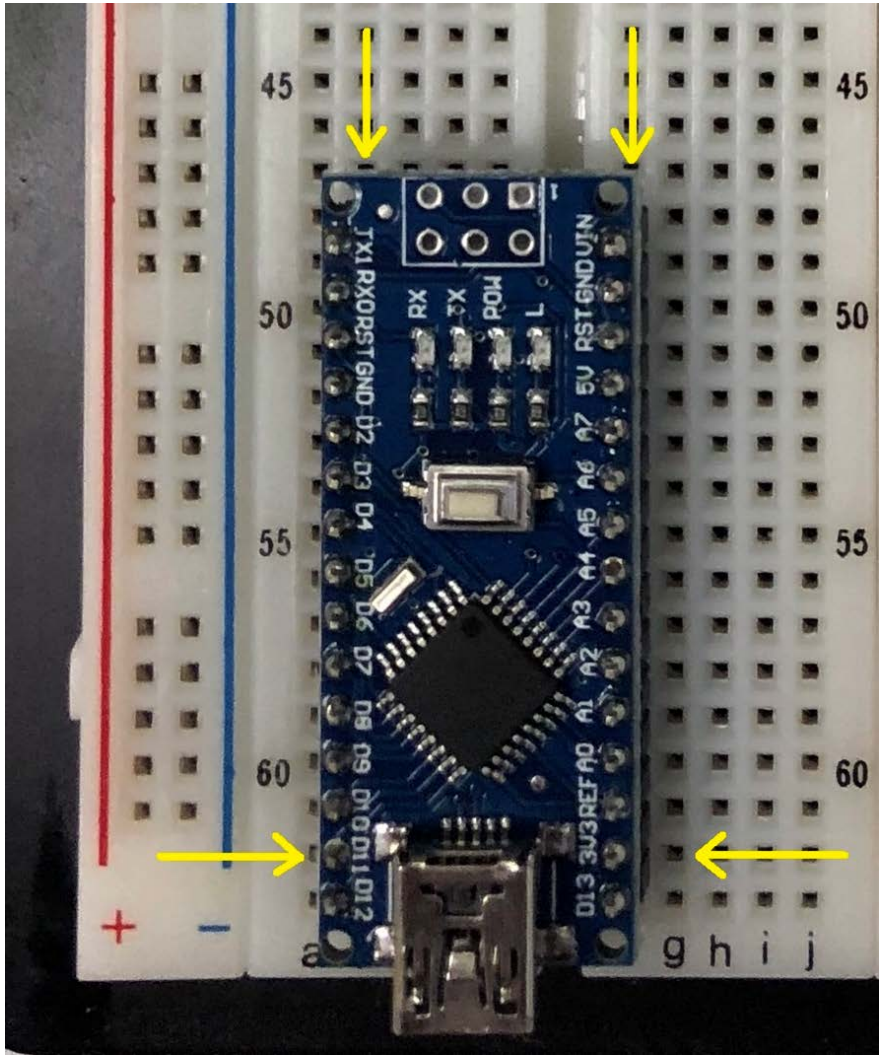
Simple Closed Circuit



Part II: Electronic Circuitry

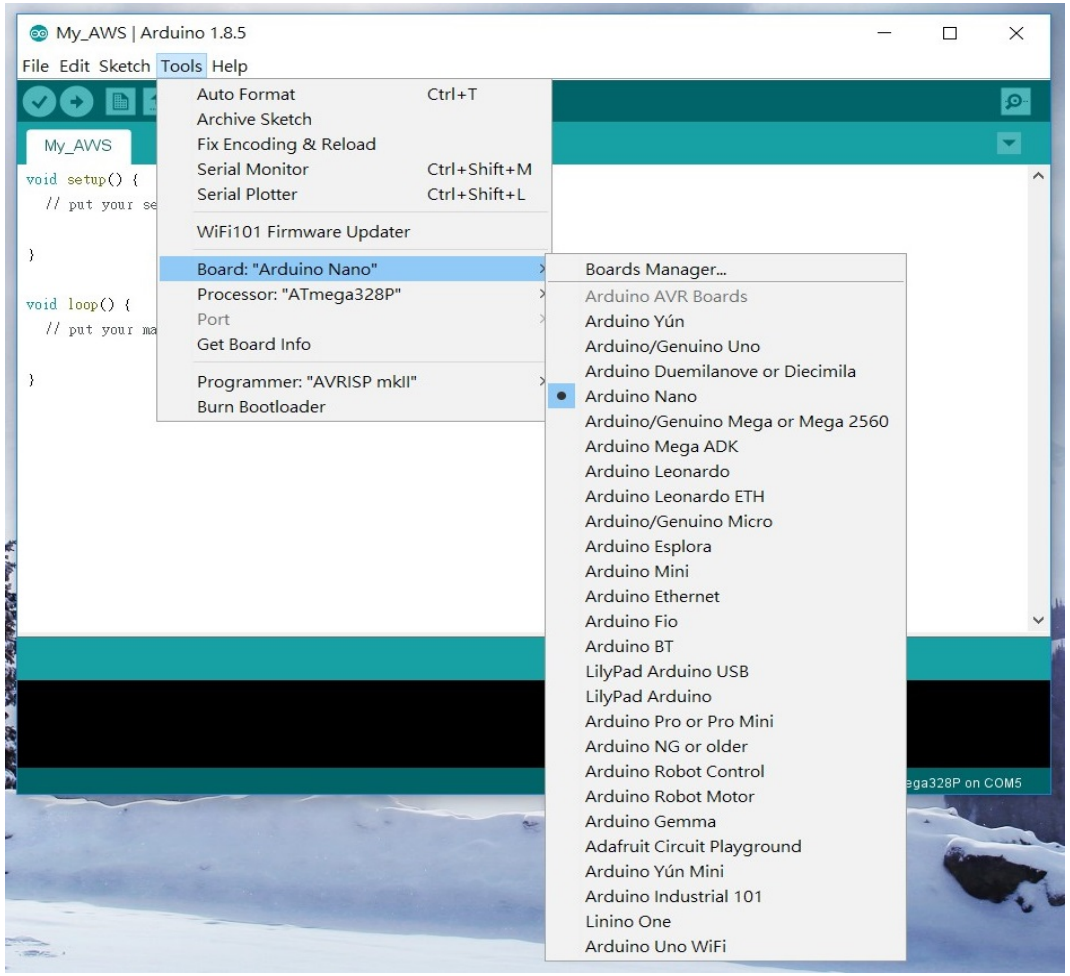


Wiring with sensors STEP BY STEP !!!



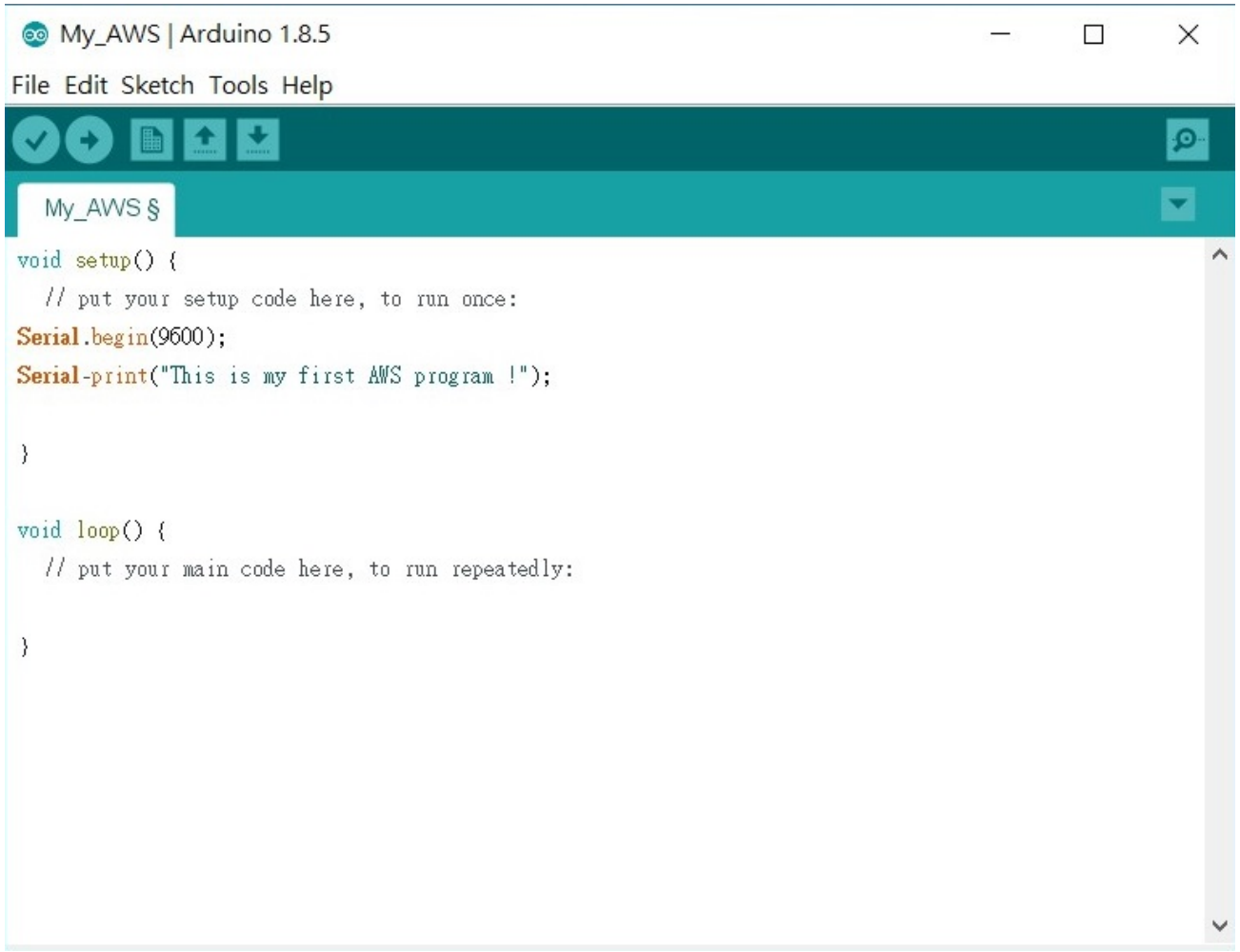
Part III: Get Started With Arduino Programming

Running the Arduino IDE and Selecting a proper Arduino board



Part III: Get Started With Arduino Programming

Setting up an appropriate Communication Port

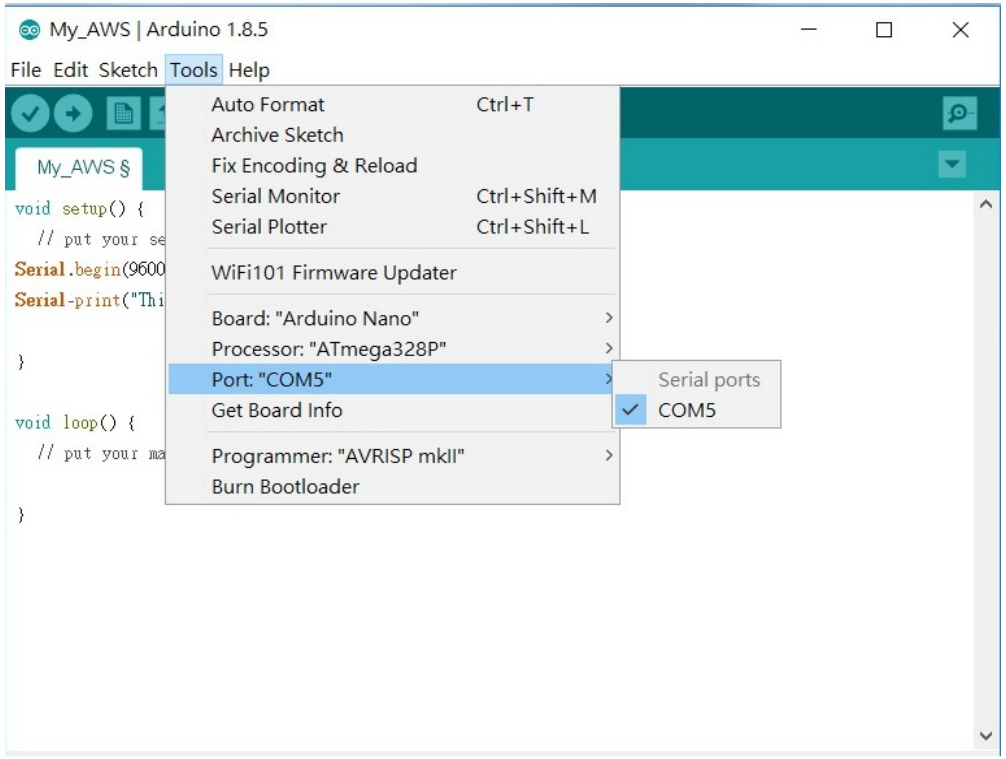


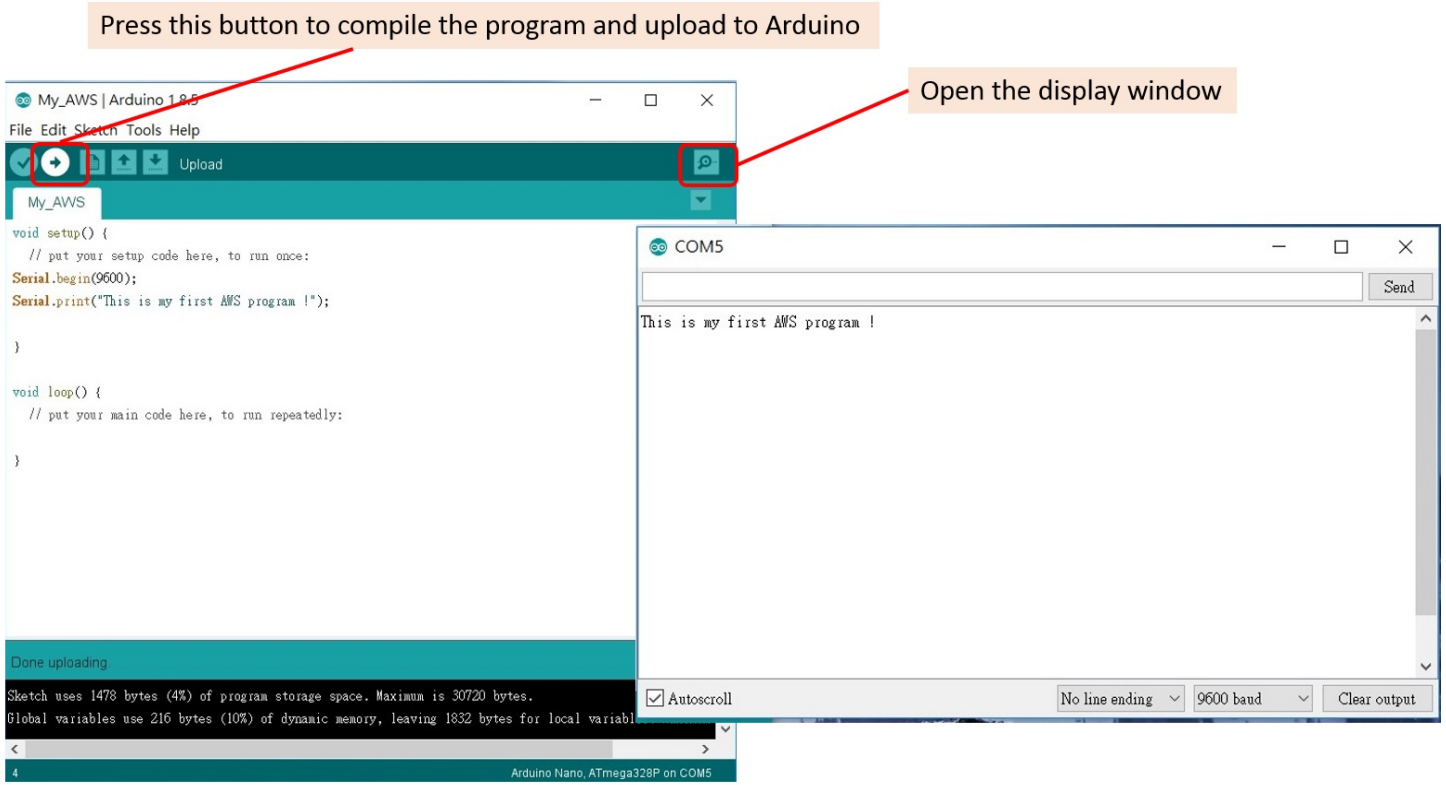
Opens up the USB port for serial communication and set the baud rate to 9600 bps

Prints the value passed into the brackets (“ ”) on to the Serial Monitor

Part III: Get Started With Arduino Programming

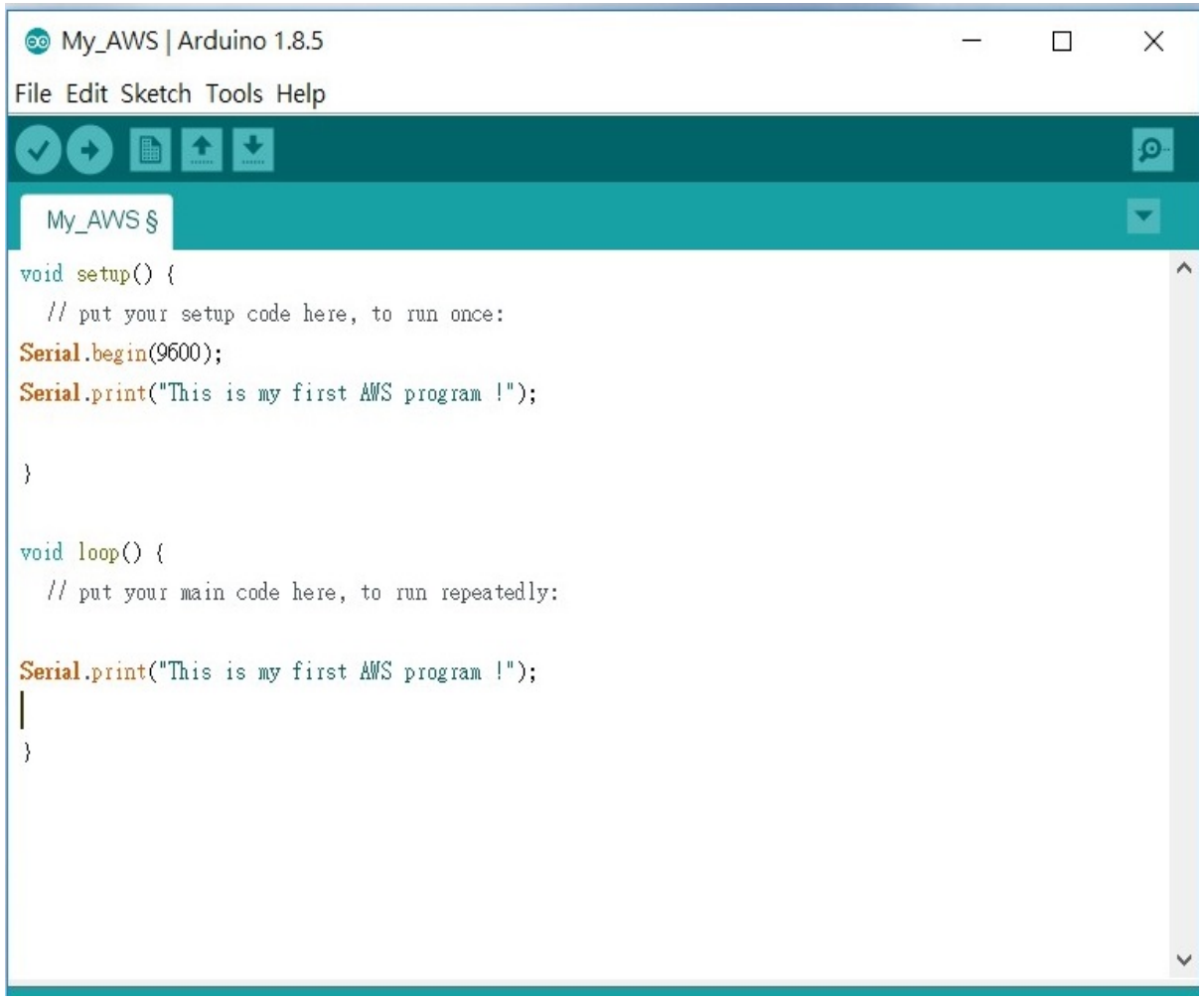
Basic structure of a new project file

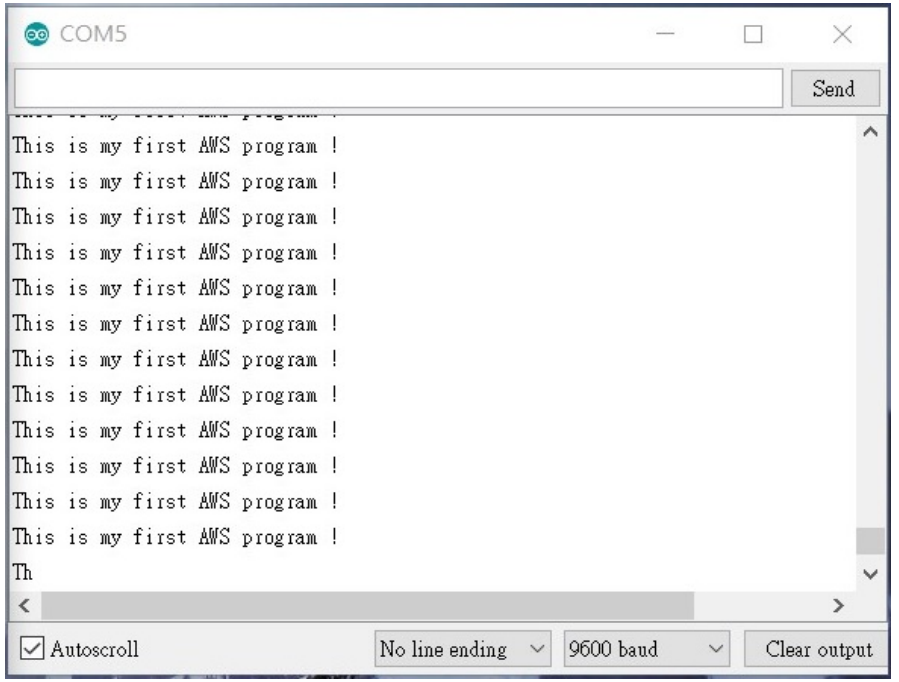




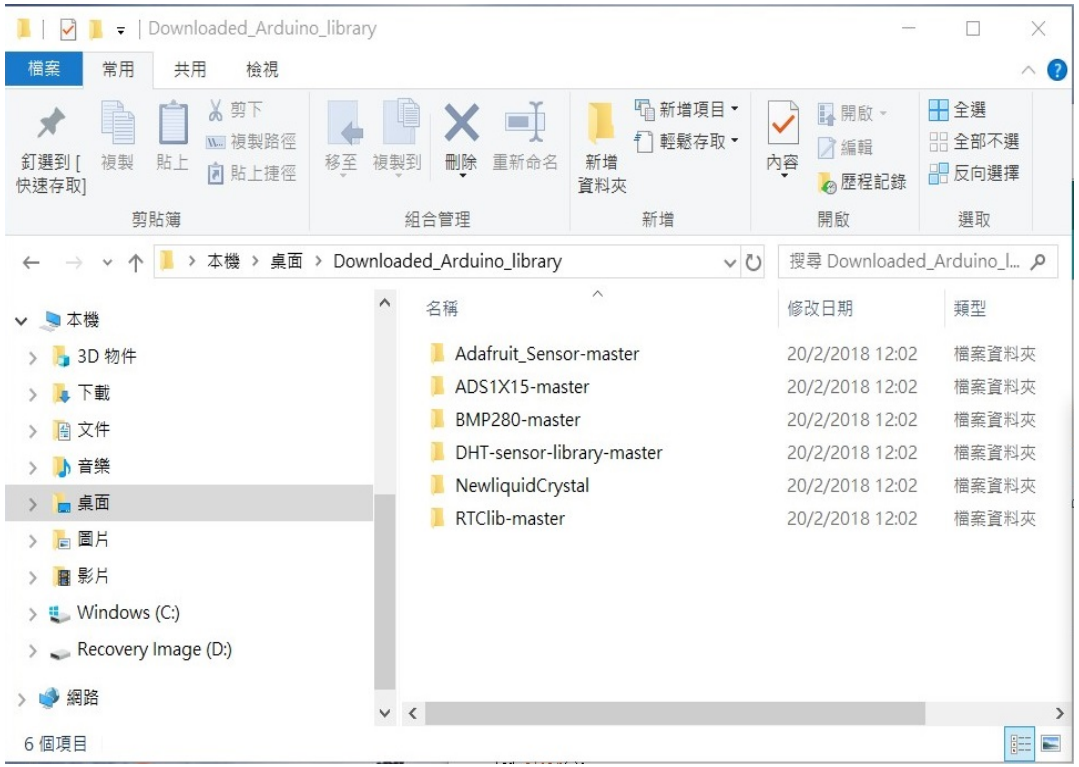
Part III: Get Started With Arduino Programming

Using the loop() function

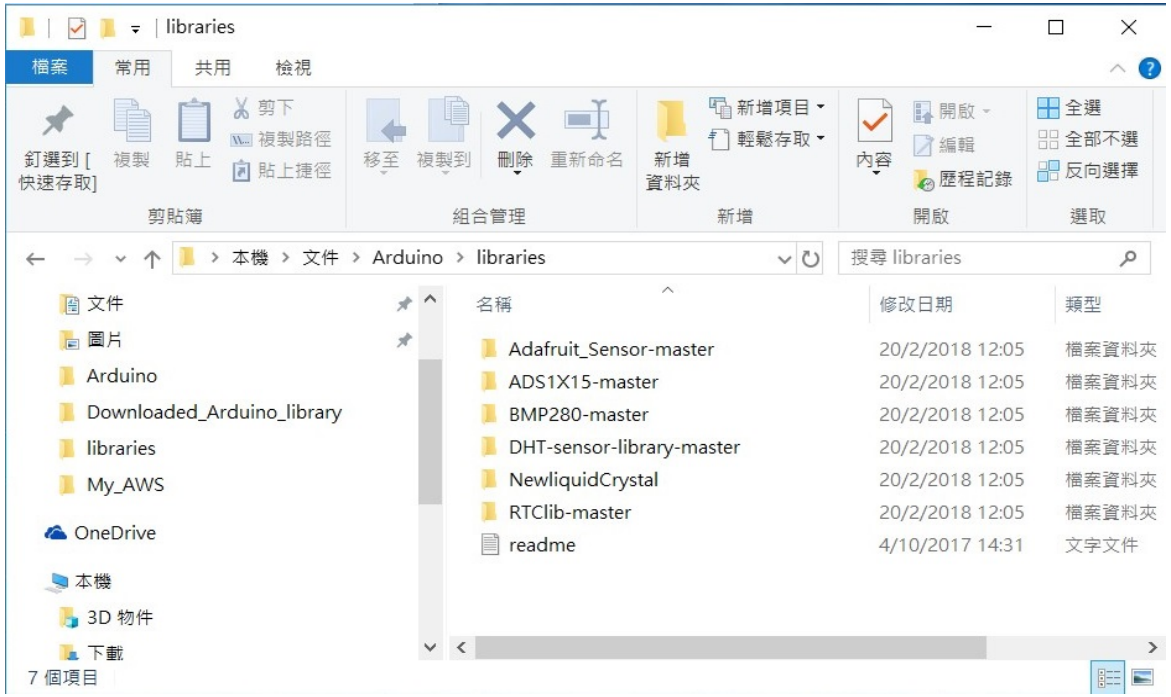




Part IV: Download Your Libraries



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

Welcome to follow our social media pages ~