



Internet of Things Weather Station

IEEE Northern Virginia Section

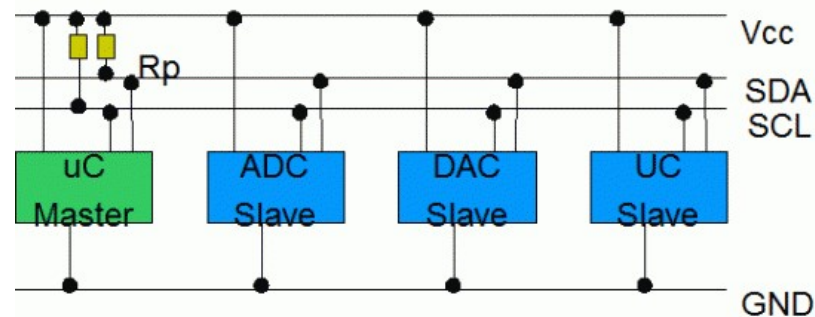
Hands-On Professional Development Series

October 29, 2016 Montgomery College

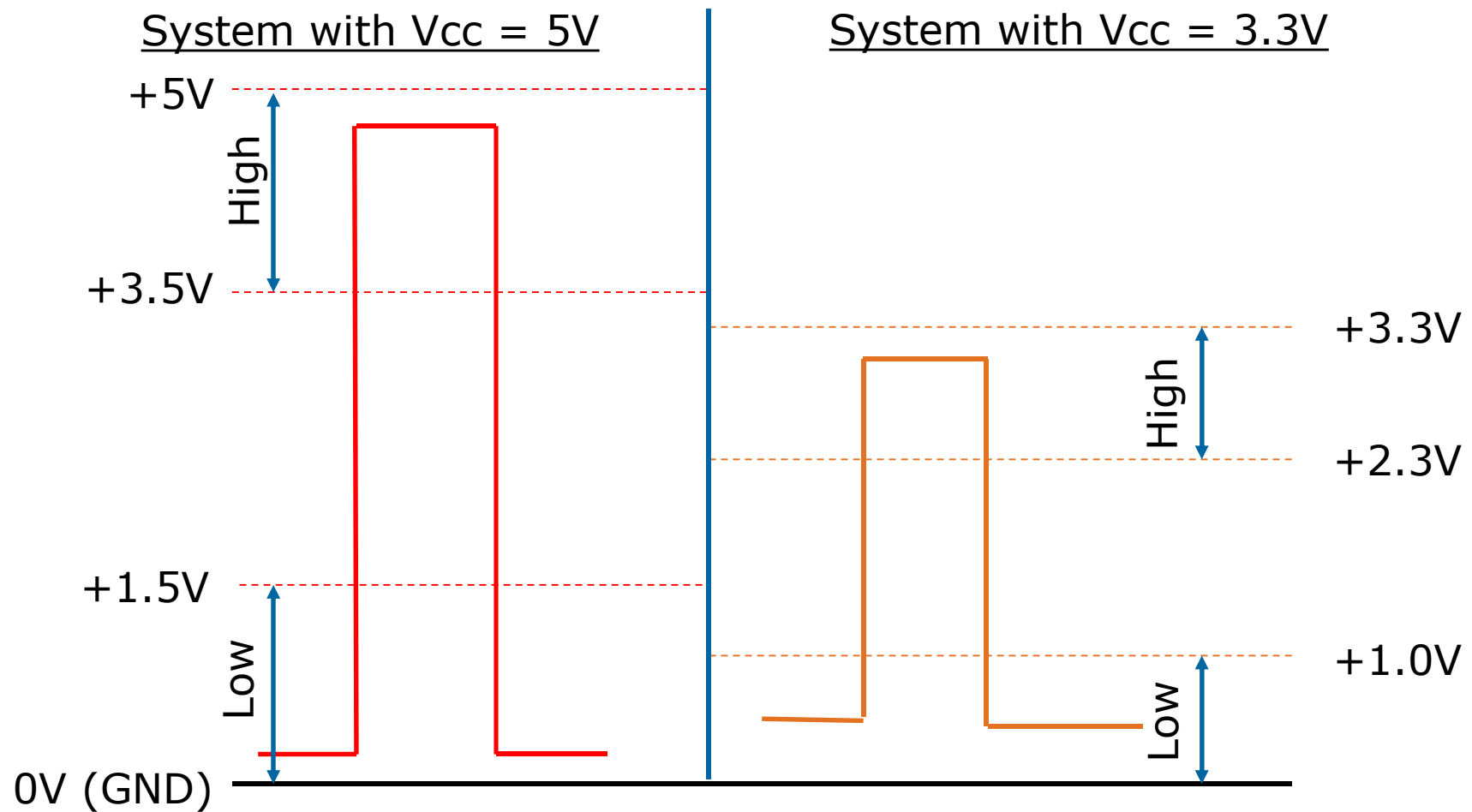
Sketch 02 – Hello World

Interfaces with the world

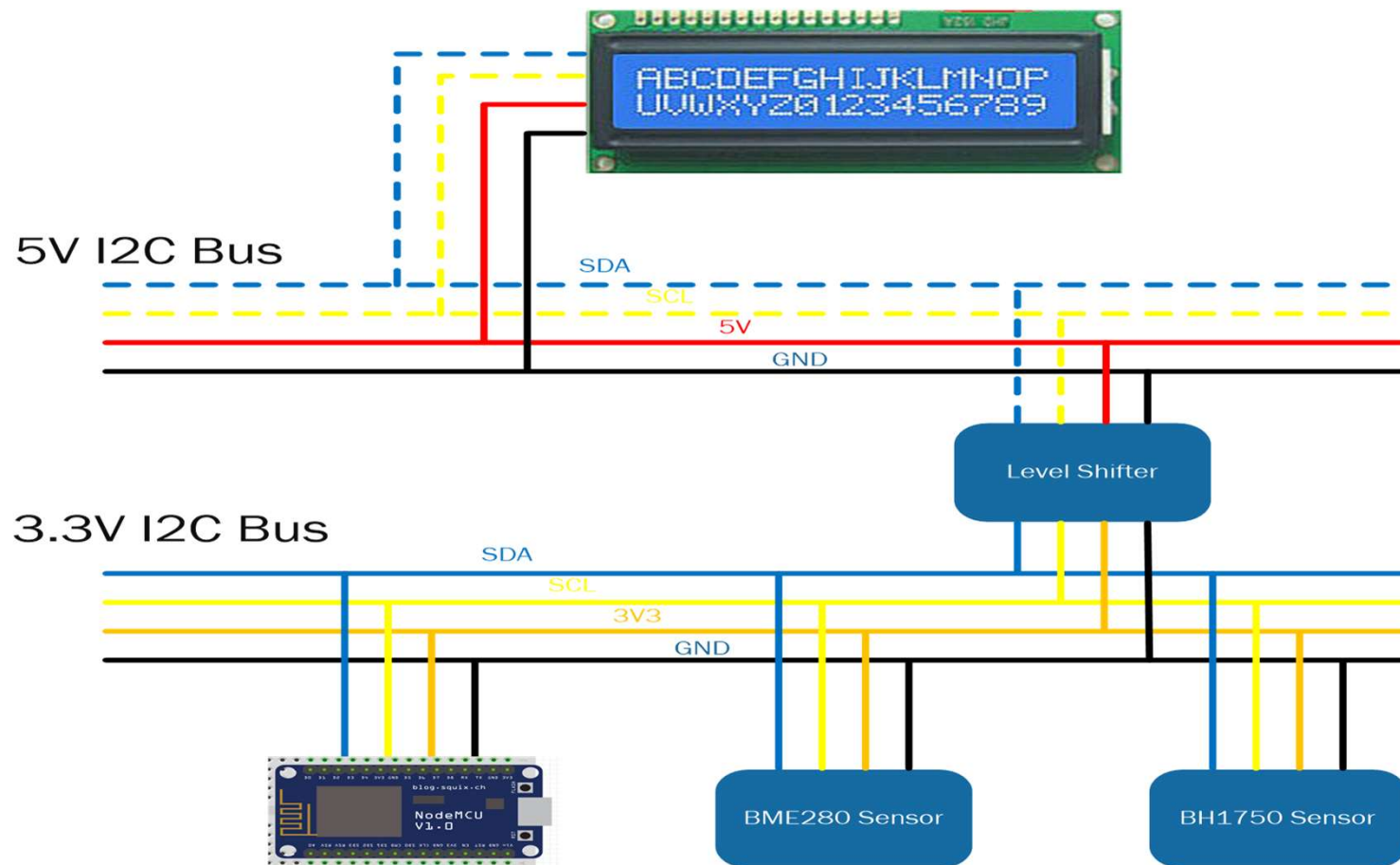
- Digital – Direct digital input or output, HIGH or LOW
- Analog – Any signal that can be converted to a voltage
- Inter Integrated Circuit (I2C) – 2 wires + power and ground
 - Data is digital regardless of parameter being measured
 - Each device has unique address
 - Many components, sensors & small networks use I2C
 - Needs a “pullup” resistor on the SCL and SDA lines



I2C Signal Levels



Weather Station I2C Bus System

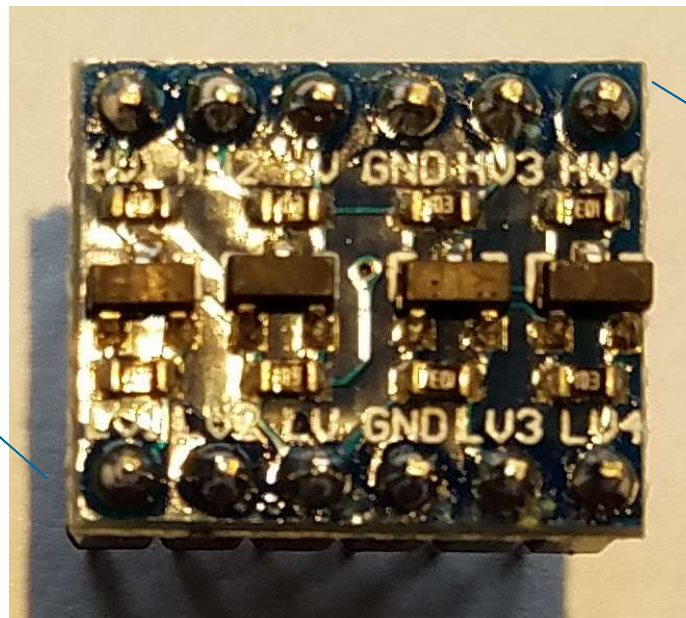


Level Shifter

4-Channel Bi-Directional Level Shifter

#1 #2 HV GND #3 #4

LV Side
(3.3Volts)



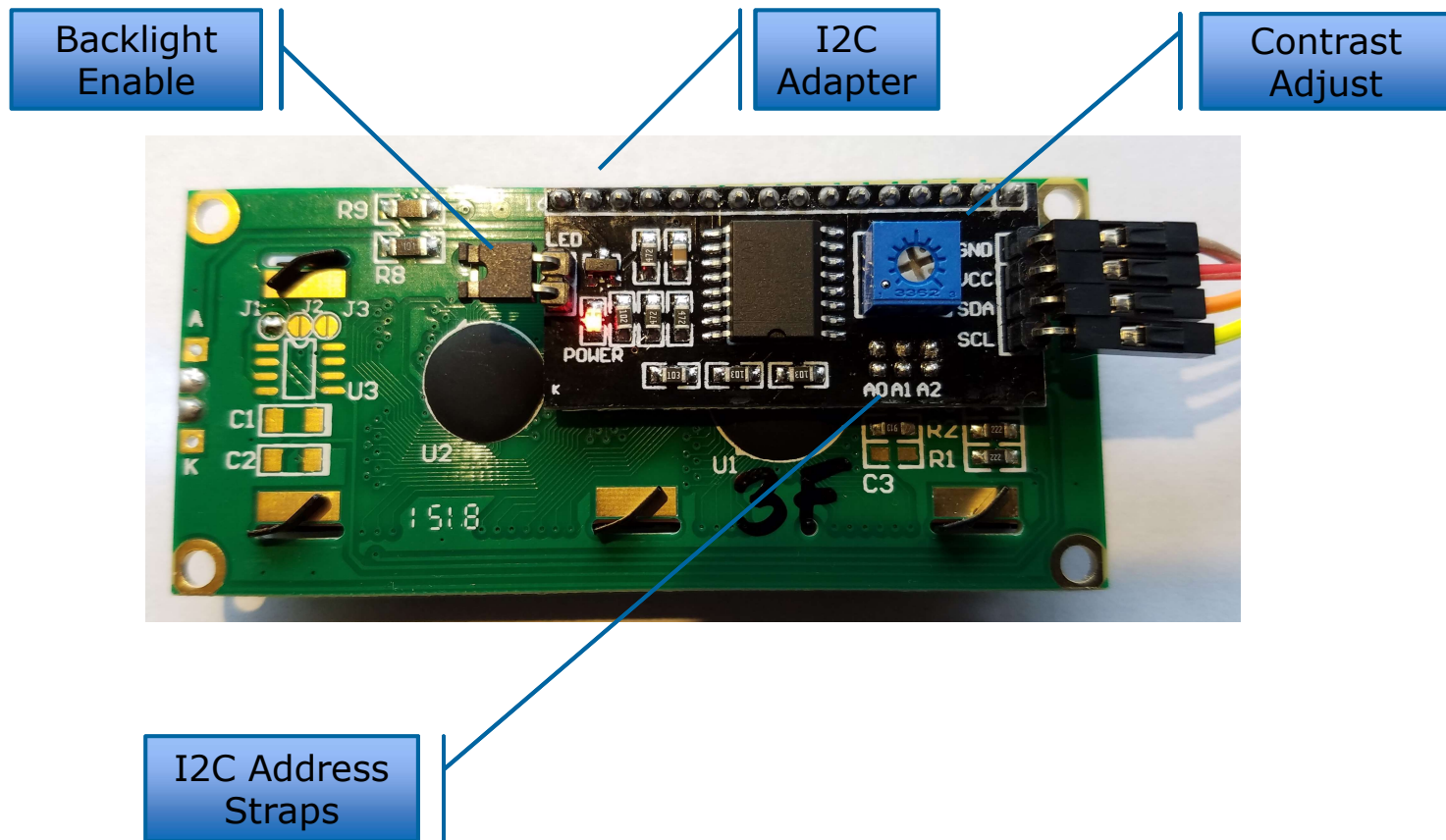
HV Side
(5 Volts)

#1 #2 LV GND #3 #4

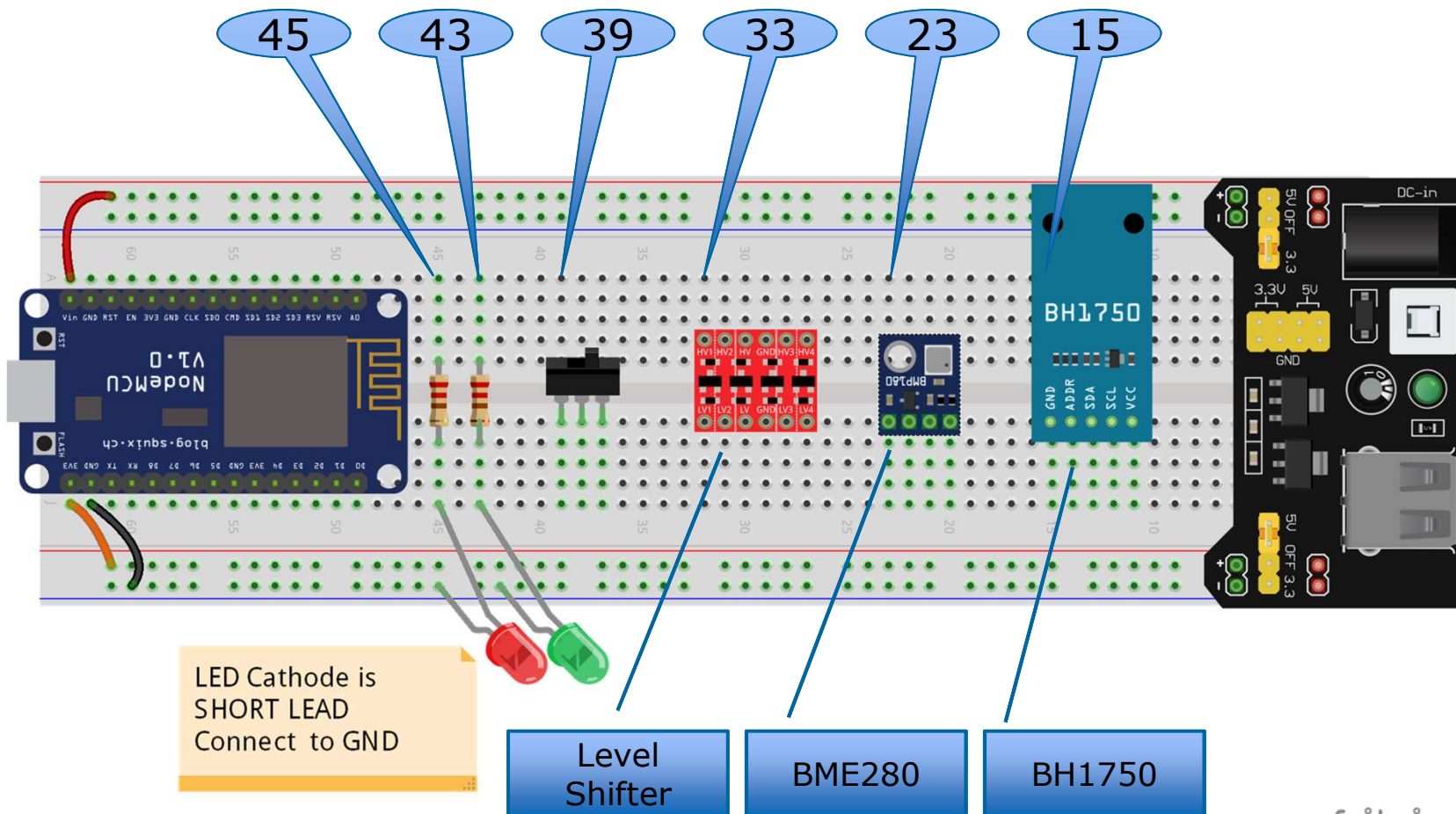
Liquid Crystal Display

- Search term: “LCD 1602” – 16 characters / 2 lines
- Strictly 5-Volt device, 8-bit parallel interface
- Our units equipped with an I2C to parallel adapter
- Address defaults to 0x27. (Sometimes!)
- A0, A1, A2 straps select different I2C address
- Carefully adjust potentiometer for best contrast

LCD with I2C Adapter



Parts Placement



Insert Components

STEPS PROGRESS LEFT TO RIGHT:

1. Insert one leg of 200Ω resistor into column **45** above middle groove. Other end of resistor in same column below groove.
2. Insert **long leg** of LED in column 45. **Short leg** in (-) bus.
3. Insert one leg of 200Ω resistor into column **43** above middle groove. Other end of resistor in same column below groove.
4. Insert **long leg** of LED in column 43. **Short leg** in (-) bus.
5. Carefully insert switch with left pin in column 39.
6. Insert level shifter with left pins in column 33.
7. Insert BME280 with VIN pin in column 23.
8. Insert BH1750 with GND pin in column 15.

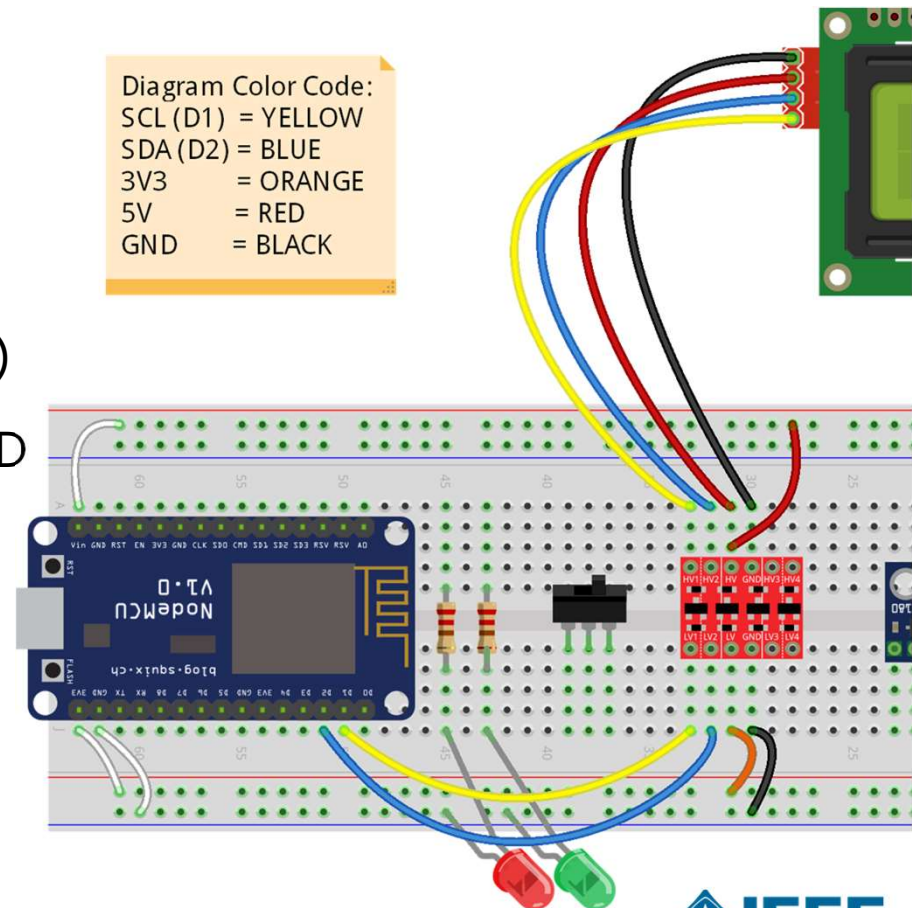
Connect the MCU to Level Shifter & LCD

1. NodeMCU to Level Shifter:

- **D1** to **LV1**
- **D2** to **LV2**
- **+3.3V** rail to **LV**
- **- rail** to **GND**
- **+5V** rail to **HV** (above groove)

2. Use 4-wire ribbon to connect LCD to HV pins as follows:

- **SCL** to **HV1**
- **SDA** to **HV2**
- **VCC** to **HV**
- **GND** to **GND**



Install the LCD I2C library

1. Download liquidcrystal-I2C from w4krl.com
2. Reconnect USB cable to NodeMCU
3. Run the Arduino IDE
4. Open Sketch | Include Library | Add .ZIP Library
5. Navigate to your download folder
6. Click on: **LiquidCrystal-I2C.zip**
6. Click Open

IEEE_IoT_Sketch02_Hello_World

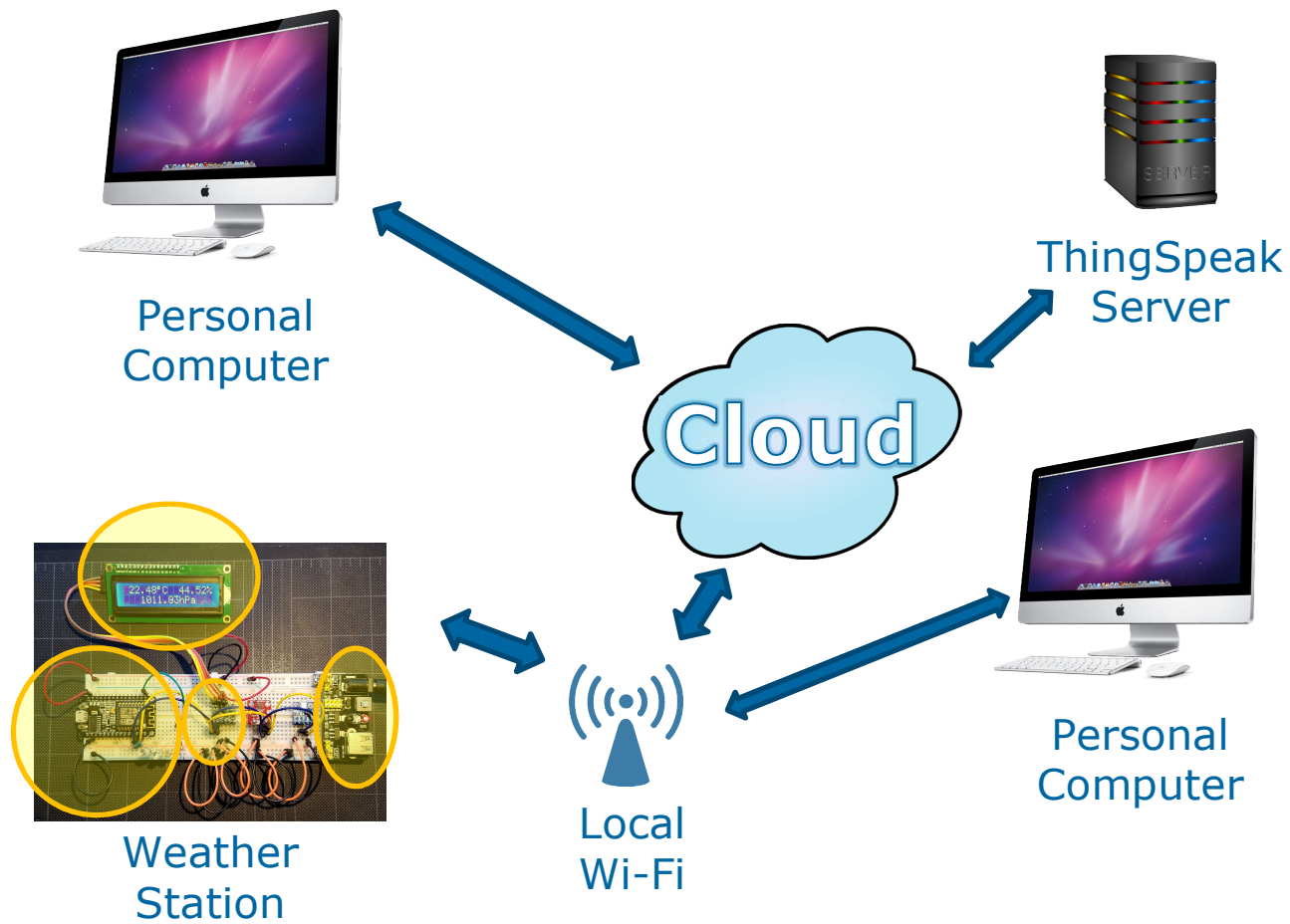
1. Open Arduino
2. File | Sketchbook |
IEEE_IoT_Sketch02_Hello_World_V02
3. Verify and Upload
4. View message on LCD
5. Adjust potentiometer for contrast if needed

Hello World

```
27 #include <Wire.h>           // I2C bus driver
28 #include <LiquidCrystal_I2C.h> // LCD display (I2C)
29
30 // ***** INSTANTIATE LCD *****
31 // usage: lcd(I2C address, number of characters per line, number of lines)
32 // use IEEE_IoT_I2C_scanner if address is not known
33
34 // usage LiquidCrystal_I2C object_name(I2C_address, columns, rows);
35 LiquidCrystal_I2C lcd(0x3f, 16, 2);
36
37 // ***** SETUP *****
38 void setup()
39 {
40     lcd.begin();           // initialize the lcd
41     lcd.backlight();       // turn on backlight
42     lcd.print("IEEE Northern VA"); // prints at (0, 0)
43     lcd.setCursor(2, 1);   // move to next line
44     lcd.print("Hello World"); // prints at second column
45 } //setup()
```

Accomplishments

- ▶ We now have a development platform for a multitude of projects:
 - A Wi-Fi Enabled Processor
 - Arduino-style C++ Coding
 - Access to huge Arduino hardware/software ecosystem
 - Text-based Display
 - Power Supply
 - I2C Buses for 3.3V and 5V devices
 - Unused but available analog input & multiple GPIO pins



Questions?