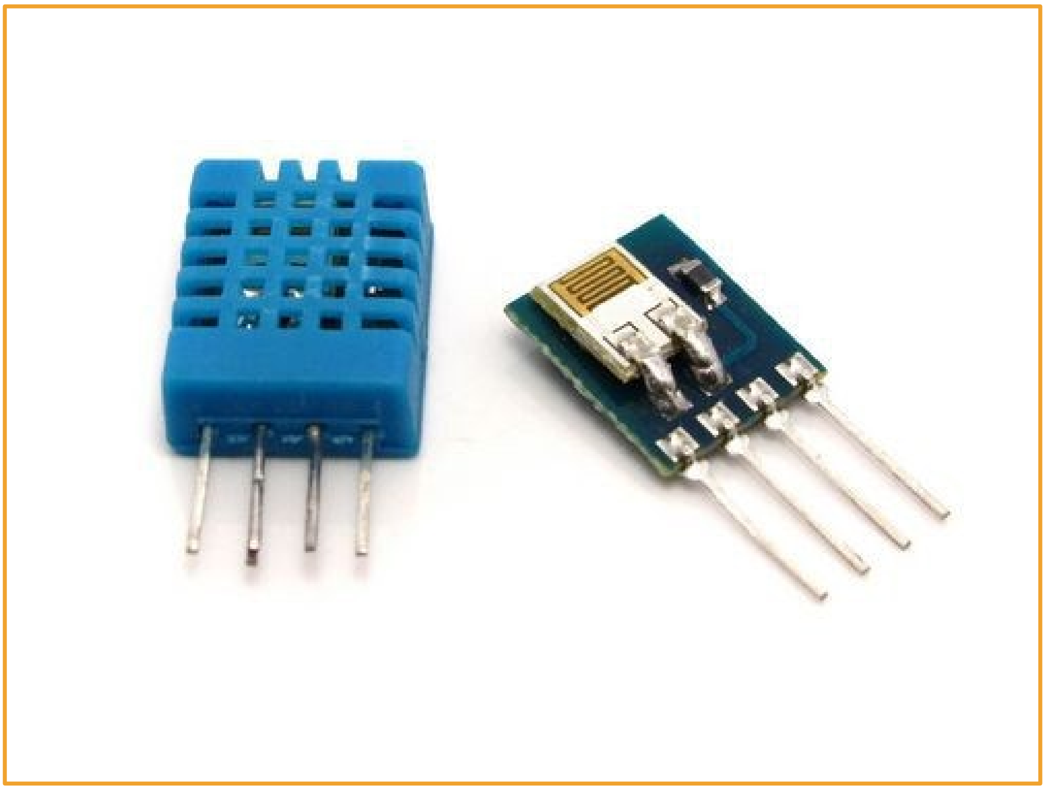
Temperature-Humidity Sensor

Introduction

DHT11 digital temperature-humidity sensor is a compound sensor containing calibrated digital signal output.

It utilizes special digital module acquisition technology and humidity-temperature sensor technology to ensure a high reliability and excellent long-term stability.The sensor consists of a resistance-type moisture element and a NTC temperature measuring element, and it is connected to a high-performance 8 bits microcontroller.

Picture of Temperature-Humidity Sensor



Pin Description

1, VDD: 3.5 V to 3.5 V DC power supply

2, DATA: serial data, single bus, has to be connected to a nearly 5.1 K pull-up resistor, thus DATA is always at the high level during free time.

3, GND: grounding, power supply cathode

4, NC: Not Connected

Working Principle of DTH11

DHT11 communicates with microprocessor with single bus. It only needs one thread, sends 40 data at a time, big endian.

Data Format

8 bits integer data of humidity + 8 bits decimal data of humidity + 8 bits integer data of temperature + 8 bits decimal data of temperature + 8 bits parity bit

Check Algorithm

Adding the integer to the decimal of humidity and temperature, only keeping low 8 bits. The communication agreement of Microprocessor (M0) and DHT11: the host-slave structure. DHT11 is the slave, while M0 is the host. The slave can only respond when the host is calling.

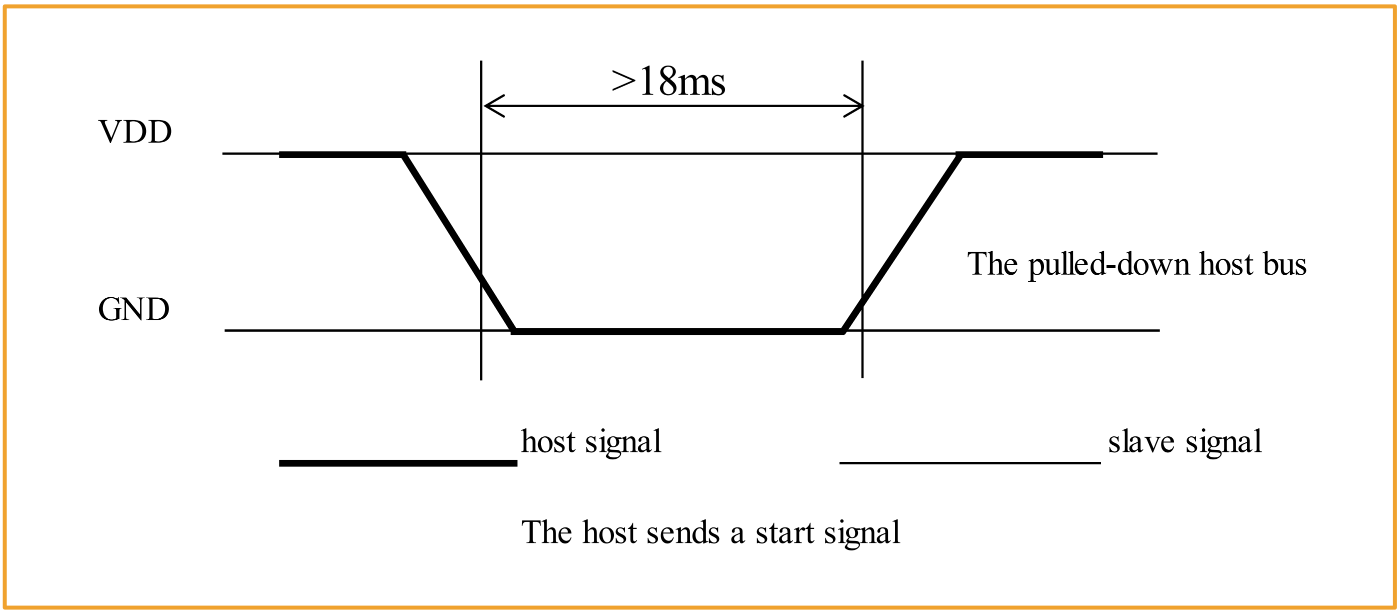
Detailed Process

M0 sends start signals -> DHT responses signals -> DHT informs M0 that it is ready to accept signals - > DHT sends the prepared data - > DHT ends signals - > DHT internally retests the environmental temperature and humidity, records the data for the next start signal from M0.

Obtained by the process, the data M0 collected each time is always the last-time DHT data. If we want to get real-time data, then M0 can collect two successive data, but, officially, reading DHT many times continuously is not recommended. If the interval time of each read is more than 5 seconds, it is enough to get accurate data. DHT needs 1s to stabilize when it is powered up.

M0 Start Signal

1, Setting the DATA pin as the output state and outputs high level
2, Then the DATA pin outputs low level, the duration is more than 18ms, after being detected, DHT is from low power mode - > high speed mode.
3, Setting the DATA pin as input state, it turns into high level because of the pull-up resistor, so as to complete a start signal.



The host sends a start signal

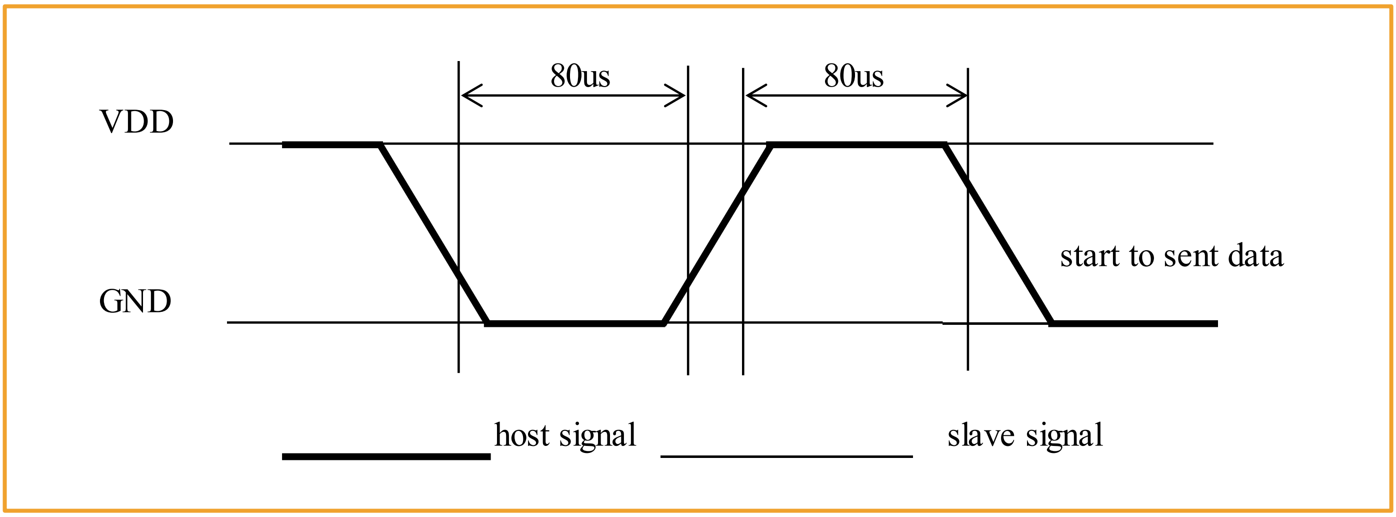
THD Response Signals, Ready Signals

(DHT shifts into high speed mode from the low power mode when the M0 DATA pin is outputting low level, waiting for the DATA pins into a high level)

1, DHT outputs 80us low level as the response signal

2, DHT outputs 80us high level, informing microprocessor to be ready to receive data

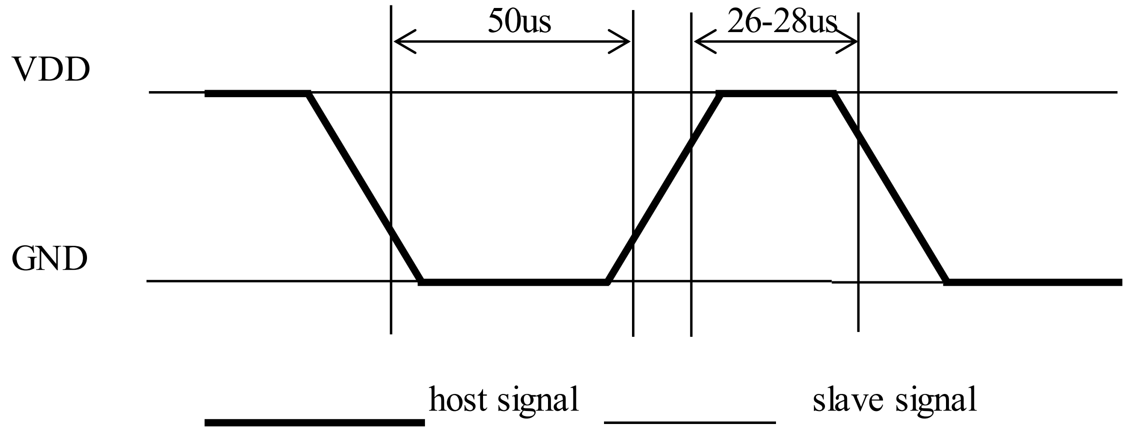
3, Sending 40 data continuously (data from the last time)



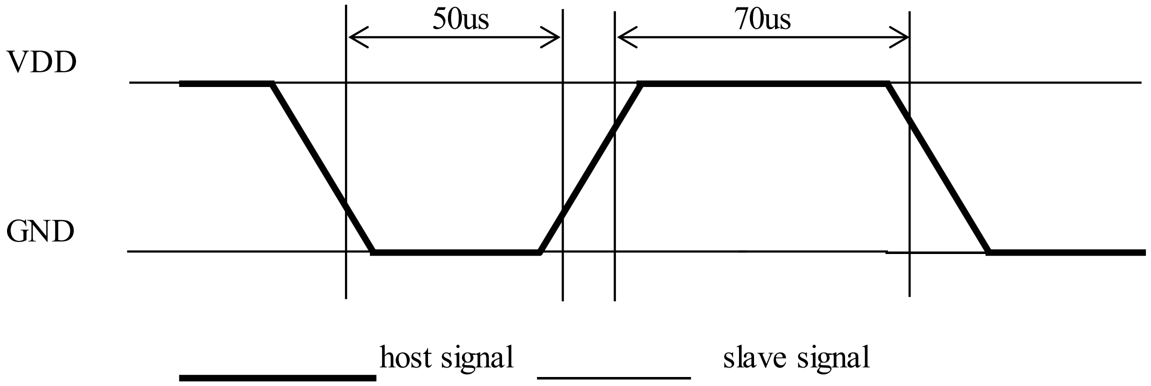
DHT Data Signals

"0" format data: 50us low level + 26-28us high level

"1" format data: 50us low level + 70us high level



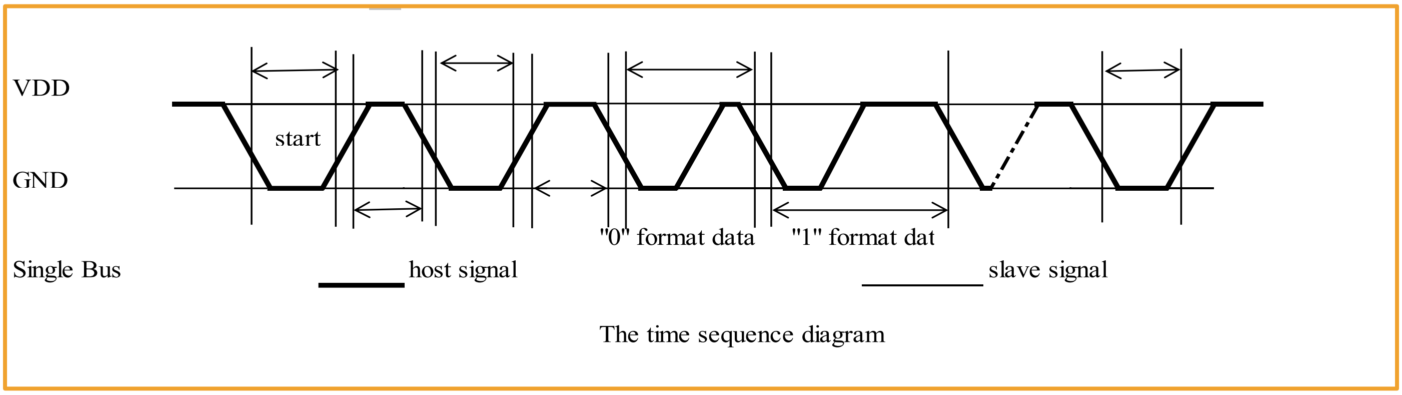
"0" format data



"1" format data

DHT End Signal

DHT DATA pin outputs 40 data, after continually outputs low level for 50us, it shifts into input state. Because of the pull-up resistor, DATA turns into high level. DHT internally retests the environmental temperature and humidity, records the data for the next start signal from the outside.



The time sequence diagram

The purpose of this experiment is to detect the temperature and humidity in the air using the temperature-humidity sensor. The sensor will send collected data to the ARDUINO board. After processing, the results will be reflected in the LCD, the first line shows the temperature, the second shows the humidity.

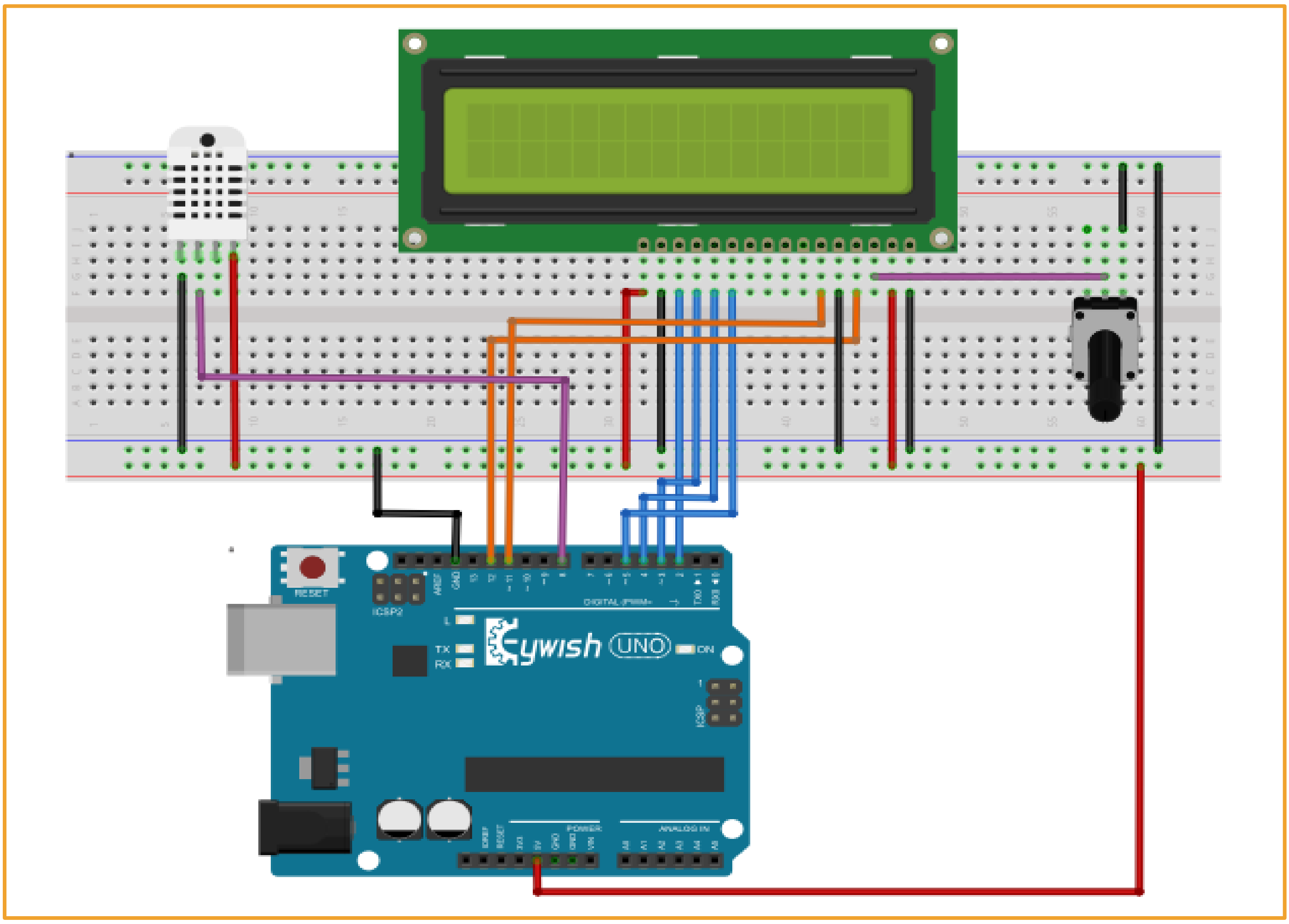
Component List

- Keywish Arduino UNO R3 mainboard
- Breadboard
- USB cable
- LCD1602 * 1
- DTH11 sensor * 1
- Potentiometer * 1
- Several breadboard jumpers

Wiring of Circuit

arduino Uno	lcd1602
5	11(DB4)
4	12(DB5)
3	13(DB6)
2	14(DB7)
11	6(E)
12	4(RS)

arduino Uno	Temperature-Humidity Sensor
8	Dout


RESET
ICSP2
AREF
GND
DIGITAL (PWM~)
TX
RX
L
Keywish
UNO
ON
ICSP
POWER
ANALOG IN

Code

```
#define   DB4   5  // lcd1602 DB4
#define   DB5   4  // lcd1602 DB5
#define   DB6   3  // lcd1602 DB6
#define   DB7   2  // lcd1602 DB7

#define   LCD1602_RS   12
#define   LCD1602_E   11
#define   DHT11PIN    8
dht11 DHT11;
// initialize the library with the numbers of the interface pins
LiquidCrystal lcd(LCD1602_RS,LCD1602_E,DB4,DB5,DB6,DB7);

void setup() {
    pinMode(DHT11PIN,OUTPUT);
    // set up the LCD's number of columns and rows:
    lcd.begin(16, 2);
}

void loop() {
    int chk = DHT11.read(DHT11PIN);
    lcd.setCursor(0, 0);
    lcd.print("Tep: ");
    lcd.print((float)DHT11.temperature, 2);
    lcd.print("C");
    // set the cursor to column 0, line 1
    // (note: line 1 is the second row, since counting begins with 0):
    lcd.setCursor(0, 1);
    // print the number of seconds since reset:
    lcd.print("Hum: ");
    lcd.print((float)DHT11.humidity, 2);
    lcd.print("%");
    delay(200);
}
```

Experiment Result