Dust Sensor User Manual

1. Characteristics and principle

This module is a dust sensing system based on the sensor GP2Y1010AU0F. It integrates an internal infrared emitting diode (IRED) to detect the reflected light of dust in air and generate an output voltage proportional to dust density so as to measure dust and smoke concentration.

Measured object:	Fine particle larger than 0.8μm in diameter
Measurement range:	500μg/m^3
Output:	Analog voltage
Working voltage:	2.5V~5.5V
Dimensions:	63.2mm×41.3mm
Fixed hole size:	2.0mm
Air hole size:	9.0mm

1.1. Output characteristics

The output voltage of the module is proportional to dust density in the range of 0 to 0.5mg/m3, as Figure 1 shows.

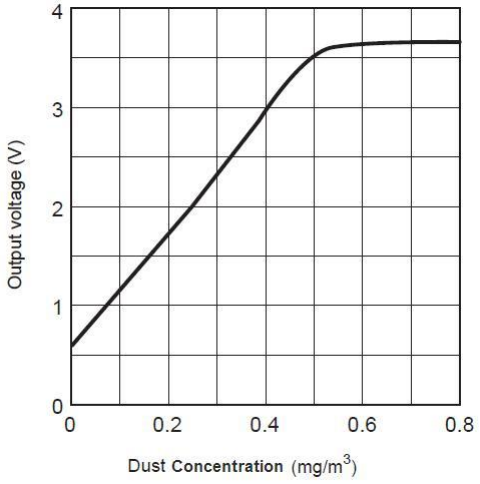

Figure 1: Output Voltage vs. Dust Concentration

1.2. Control principle

1) Enable the internal infrared emitting diode by setting the pin I_{LED} to HIGH.
2) Wait 0.28ms, then the external controller starts to sample the voltage from the pin A_{OUT} of the module. Notes that the output wave will take 0.28ms to reach steady state after the internal infrared emitting diode is enabled, as Figure 2 shows.

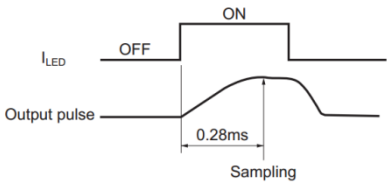

Figure 2: Sampling timing of output pulse

3) There is a period of 0.04ms for sampling. When finished, set the pin I_{LED} to LOW to disable the internal infrared emitting diode.
4) Calculate the dust concentration according to the relationship between output voltage and dust concentration. For more detailed information, please refer to the relative Demos.

Note: The output voltage has been divided (see schematic), so that the voltage measurement should x 11 to get the actual voltage.

1.3. Applications

It is applied to detect of dust in the air, such as the applications of Air Purifier, Air Monitor and PM2.5 Detector.

2. How to use

2.1. Pin descriptions

Pin No.	Symbol	Description
1	V_{CC}	Supply voltage (2.5V-5.5V)
2	GND	Ground
3	A_{OUT}	Analog voltage output
4	I_{LED}	LED terminal current

Table 1: Pin descriptions

2.2. How to use with development board

In this section, we will illustrate how to use this module to work with the development boards.

2.2.1. Open103R board with main control chip STM32F103R

1) Compile and download the Demo to the development board;
2) Connect the development board to your PC via the USART2 interface on the board and with a serial communication module. Here is the serial setting by the serial debugging assistant:

Baud rate	115200
Data bit	8
Stop bit	1
Parity bit	None
Flow control bit	None

3) Connect the module and the Open103R development board as below:

Module pin	Open103R pin
V_{CC}	3.3V or 5V
GND	GND
A_{OUT}	GPIOA.6
I_{LED}	GPIOA.7

Table 2: The relationship between module pins and Open103R pins

4) Power up the development board, and then you can see the relative data of current dust concentration shown on the serial assistant. And there will be obvious changes of the data displayed when lots of fine particle go through the

air hole of the module. For more information, please see to the section Appendix in this document.

2.2.2. Open407Z-C board with main control chip STM32F407Z

1) Compile and download the Demo to the development board;
2) Connect the development board to your PC via the USART2 interface on the board and with a serial communication module. Here is the serial setting by the serial debugging assistant:

Baud rate	115200
Data bit	8
Stop bit	1
Parity bit	None
Flow control bit	None

3) Connect the module and the Open407Z-C development board as below:

Module pin	Open407Z-C pin
V_{CC}	3.3V or 5V
GND	GND
A_{OUT}	GPIOA.6
I_{LED}	GPIOA.7

Table 3: The relationship between module pins and Open407Z-C pins

4) Power up the development board, and then you can see the relative data of current dust concentration shown on the serial assistant. And there will be obvious changes of the data displayed when lots of fine particle go through the air hole of the module. For more information, please see to the section Appendix in this document.

2.2.3. NUCLEO-F103RB board with main control chip STM32F103R

There are two versions of the Demos for this development board: Mbed Version and ST Library Version. And the relative operation steps and the experimental phenomena of these two versions are the same.

1) Compile and download the Demo to the development board;
2) Connect the development board to your PC via the USB interface. Here is the serial setting by the serial debugging assistant:

Baud rate	115200
Data bit	8
Stop bit	1
Parity bit	None
Flow control bit	None

3) Connect the module and the XNUCLEO-F103RB development board as below:

Module pin	XNUCLEO-F103RB pin
V_{CC}	3.3V or 5V
GND	GND
A_{OUT}	A0
I_{LED}	D7

Table 4: The relationship between module pins and XNUCLEO-F103RB pins

4) Power up the development board, and then you can see the relative data of current dust concentration shown on the serial assistant. And there will be obvious changes of the data displayed when lots of fine particle go through the air hole of the module. For more information, please see to the section Appendix in this document.

2.2.4. Arduino UNO

1) Compile and download the Demo to the development board;
2) Connect the development board to your PC via the USB interface. Here is the serial setting by the serial debugging assistant:

Baud rate	9600
Data bit	8
Stop bit	1
Parity bit	None
Flow control bit	None

3) Connect the module and the development board as below:

Module pin	development board pin
V_{CC}	3.3V or 5V
GND	GND
A_{OUT}	A0
I_{LED}	D7

Table 5: The relationship between module pins and UNO PLUS pins

4) Power up the development board, and then you can see the relative data of current dust concentration shown on the serial assistant. And there will be obvious changes of the data displayed when lots of fine particle go through the air hole of the module. For more information, please see to the section Appendix in this document.

3. Appendix

3.1. Experimental phenomena

The relative data of current dust concentration will be displayed during the detection.

```
************************************ WaveShare ************************************
The current dust concentration is: 64.8 ug/m3
The current dust concentration is: 67.0 ug/m3
The current dust concentration is: 67.2 ug/m3
The current dust concentration is: 64.0 ug/m3
The current dust concentration is: 64.8 ug/m3
The current dust concentration is: 69.0 ug/m3
The current dust concentration is: 65.8 ug/m3
The current dust concentration is: 65.4 ug/m3
The current dust concentration is: 62.0 ug/m3
The current dust concentration is: 58.6 ug/m3
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Here is the air quality criterion:

PM2.5 density value (μg/m3)	Air quality index	Air quality level	Air quality evaluation
0-35	0-50	Level 1	Excellent
35-75	51-100	Level 2	Average
75-115	101-150	Level 3	Light pollution
115-150	151-200	Level 4	Moderate pollution
150-250	201-300	Level 5	Heavy pollution
250-500	≥300	Level 6	Serious pollution