Session 4

Research Center for Environmental Changes, Academia Sinica, Taiwan

AS-LUNG Manual

V2.0

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AS-LUNG
Academia Sinica.TAIWAN

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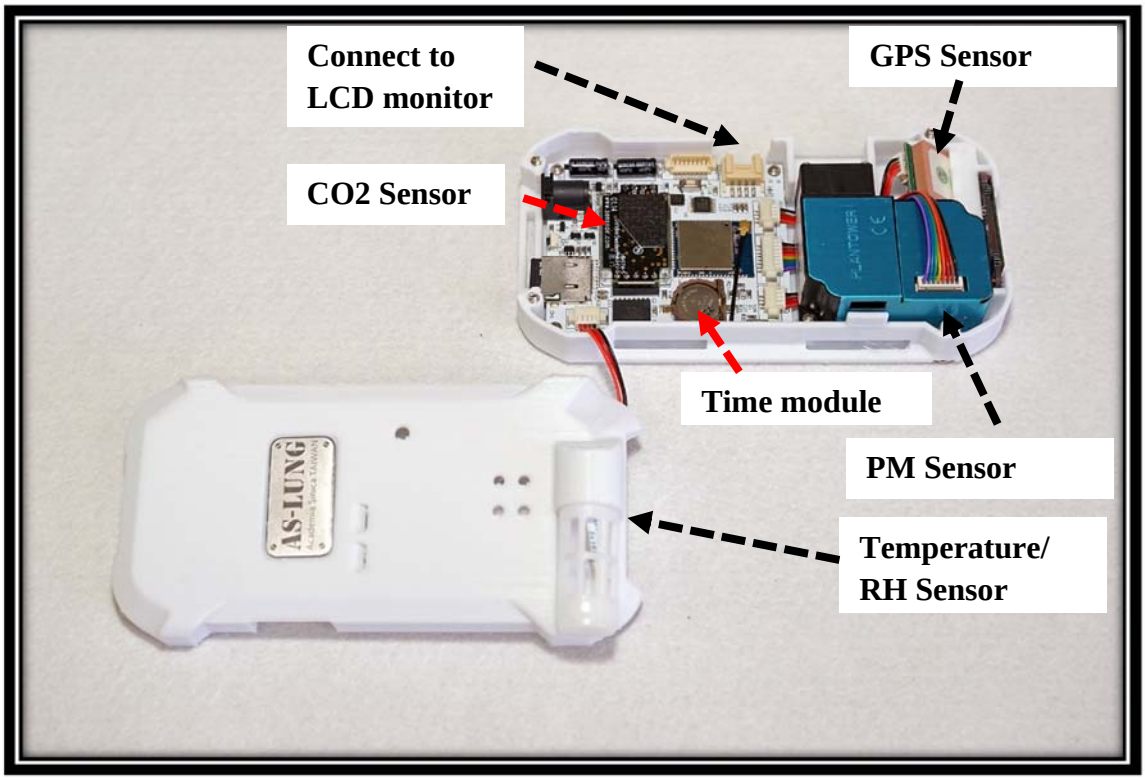
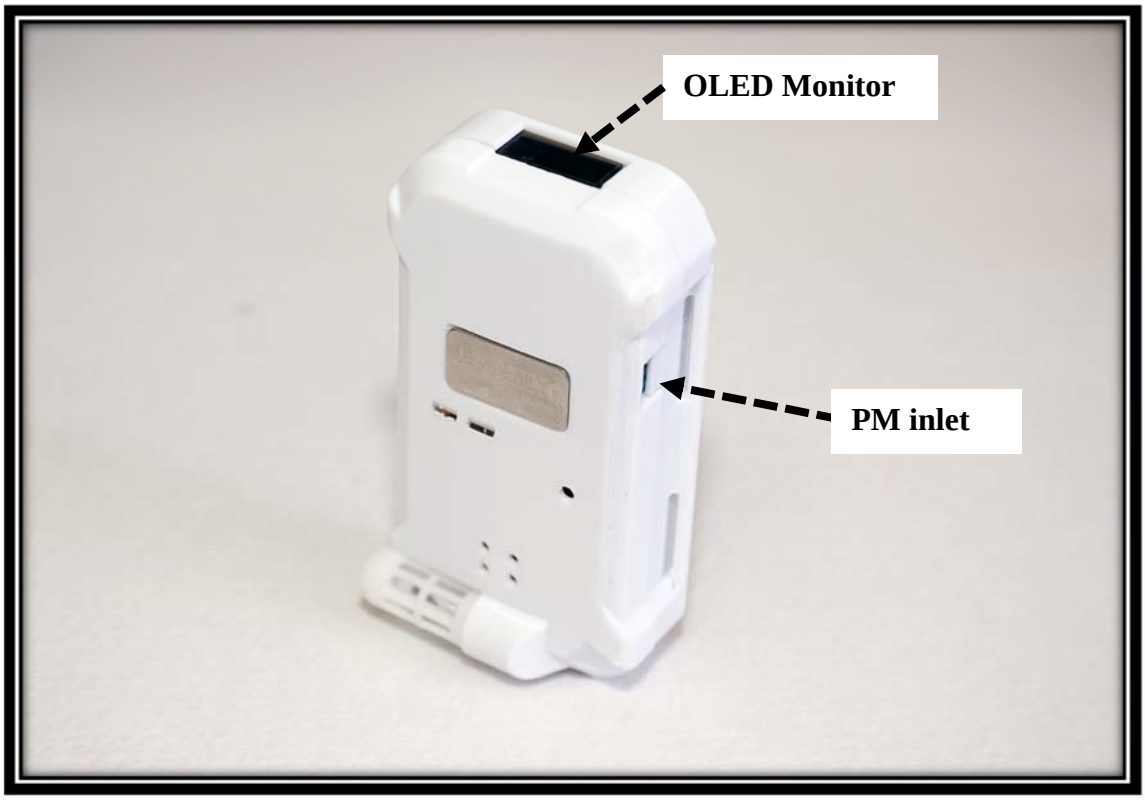
1. Component

1.1 Portable version





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1.2 Outdoor version

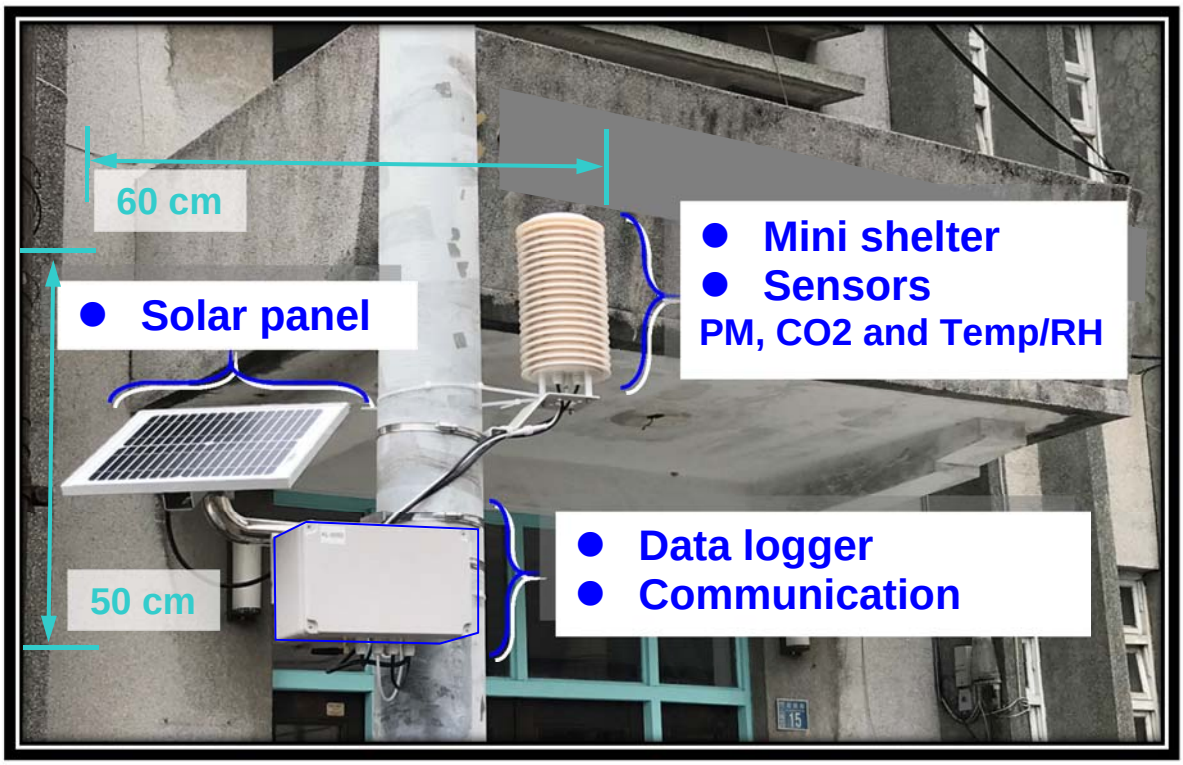

Fig 1.2(a) Outdoor version of AS-LUNG

This is a street-level air quality sensing system, which is low-cost and will be applied to monitor air quality in communities under a well designed scientific framework. "Street-level" means under one floor high. This is usually set up around 2 to 3 meters high in a stand such as street lamp poles shown here.

There are three components including (1) mini shelter with sensors inside, (2) water-proof box with a data logger and a communication module and (3) a solar panel providing electricity. This shelter is like an umbrella to protect sensors from rain and sun burn. There are PM, CO2, Temperature and RH sensors insides. These are basic and important index of air quality. Users can also manage to put other sensors customized for their own research interests. The box includes a data logger, a communication module and a 10,000 mAh li-battery. An 8GB SD card is equipped for data storage and three different types

of transmission are optional for users, namely LTE (sim card), NB-IoT and WiFi. With sampling rates of 5 minutes, roughly 25 MB data will be generated in one year. The data format is CSV which could be easily shown in Excel or SPSS software.

With low-cost advantage and good calibration schemes, this system will be a strong tool to be applied to monitor various types of community PM emission sources such as traffic, restaurants, temples, and home factories etc. In the near future this air quality sensing network will provide useful data for citizens and for the authorities to formulate air pollution control strategies.

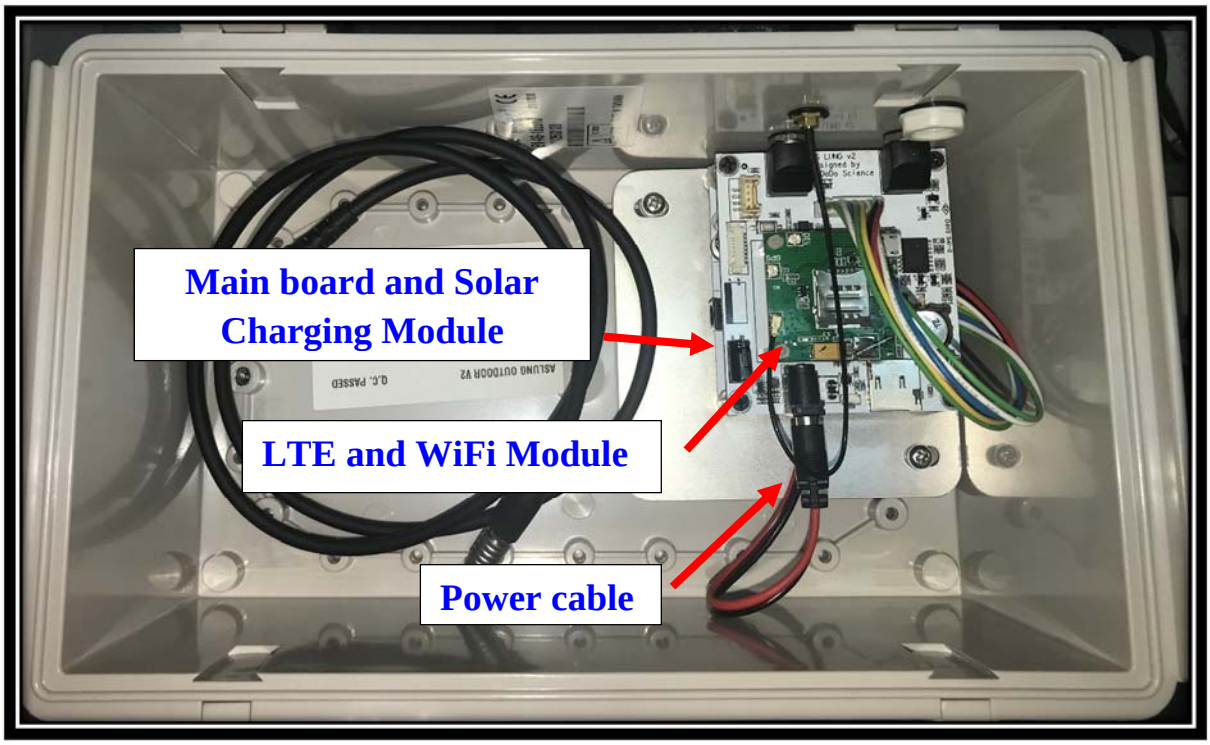

Fig 1.2(a) Outdoor version of AS-LUNG (components)

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2. Setting

Step 1 Turn on AS-LUNG

Step 1.1 Connect with LCD Monitor then connect with mobile battery, you can see the startup screen (Fig 2.1)

Fig 2.1 Startup screen of AS-LUNG

Note: Please press release button to disconnect the HMI from ASLUNG

Step 1.2 Wait for a second, you can see the main screen. If you cannot see the main screen (Fig2.2), please reconnect the mobile battery.

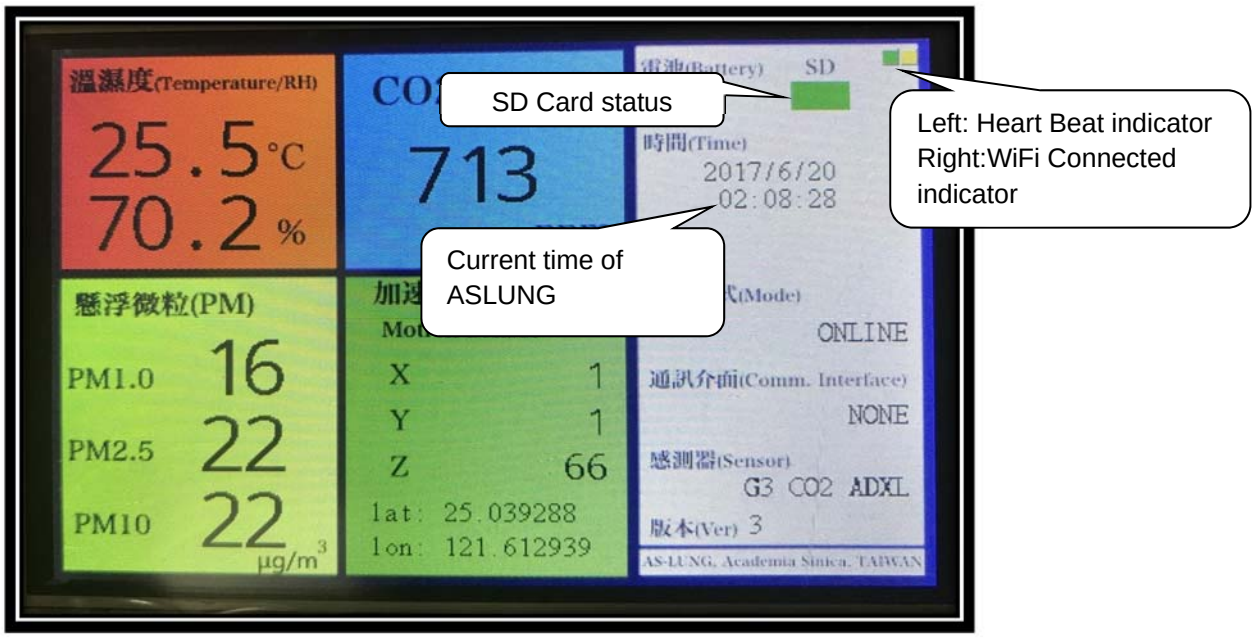

Fig 2.2 Main screen of AS-LUNG

Step1.3 Touch the screen with a finger nail, then you can see the set-up screen

Step 1.4 Touch the Academic Sinica logo in the center and input the password of “ASLUNG”, then you can use the set-up screen (Fig2.3).

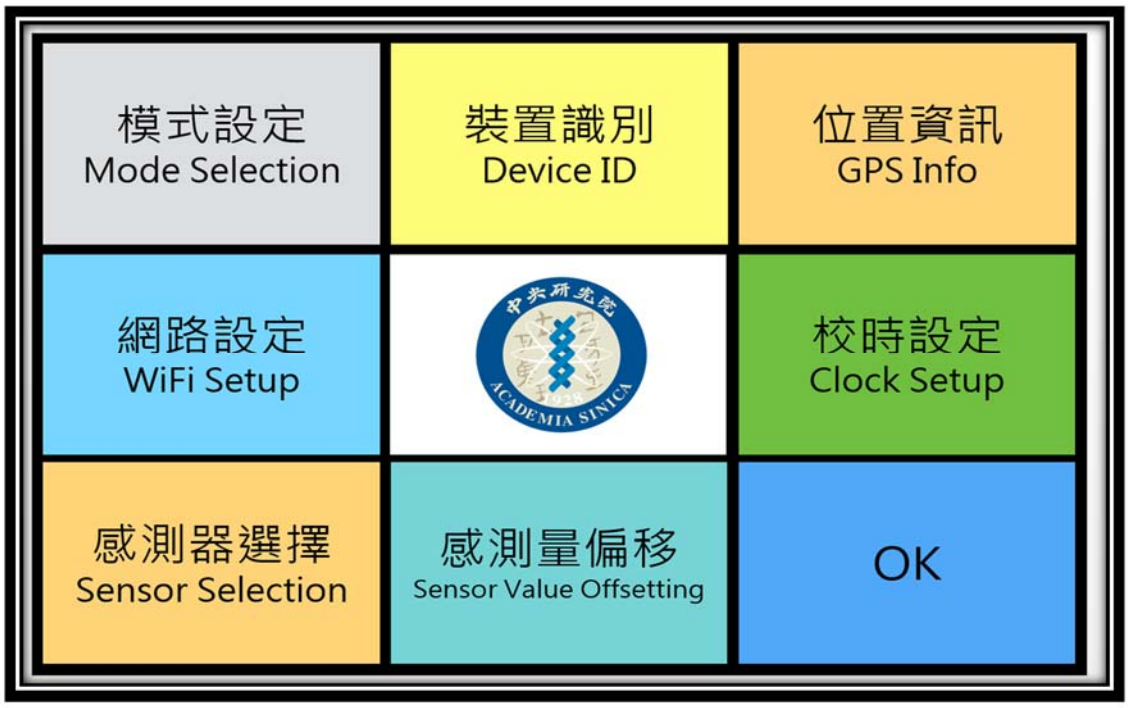

Fig 2.3 Set-up screen of AS-LUNG

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Step2 Device ID

Touch the device ID icon, you can see the device ID of AS-LUNG (Fig2.4). The device ID is WiFi MAC ID, so the ID is unique. You cannot change the device ID. IF you send data with LoRa (outdoor version only), the device ID will use LoRa MAC ID not WiFi MAC ID

Fig 2.4 Device ID of AS-LUNG

Step3 Mode Selection

This selection is to select log interval and data transmission mode you want. You need to select data transmission mode first which will limit the selection of log interval (Please see Table1). For log interval, you can choose online (15s), 30s, 60s and 5mins.

(a) To ensure data will not be lost during transmission. SD card is equipped in each AS-LUNG, with the capacity of 8GB (good for 118 years for 1 data per minute)

(b) For portable version, WiFi mode is the only choice of data transmission beside SD card. After setting the log interval on the LCD monitor, you need to adjust the jump on the mail board (Fig 2.5).

(c) For outdoor version, after setting the log interval on the LCD monitor, you need to adjust the jump on the solar charging board (Fig 2.5). IF you set log interval equal or higher than 1 min and transfer data with LTE or NB-IoT module, the battery can support long-tern monitoring under sufficient

sunshine (ex: sunshine hour longer than 4 hours/day which has cover the period of 10:00 to 14:00).

Table 1 Different combinations of “Log mode” and “Communication Mode”

Log interval / **Data transmission**	Online (15s)	60s	1 min	5min
WiFi	V			
LTE (outdoor only)		V	V	V

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Step 4 WiFi Setup

Select the WiFi setup icon then enter the SSID, password, and security mode. WiFi SSID and password only support number and English alphabet. We suggest select WPA to protect data.

Fig 2.6 WiFi SSID and password set-up screen

Step 5 GPS Info

(a) For portable version, you can select real GPS to record the track.

(b) For outdoor version, you can get the GPS information from Google map, and key in into the input box (Fig2.8).

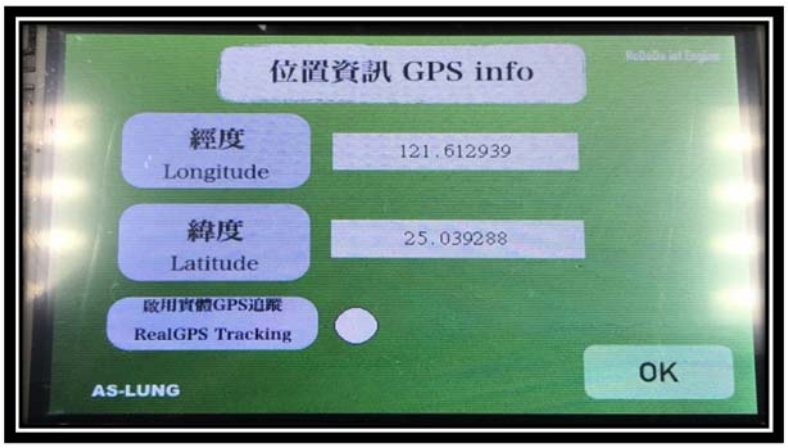

Fig 2.7 GPS set-up screen

Fig 2.8(a) Get Academia Sinica GPS from Google map

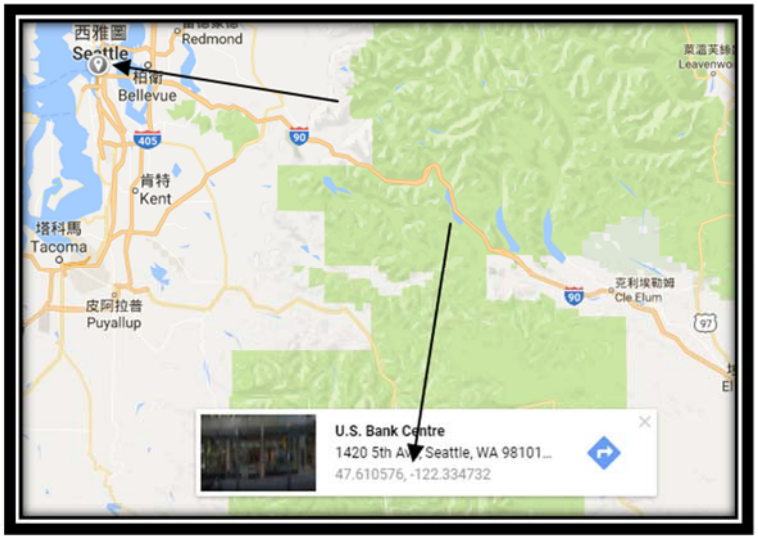

Fig 2.8(b) Get Seattle GPS from google map

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Step 6 Clock Setup

There are three ways to set system time (a) manual, (b) via LCD monitor or (c) Get NTP time

(a) Manual setting：input the date, time, and time zone into the input box and clock “OK” to set system time (Fig 2.9).

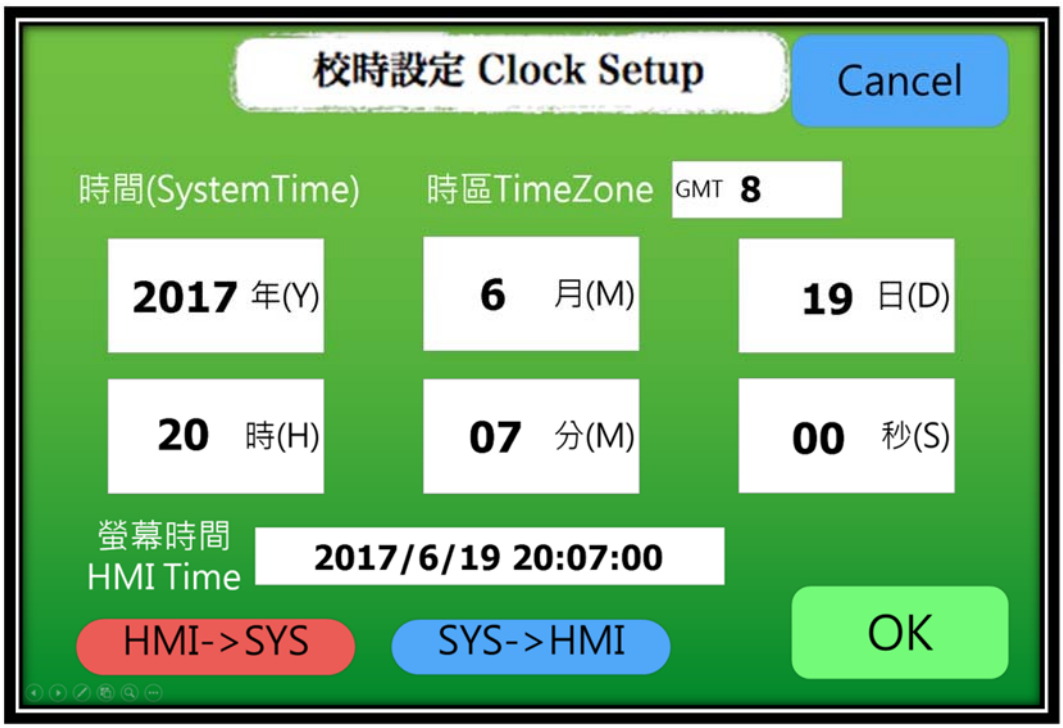

Fig 2.9 System time set-up screen

(b) LCD Monitor：If you have lots of AS-LUNG devices, you can use LCD monitor to set system time. First click the blue icon (SYS->HMI) to get the system time. Second, connect to another device and click the red icon (HMI->SYS) to set system time. ***Please make sure that time of LCD monitor has been calibrated before use.***

(c) Get NTP time：Select WiFi module and connect to WiFi, AS-LUNG will automatically calibrate system time within 3 mins.

Step 7 Sensor Selection

(a) For portable version (CO_2 sensor is optional and external SHT31 is not available)

Fig 2.10 Sensor select of portable version

(b) For outdoor version (CO_2 sensor is optional)

Fig 2.11 Sensor select of outdoor version

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Step 8 Sensor value offset

2.8.1 If offset value of sensor is available (from zero-adjustment), you can set the offset value to the input box. For example, the zero-adjustment of temperature is 5, please input “-5”.

2.8.1 Do not press “ABC” for CO_2 sensor. If you want to press “ABC”, **PLEASE make sure the sensor in the fresh air value is 405 ppm CO_2.**

2.8.2 For portable version, put the device on the table and click “PRESS ME”, the motion sensor will be leveled.

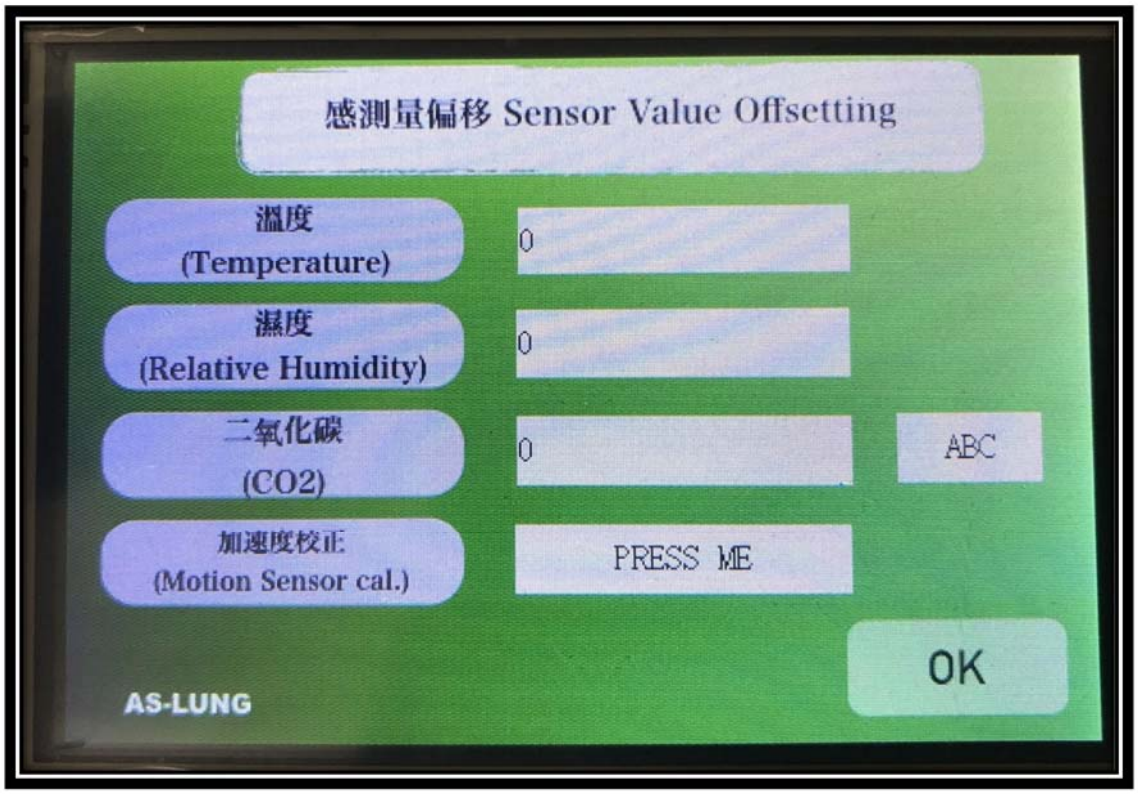

Fig 2.12 Sensor value off-set of AS-LUNG

Step 9 Get data from SD card

Remove SD card from the main board and connect SD card to PC or notebook, you can see the data file in the folder of logs (Fig2.13). Fig 2.14 show the example of a csv file and the details of columns shown in table 3.

Fig 2.13 Data file in the SD card

date	time	sht_t	sht_h	pm1	pm25	pm10	co2
2017-07-01	20:20:30	26.2	66.4	11	15	17	1892
2017-07-01	21:18:45	24.3	63.4	9	15	15	2201
2017-07-01	21:19:00	24.3	63.4	10	16	16	2195
2017-07-01	21:19:15	24.3	63.3	7	11	12	2192
2017-07-01	21:19:30	24.3	63.4	9	14	14	2195
2017-07-01	21:19:45	24.4	63.3	9	13	13	2196
2017-07-01	21:20:00	24.4	63.2	8	13	14	2197
2017-07-01	21:20:15	24.5	63	9	12	13	2197
2017-07-01	21:20:30	24.6	62.8	9	12	13	2199
2017-07-01	21:20:45	24.6	62.5	9	13	15	2201

Fig 2.14 Example of a csv file

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Table 3 Details of columns in the CSV File

Column Name	detail	comment
id	MAC ID of Device	Use LoRa module, the id is LoRa MAC ID.
date	data date	Local time
time	data time	Local time
sht_t	Temperature	℃，for portable version
sht_h	relative huminity	%，for portable version
pm1	PM1	ug/m3
pm25	PM2.5	ug/m3
pm10	PM10	ug/m3
co2	CO2 value	ppm
adc	battery	for outdooe version, 0=no batt 1=low batt , other is est. capacity in %
acc_x	initial value of x	64 = 1 g
acc_y	initial value of y	64 = 1 g
acc_z	initial value of z	64 = 1 g
accx_int	sum of difference at x	n=10 per sec
accy_int	sum of difference at y	n=10 per sec
accz_int	sum of difference at z	n=10 per sec
accx_i	Instantaneous value of x	64 = 1 g
accy_i	Instantaneous value of y	64 = 1 g
accz_i	Instantaneous value of z	64 = 1 g
sht_t_ext	external temperature	℃，for ourdoor version
sht_h_ext	external relative huminity	%，for ourdoor version
gps_lat	lattitude	google map format
gps_lon	longtitude	google map format
gps_alt	Hight	m from sea level
gps_speed	Speed	km/h
gps_dir	direction	0-360
gps_fix	use GPS or not	1=fix (use GPA) 0=not fix (do not use GPS)

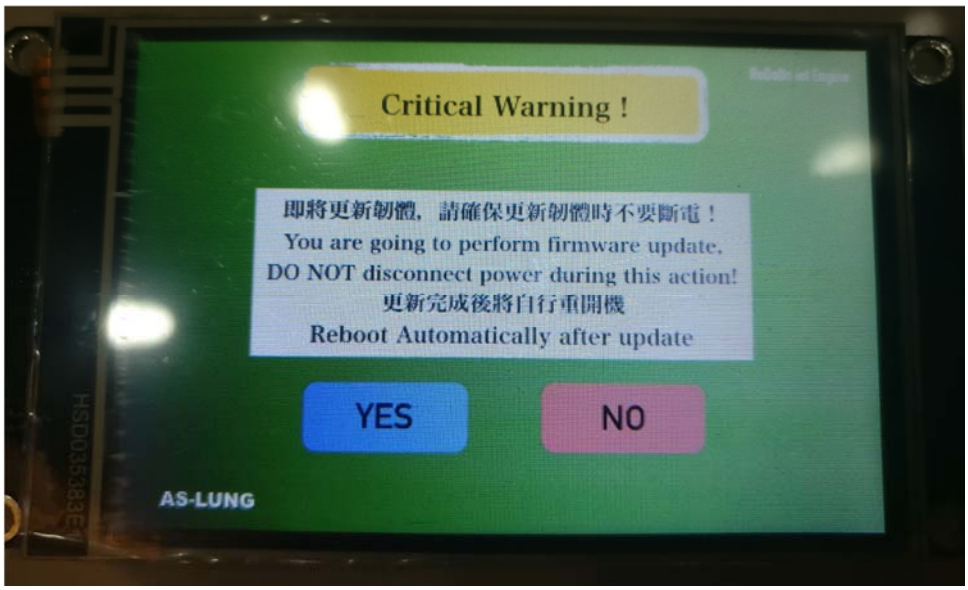
3. Framework Upgrade

3.1 With update firmware is copied to your root directory of SD cared.

3.2 Press logo exactly 3 times, and then press OK(Figure 3.1)

Figure 3.1 Framework upgrade

3.3 When you see this page, just press YES and the LED will start blinking with very short



period.