YUANDA LLONGWILL®

llongwill® Classroom Environment Monitoring System

PM2.5

TVOC
Total Volatile Organic Compounds

TVOC

Temperature

HCHO

PM10

Noise

worlddidac MEMBER PLATINUM

worlddidac AWARD 2014/2018/2020

Shandong Yuanda-llongwill Educational Science and Technology Ltd.

CONTENT

1. Product Introduction

llongwill® Classroom Environment Monitoring System V2.0 (hereinafter referred to as "CEMS") is an innovative product developed by Yuanda-llongwill based on sensor technology and internet communication technology, mainly applied to:

1.1 Provide schools with powerful tools for real-time online monitoring of environment conditions in classrooms, offices, and other applicable sites;

1.2 Provide an education system for students to study the relationship between human activities and classroom environment conditions based on real data;

1.3 Develop a sustainable class environment database that can be compared and analyzed horizontally and vertically to promote environmental improvement work in schools.

2. System Composition

CEMS consists of terminals, universal display platforms (computers, school display screens, mobile phones, etc.), cloud database, and App software (Figure 1). Any number of terminals can be installed in different locations within the same school or in different schools within the same school district. These terminals form a network of different levels and can provide environment data on a school or school district basis. The data obtained by the CEMS system is saved in the cloud database by default.

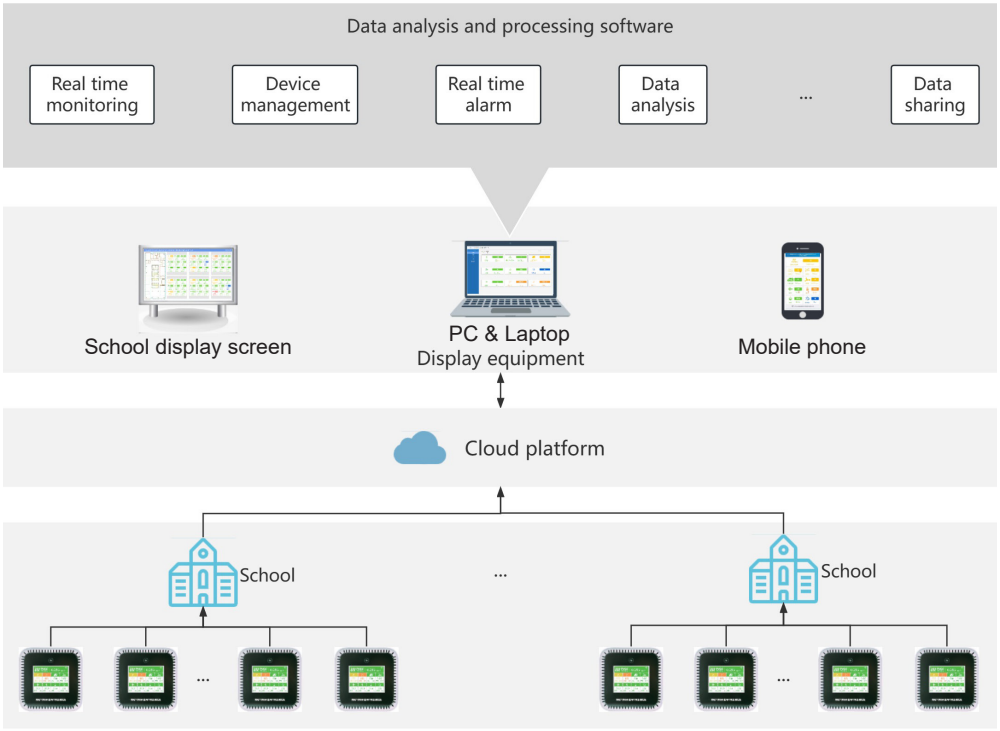

Figure 1 System composition of CEMS

2.1 CEMS Terminal

2.1.1 Terminal Composition

The CEMS terminal consists of a casing, a color LCD screen, sensors, measurement and control circuits, a Wi-Fi communication module, a power supply (built-in power supply equipped with external charging cable, and AC converter), and a mounting stand. The casing adopts a hollowed-out design, forming continuous air exchange, which makes it easy for the built-in sensor to collect environment data. The CEMS terminal supports various installation such as desktop placement (Figure 2) and wall mounting (Figure 3).

Figure 2 Desktop placement of CEMS terminal

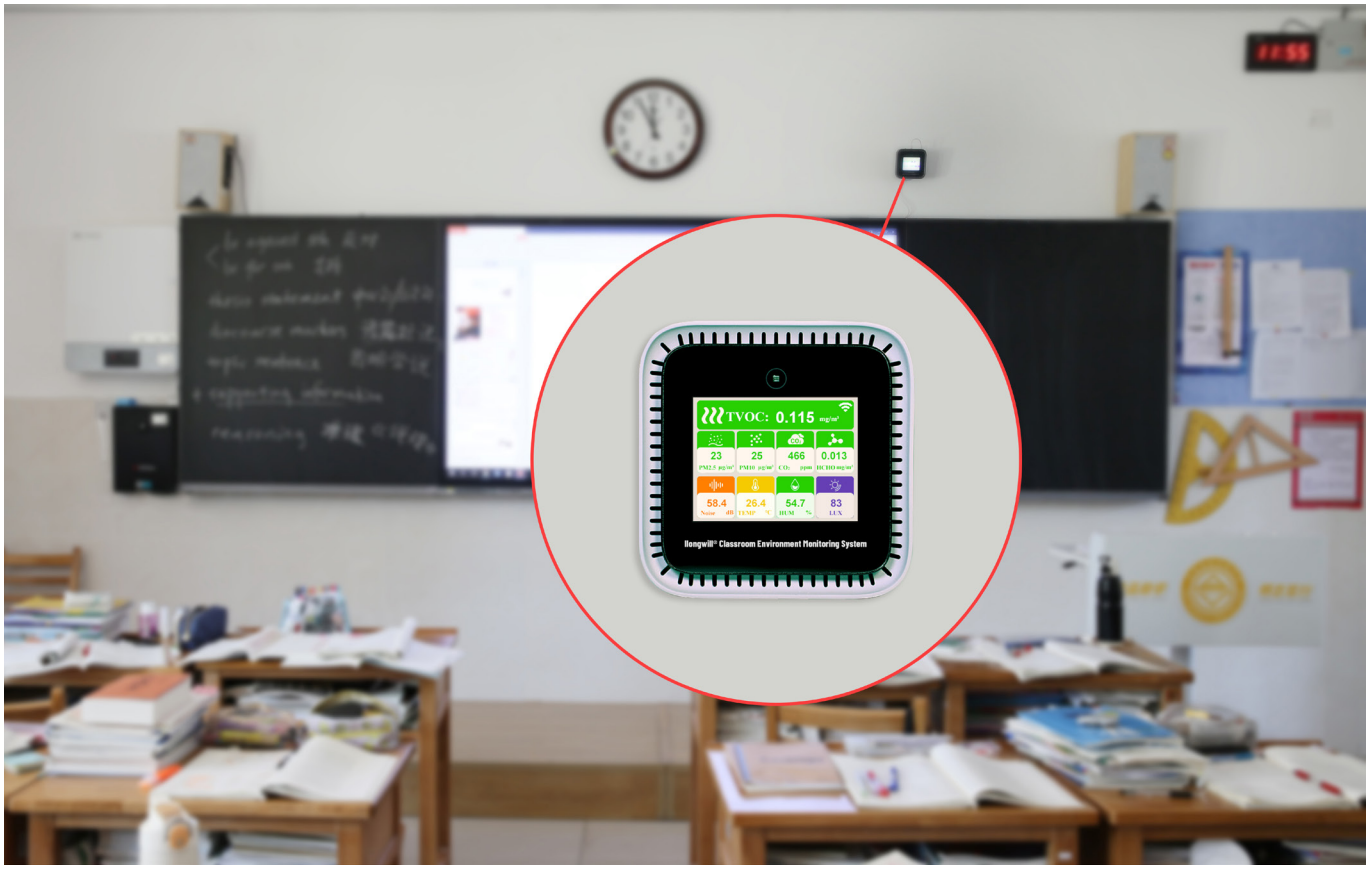

Figure 3 Wall mounting of CEMS terminal

2.1.2 Built-in Sensors

There are 9 built-in sensors of CEMS terminal: PM2.5, PM10, carbon dioxide(CO2), formaldehyde(HCHO), Total Volatile Organic Compounds(TVOC), illumination, noise,

temperature, and humidity (Figure 4 and Table 1). The measurement data is refreshed every 6 seconds, accurately reflecting the environmental quality situation in real-time.

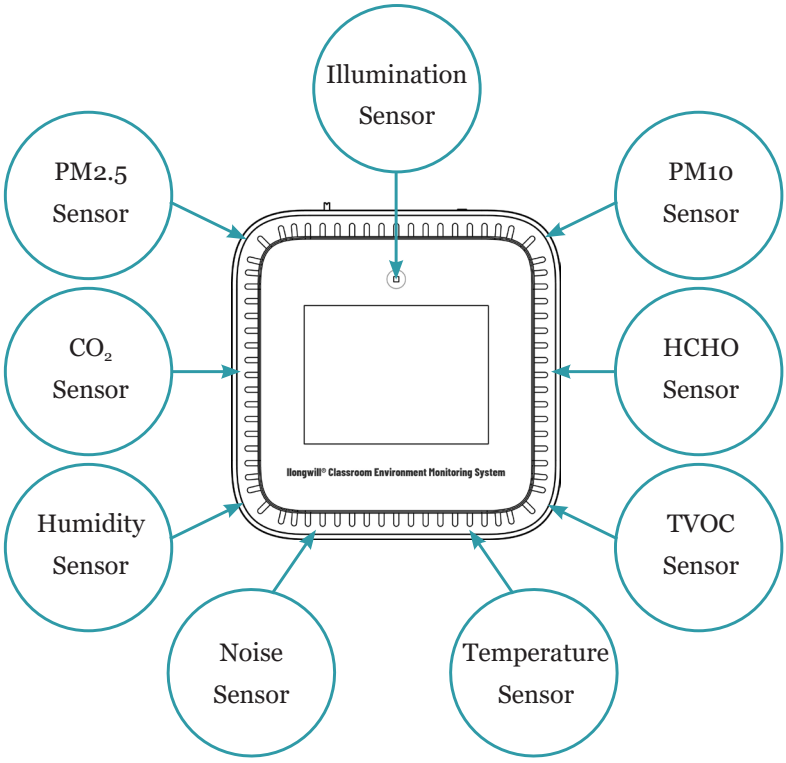

Figure 4 Built-in sensors of CEMS terminal

Table 1 Performance parameters of sensors embedded of CEMS terminal

NO.	Sensors	Ranges	Resolutions
1	PM2.5	0~500ug/m^3	1ug/m^3
2	PM10	0~500ug/m^3	1ug/m^3
3	CO_2	350~5000ppm	1ppm
4	HCHO	0~3mg/m^3	0.001mg/m^3
5	TVOC	0~4.5 mg/m^3	0.001mg/m^3
6	Illumination	0~10000lux	1lux
7	Noise	35~120dB	0.1dB
8	Temperature	-40~60℃	0.1℃
9	Humidity	0%~100%	0.1%

The above sensors are basic configurations, and the CEMS system can adjust the sensor composition according to user needs, including adding more other types of sensors.

2.1.3 Display Mode of the Terminal

There are two display modes for the CEMS terminal:

A. Single parameter display mode, which focuses on displaying a specific environmental parameter of concern (Figure 5); B. Multi-parameter display mode, which is capable of displaying 9 types of environmental data at the same time (Figure 6).

Figure 5 Single parameter display mode of CEMS terminal

Figure 6 Multi-parameter display mode of CEMS terminal

Press the illumination sensor in the up center of the LCD display screen of the terminal for 5 seconds to realize the switching between the A and B display modes (Figure 7). In display mode A, press the same position for 2 seconds to realize the display switching from one parameter to another.

Figure 7 CEMS terminal display mode switching

In addition to data display, CEMS terminal can also prompt for environmental data that exceeds the standard range through different types of colors (Figure 8). The corresponding rules for different colors and exceeding standards are shown in Table 2. From Figure 8, it can be seen that the noise and temperature at this measurement point exceed the normal values, with noise moderate exceeding the prescribed standard, temperature mild exceeding the prescribed standard, and illumination lower than the normal value.

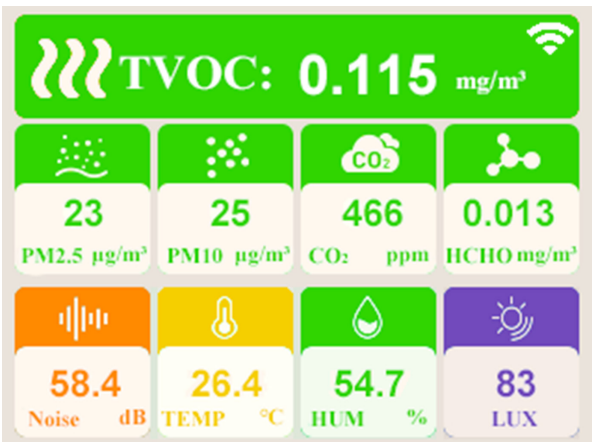

Figure 8 Data exceeding warning on CEMS terminal

Table 2 Meanings of CEMS data corresponding to different colors

Colors	Blue	Green	Yellow	Orange	Red	Purple
Meanings	Below normal	Normal, good	Mild exceeding	Moderate exceeding	Severe exceeding	Seriously exceeding

2.2 CEMS App Software

The CEMS terminal can access the Wi-Fi system on campus and transmit data to the cloud platform. With the help of App software, display devices such as computers, mobile phones, and school display screens can obtain data from cloud platforms, collectively forming a real-time display platform and owning the alarm prompt function.

2.2.1 Installation

Android users can search for "llongwill" or "Classroom Environment Monitor" through the Google Play store, select the Classroom Environment Monitor software, click download, and follow the prompts to install. They can also scan the QR code shown in Figure 9 to obtain the software and follow the prompts to install.

iOS users can get the software from the App Store by entering the keyword "Classroom Environment", and select the Classroom Environment software. Then click the "Get" button, and follow the prompts to install. They can also obtain the software by scanning the QR code shown in Figure 10.

Figure 9 Scanning QR code to get App by Android

Figure 10 Scanning QR code to get App by iOS

2.2.2 Registration

After the installation is completed, uses can open the application for the first time and enter the App login page, as shown in Figure 11. If the user has not registered an account for the first time, please click the "register" button to enter the user registration page (as shown in Figure 12). The following steps need to be taken to register: ①Enter the account name. This account name is used for your future login (it is recommended to choose the school or class name as the preferred account name, as well as the specific name that the user likes); ②Enter the user's phone number; ③Confirm and enter the password, click on "register" to complete the registration.

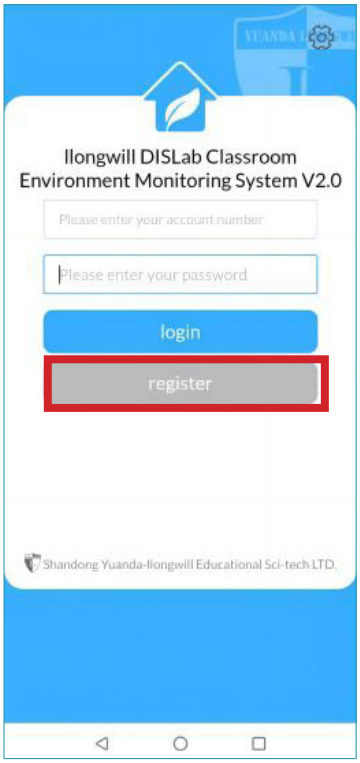

Figure 11

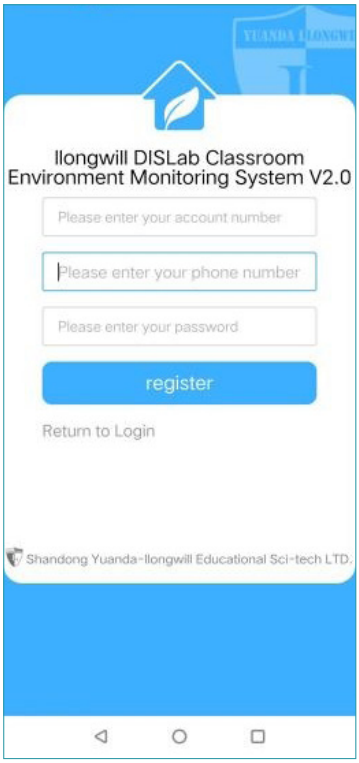

Figure 12

2.2.3 Login

After the registration is completed (as shown in Figure 13), click "Yes" to enter the login page (as shown in Figure 14). After entering the account name and password you filled in during registration, you can complete the login (the user account name shown in Figure 14 is dislab).

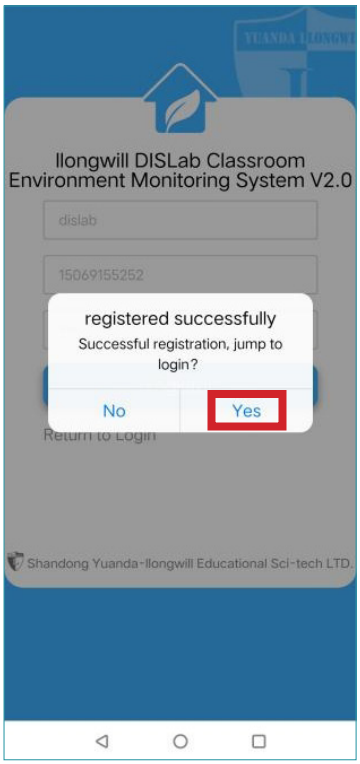

Figure 13

Figure 14

2.3 Network Configuration of Device

2.3.1 Configuring Network

1. Connect the mobile phone to a 2.4GHz wireless network environment (5GHz is not supported).

2. Click the "Menu" button on the upper left (as shown in Figure 15) to open the menu page (as shown in Figure 16).

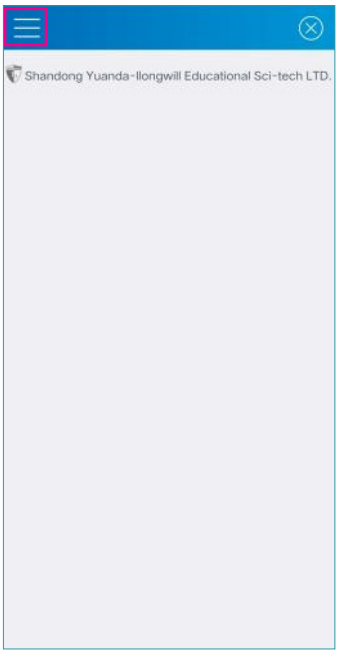

Figure 15

Figure 16

3. Click the "Add Device" button at the bottom (as shown in Figure 17) to open the scanning interface (as shown in Figure 18) and prepare to add the device.

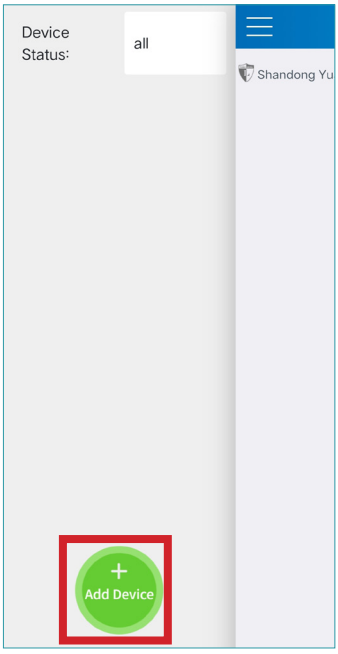

Figure 17

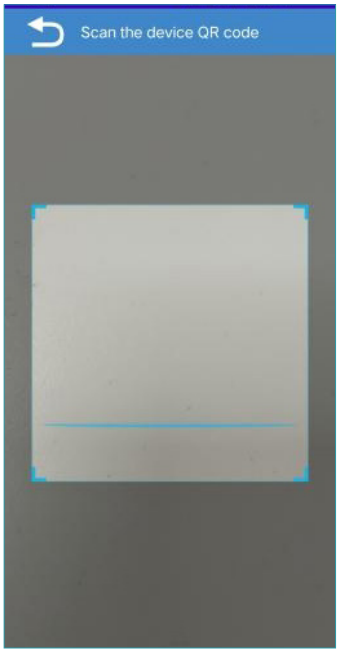

Figure 18

4. Long press the "Configure Network" button on the hardware logger of the Classroom Environment Monitoring System (as shown in Figure 19) until the QR code interface appears (as shown in Figure 20).

Figure 19

Figure 20

5. Scan the QR code with the App and enter the device network configuration interface. In the network configuration interface (as shown in Figure 21), the user should first name the device. If the user is using more than one device, it is recommended to use numbers to distinguish each device, such as Class Room1, Class Room 2, etc. After completing the device naming, enter the wireless network password that the current mobile phone is connected to, and then click "Connect" to start automatic configuration. The network configuration would take some time, please be patient (as shown in Figure 22).

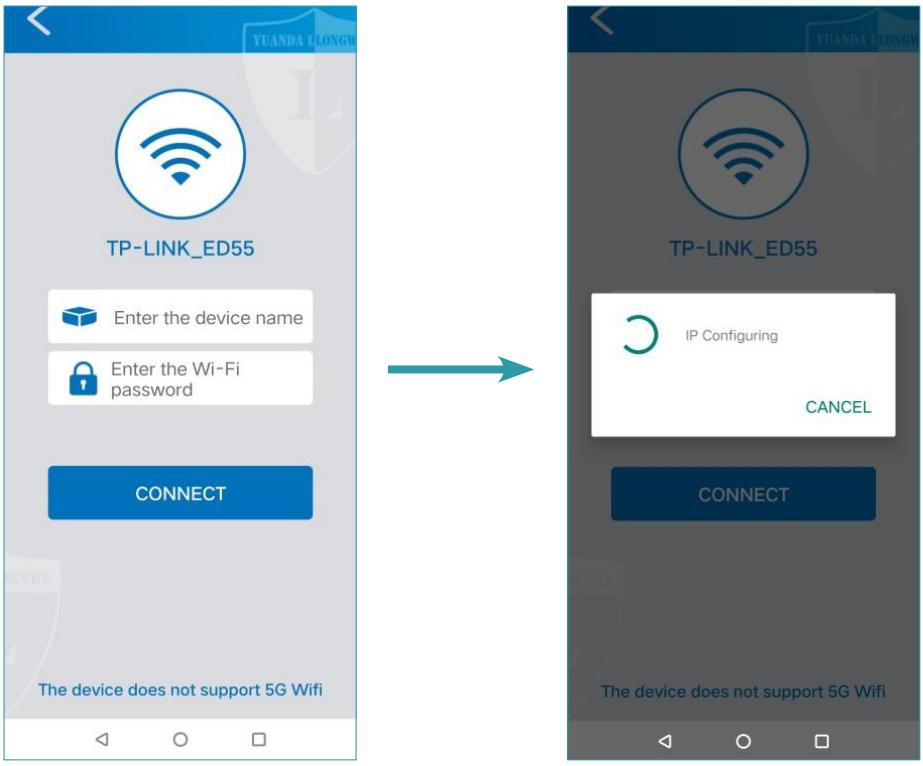

Figure 21

Figure 22

6. After the network configuration is completed, it will prompt that the network configuration is successful (as shown in Figure 23), and return to the main interface.

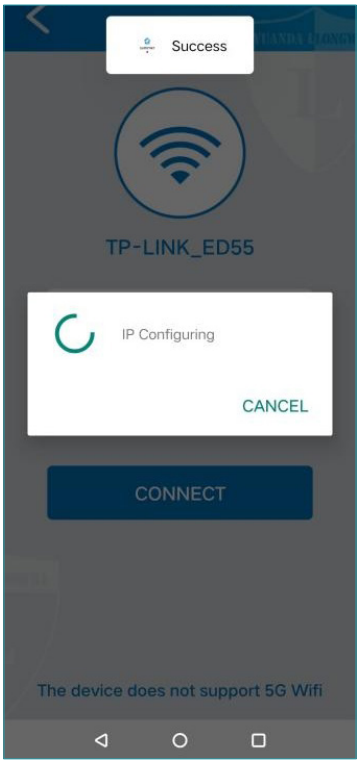

Figure 23

7. If it prompts that the network configuration has failed, please restart the device and follow steps 4 and 5 to re-configure the network.

2.3.2 Possible Causes and Solutions for Network Configuration Failures

1. Firstly, check if the Wi-Fi connected to the mobile phone is in the 2.4GHz frequency band.

2. Password input error. Please confirm the correct password for Wi-Fi and enter it correctly before re-configuring the network.

3. Network fluctuations during configuration could cause devices to be unable to search for Wi-Fi networks.

4. If the network signal is weak and it is difficult for devices to search for Wi-Fi, multiple configuration attempts are required. Please try to configure network near Wi-Fi or in a location with good Wi-Fi signal.

2.3.3 Viewing Data

After the user logs in, the App can display the real-time data of the current online device (Figure 24, taking a mobile phone as an example). Figure 24-1 shows the main interface of the mobile

App software; Figure 24-2 shows the CEMS terminal device list displayed by clicking on the red circle of Figure 24-1; Figure 24-3 shows the history of a certain environment data after clicking the icon in the blue circle Figure 24-1 or 24-2.

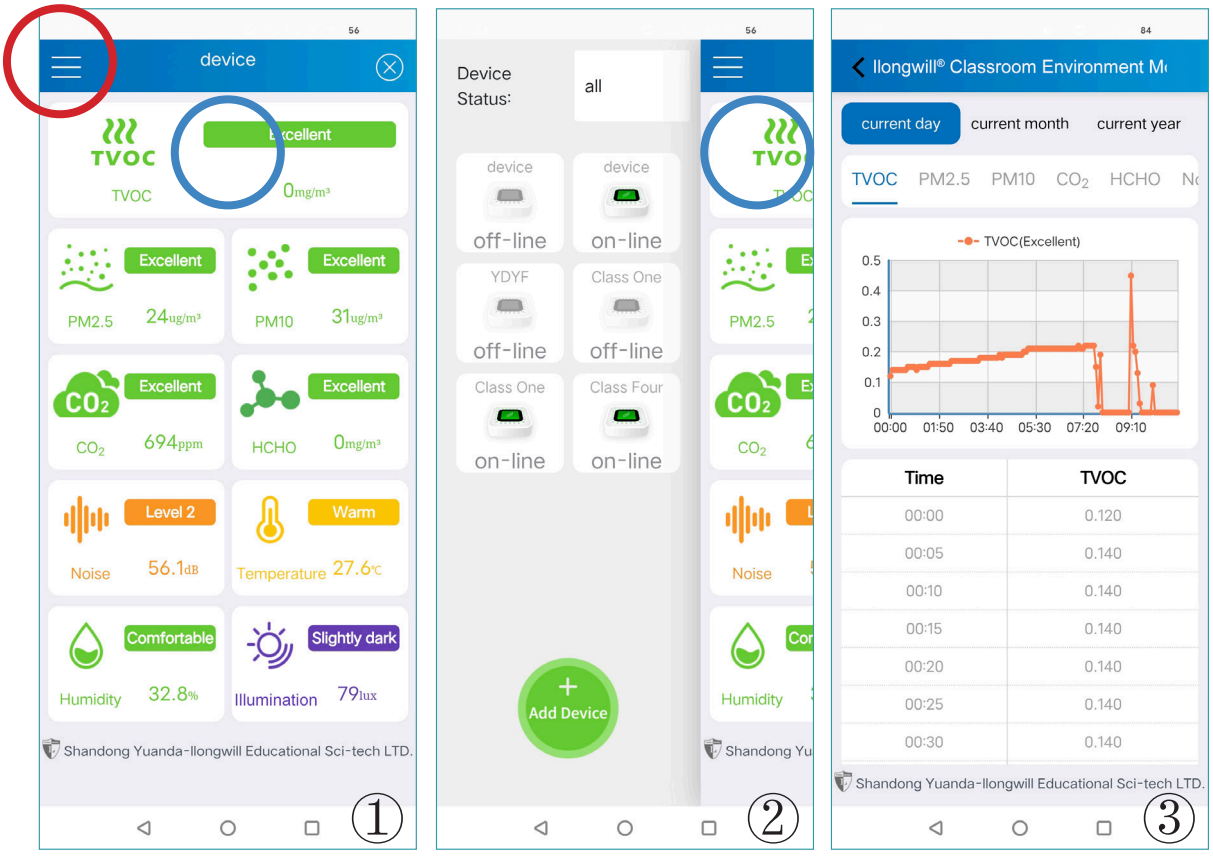

Figure 24 How to use the mobile App software

2.4 Multi Devices Networking

Assuming that the school is the basic user unit, and a responsible personnel uses the App to connect the CEMS terminals equipped by the school to the network one by one, forming the CEMS group of the school.

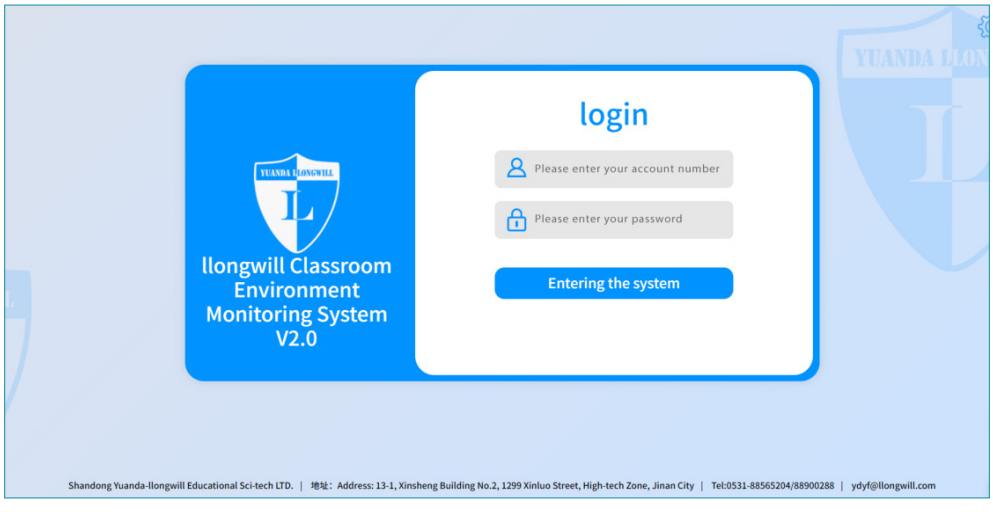

Figure 25

Access cloud data analysis software on devices such as PC or Laptop at: http://cloud.llongwill.com/IntNat/login.html (As shown in Figure 25). Enter the account name and password you filled in when registering to complete the login. Click on "Entering the system" to view the CEMS group monitoring data.

After successfully logging in, you can view all the CEMS devices that have been connected to the network in your school. After checking the CEMS devices that need to be viewed, click on "Data analysis" (as shown in Figure 26) to compare and view the data monitoring indicators of multiple devices. You can select different indicators to compare and view them separately (as shown in Figure 27).

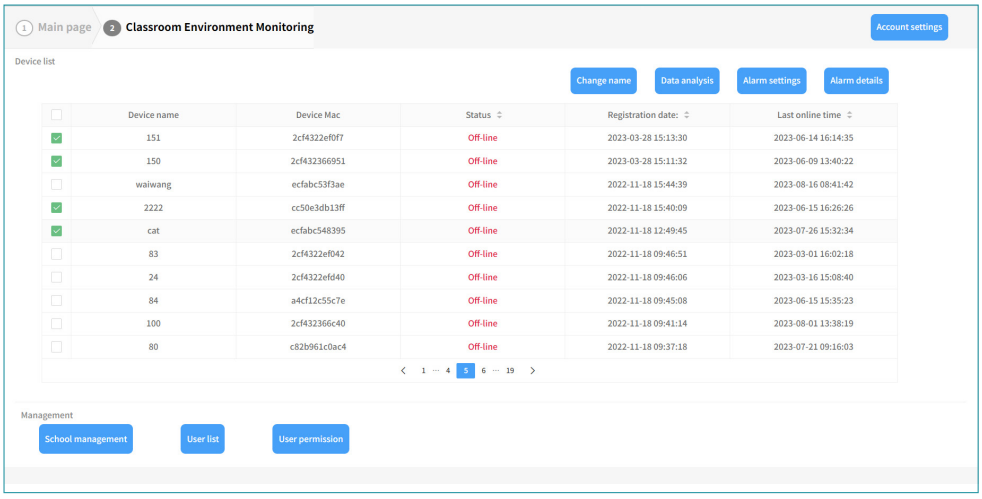

Figure 26

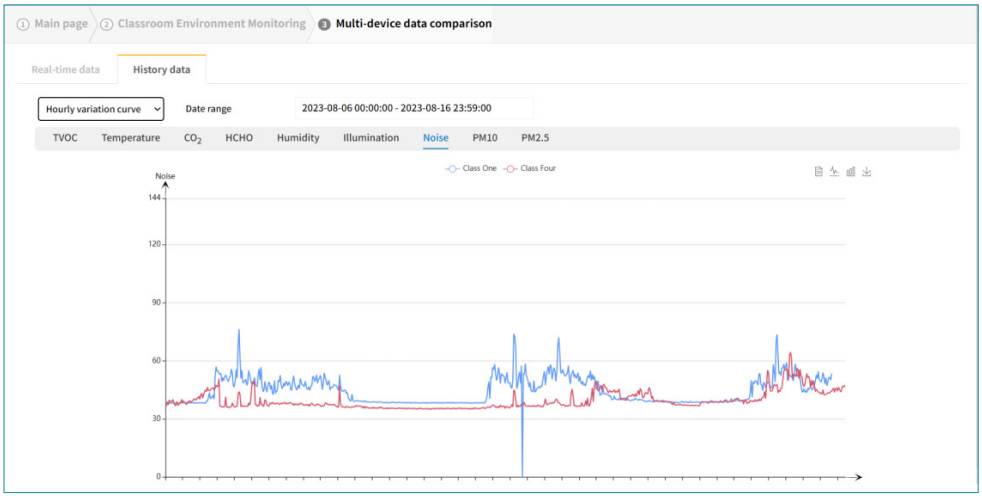

Figure 27

Cloud data analysis software not only displays real-time data of corresponding devices, but also has the following important functions:

A. Terminal device management; B. Historical data analysis; C. Data exceeding alarm settings, etc.

2.5 User Database Migration Deployment

We can provide privatization deployment for users, which involves migrating and deploying data stored in cloud databases to user designated servers to increase data security and controllability.

If you have a need for privatization deployment, please send an email to ydyf@llongwill.com. We will contact you as soon as we receive your email.

3. Application Cases

The following is a representative list of users in the CEMS section.

Table 3 List of CEMS users

NO.	Region	Schools	Tel
01	Shanghai	Shanghai Fenghua High School	86-21-66250808
02	Zhejiang	Zhejiang Teachers University	86-579-82282245
03	Zhejiang	Jiashan Experimental School Affiliated to Zhejiang Teachers University	86-573-89108737
04	Shandong	Jinan Licheng No.2 Middle School	86-531-88722886
05	Hunan	Meixihu Middle School Affiliated to Hunan Teachers University	86-731-89678833
06	Shanxi	Jiaokou County Fifth Primary School	86-358-5425453
07	Hubei	Luotian County Experimental High School	86-713-5096008

In the practical application of CEMS, the matching function between the school plane figure and the detection data of monitoring points has been widely welcomed by users (Figure 28). CEMS is expected to become a global development hotspot in the field of educational equipment in the next decade.

Figure 28 Floor layout and environmental data of 6 different monitoring areas displayed on the large display screen of a school

4. Application Research

CEMS has been developed from 2018 and was finalized in 2020. In addition to equipping nearly a hundred users, from 2020 to 2021, CEMS participated as the main equipment in the joint survey of school classroom environmental pollution conducted by the Shanghai Municipal Education Commission and the Shanghai Municipal Health Commission, and provided massive fundamental data for the survey.

Since 2021, CEMS has been listed as a key research project on campus environment and student health by the Education Equipment Research and Development Center of the Ministry of Education of China, and has formed relevant research.[1]

5. After-sales Service

If you have any questions or issues during use, please send an email to notify our after-sales service team as soon as possible, and we will provide you with a satisfactory response in the shortest possible time.

After-sales service email: service@llongwill.com

Shandong Yuanda-llongwill Educational Science and Technology Ltd.

May 25, 2023

[1] Zhao Meng, Research and Application Analysis of Intelligent Classroom Environment Monitoring and Control System

[EB/OL].https://xueshu.baidu.com/usercenter/paper/show?paperid=1m4t0re0fh1u0410e94704f0dw041003&site=xueshu_se

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