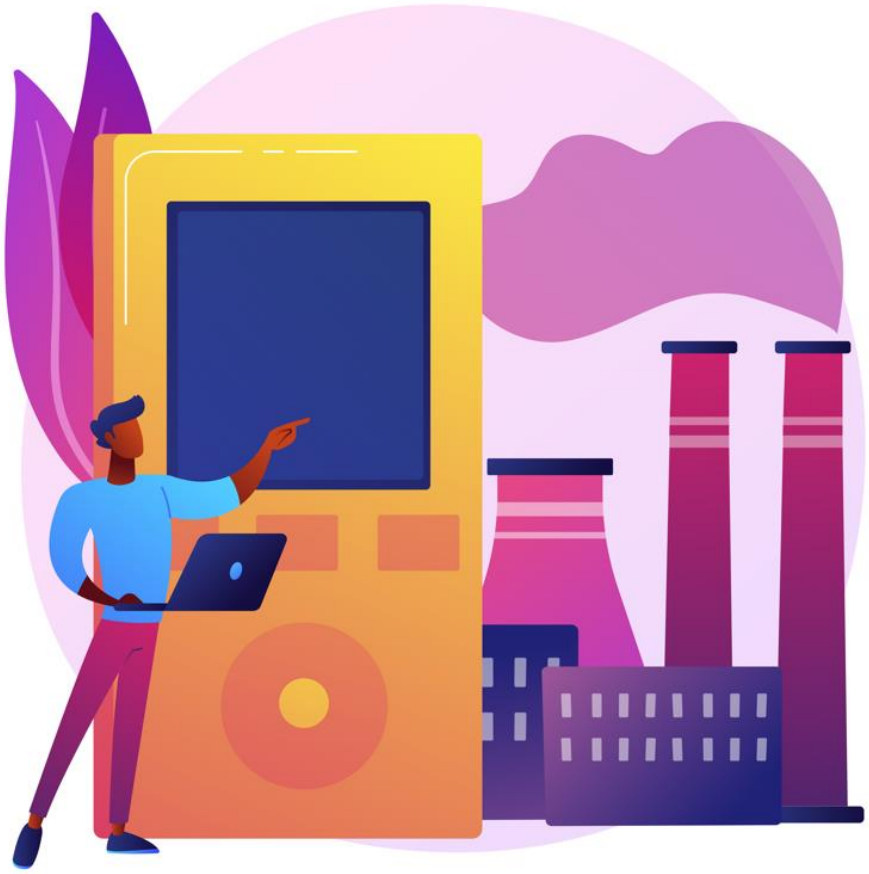
USER MANUAL

Air Quality Monitoring System

AQMx V1.0 (July 2023 | Version 1.0 | Document ID: 500-10013)



DISCLAIMER

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Glossary

Abbreviation/ Definition	Description
AQI	Air Quality Index
AQMx	Air Quality Monitoring System
IAQ	Indoor Air Quality
mg/m3	milligrams per meter cube
µg/m3	micrograms per meter cube
PM	Particulate Matter
ppb	parts per billion
ppm	parts per million
STEL	Short-Term Exposure Limit
TWA	Time-Weighted Average

AQMx Overview

AQMx (Air Quality Monitoring System) is a smart, one-stop solution for enterprise-level air quality monitoring. It enables centralised monitoring across all physical entities (both indoor and outdoor air quality monitoring falls within its purview) of the organisation and measures the concentration of various air pollutants in the atmosphere.

Some salient features of the platform include the ability to track real-time levels of air pollutants. Alert generation is configured into the System when AQMx observes pollutant levels above the established baseline threshold; allowing for quick redressal. AQMx is an important bulwark against industrial accidents and aids organisations to be in compliance with regulations and norms. Analytics and data modelling on the AQMx data can be used to inform an organisation's future strategy.

The mechanics behind AQMx are as follows:
AQMx consists of multiple indoor and outdoor sensors connected to a central device that send the air quality data to either the on-site server or cloud server. The underlying logic embedded in the system is run on the data - 24*7 - and if deviations from normal air quality levels are observed by the system, they are communicated via the dashboard in the form of STEL or TWA alerts.

AQMx is a highly customisable, bolt-on solution that requires minimal time and resource commitment from end-users for set up. Ai-DEA Labs has different instances of the AQMx which provide varied read and write accesses. All activity on the System is logged to allow for optimal traceability.

This user manual is a handy guide for configurigation, and usage of the AQMx web application. The manual also provides instructions on how to view and analyse the data captured by AQMx.

1.1 Air Quality Index

AQI is a weighted average of the concentration levels of various air pollutants. The index returns a single value that embodies the quality of air in a particular area.
The higher the AQI value, the greater the level of air pollution, and the greater the risk to public health. There are six AQI value ranges, each with a corresponding colour:

The calculation of AQI requires a minimum of 3 parameters - Either Particulate Matter 10 (PM10) or Particulate Matter 2.5 (PM2.5) must be included, along with any two of the following parameters: Nitrogen Oxide (NO2), Ozone (O3), Carbon Monoxide (CO), Sulphur Dioxide (SO2), Ammonia (NH3), Lead (Pb).

If CO or O3 is one of the parameters, at least 8 hours of data are needed to display the AQI value and trend. For the remaining parameters, a minimum of 16 hours of data is required to calculate AQI. The AQI details will be entered when adding the parameters to the application for displaying AQI.

1.2 AQMx User Roles

The AQMx web application has 4 level of roles. These roles are assigned based on their read and write access limits. They are:

1. System Specialist
2. Admin
3. Manager
4. User

The System Specialist account will be managed by Ai-DEA Labs. The System Specialist will configure the system for the company. The role of System Specialist is to -

- Add location, branch, and zone level details
- Add devices and configure it with the server
- Add sensor category, device category, sensors and sensor limits
- Add and create Admin, Manager and User profiles.

Admins, Managers, and Users can be assigned to specific locations. They can view data and receive email and message alerts only pertaining to their assigned location.

The Admin role has maximum privileges in managing the application. They manage user accounts, access control, system performance, and can edit location, sensor and device details.

The Manager role has read and write access privileges restricted to specific locations.

The User role is limited to viewing data only. Users do not have write access privileges like Managers or Admins.

System Requirements and Login

2.1 System Requirements

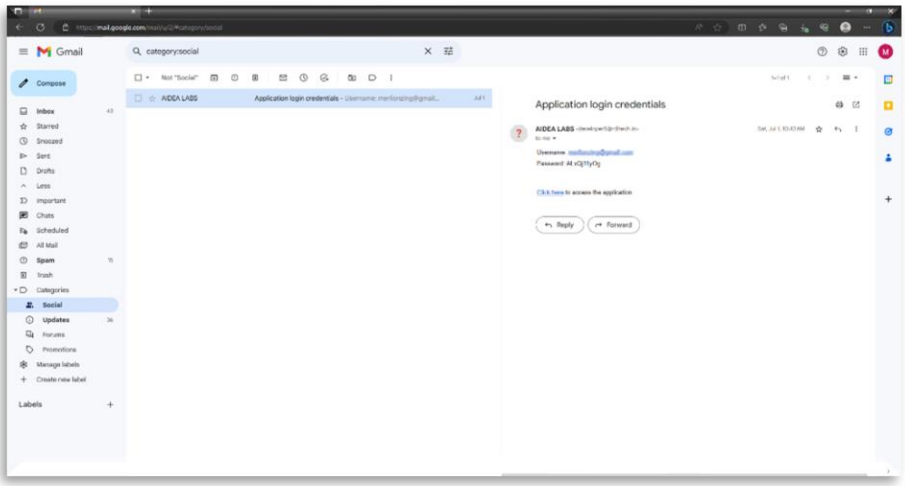
To view the AQMx software on the computer or tablet or mobile, ensure that the device meets the following requirements:

- Windows 7 or later, or Mac OS X 10.10 or later, Android 12 or later
- Web browser (Google Chrome, Mozilla Firefox, or Microsoft Edge)
- Internet connection

2.2 Log-in Procedure

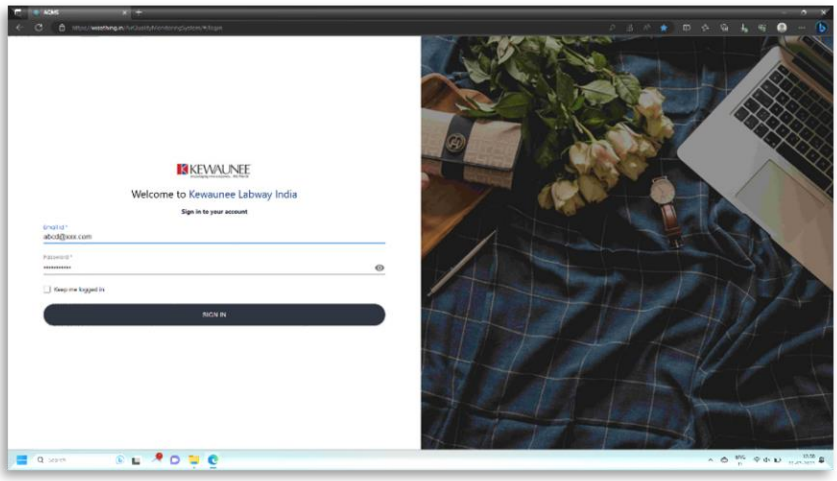
Step - 1

Open the mail sent by Ai-DEA Labs and click on the AQMx web application link.



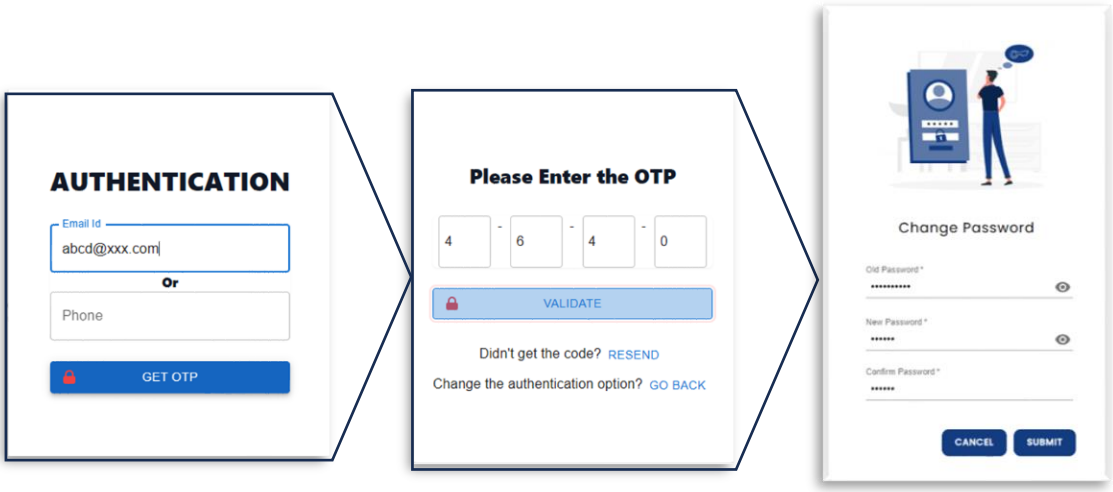
Step - 2

The login page will be displayed. Enter the registered e-mail ID and the system generated password received.

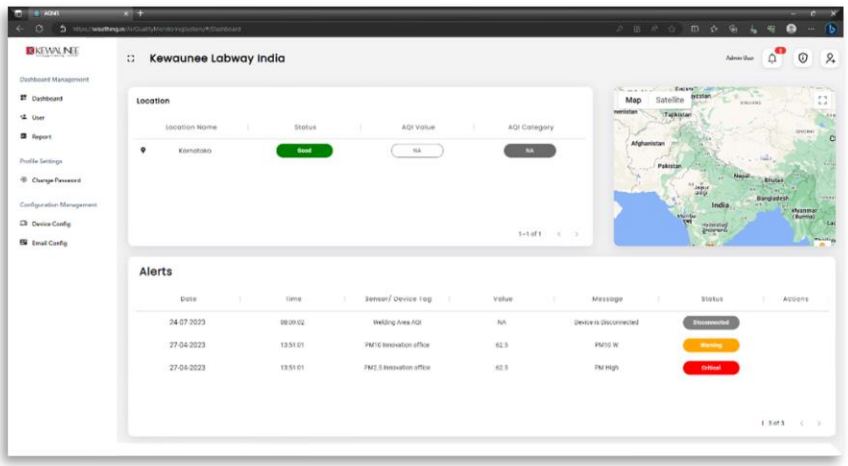


Step -3

Verify your account via OTP sent on the email or phone number. Once verified, reset the system generated password



Once the password has been reset, the application will log you out. Enter the e-mail ID and the new password set to sign in and view the dashboard.



Application Overview

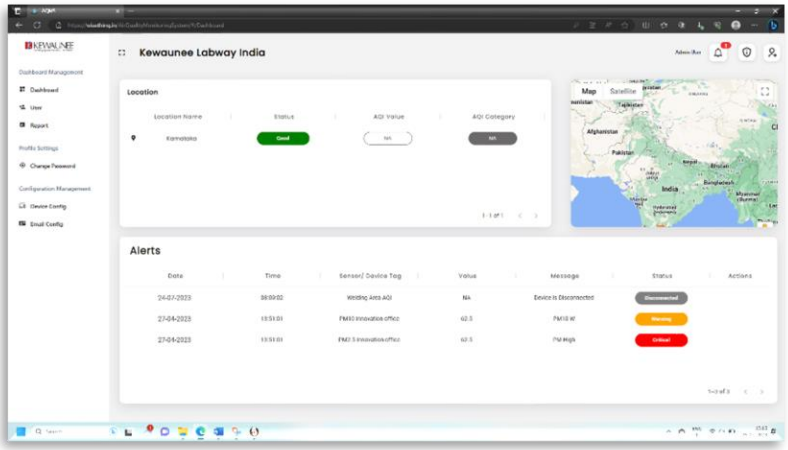
The following are the major categories on the side bar:

- Dashboard Management
  - Dashboard
  - User
  - Report
- Profile Settings
  - Change Password
- Configuration Management
  - Device Config
- Device Management
  - Devices

The Device Management menu will be available only for the System Specialist and will not be accessible for the Admins, Managers and Users.
The **Admin and Manager have editing access**. The User has only read-only access. Please note that the option to delete any data is not available.

2.3 Dashboard

The application provides a dashboard which shows the performance of the system at the aggregate level.



The AQMx grid displays the following:

- Location Name
- Status
- AQI Value
- AQI Category

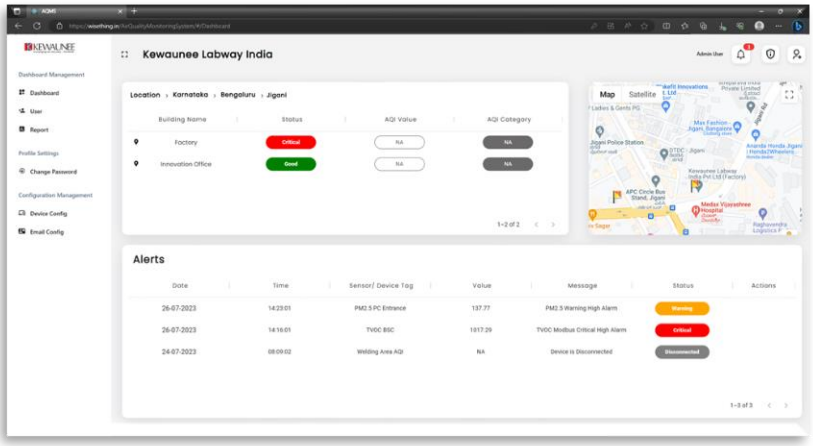
The status displays the real time highest level of alert among all sub-levels. The location architecture follows a hierarchy of

Location > Branch > Facility > Building > Floor > Zone > Devices > Sensor

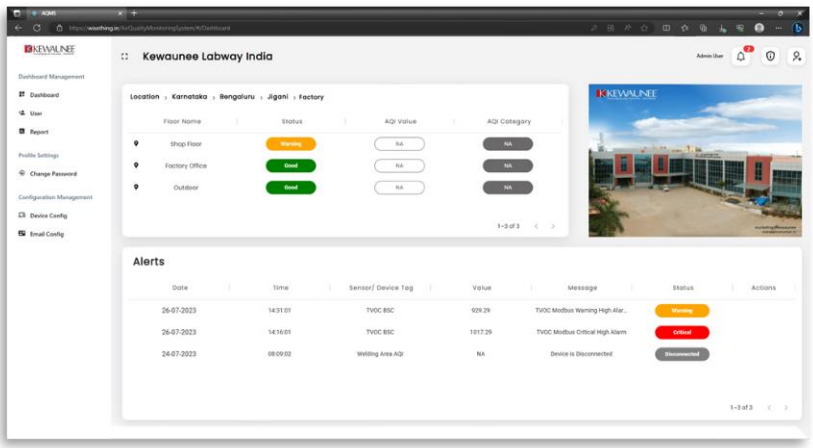
To view a specific device or sensor, click on Location and navigate through each level, selecting the associated Branch, Facility, Building, Floor and Zone. Click on the device to view connected sensors. All Admins, Managers and Users can view this data.

The main dashboard displays location, branch, facility and building positions on the map.

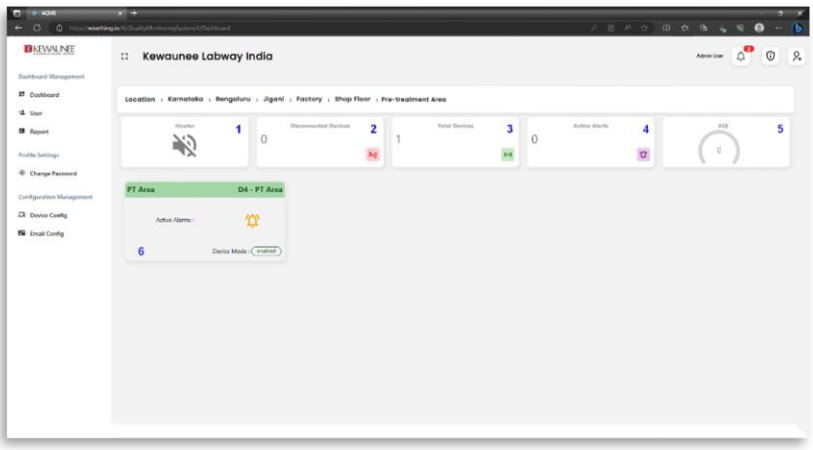
Till Branch level, the average of availabe AQI of different facilities in the branch is provided. From Facility level, the maximum of available AQI is displayed. At the sensor level, the AQI value and 24 hour AQI trend can be viewed.



The Floor and Zone screen displays uploaded building and floor plan images, respectively, for better visualization of the location and its zones.

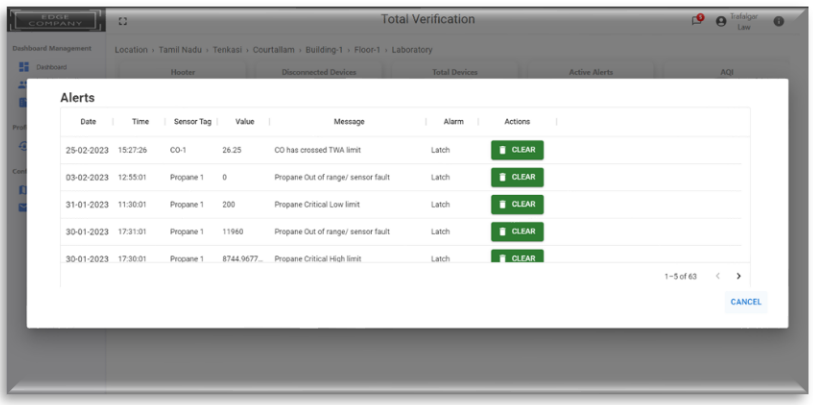


2.3.1 Device Screen



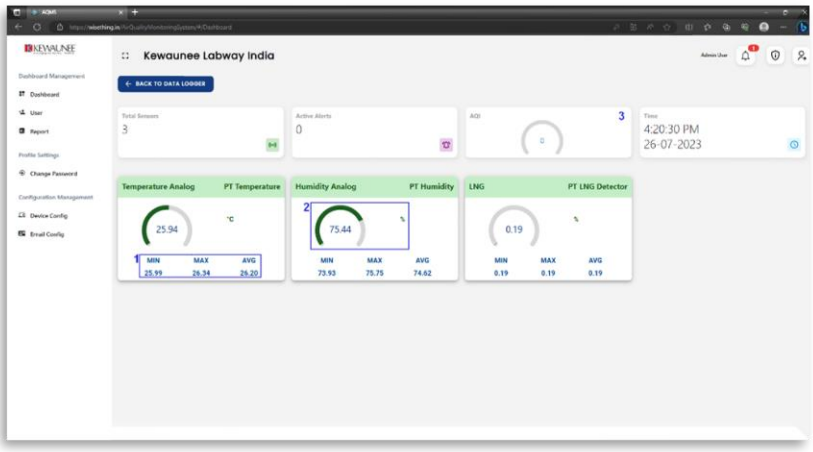
On the **Device screen**, the following icons are displayed on the top bar:

1. **Hooter:** The Admin, Manager can mute the localized hooter when there is an alert by clicking on hooter icon.
2. **Disconnected Device:** Displays the total number of disconnected devices in the zone.
3. **Total Devices:** Displays the total number of deployed devices in the zone.
4. **Active Alerts:** Displays the total number of active alerts. On clicking the card, the following details of the alerts are displayed: Date, Time, Sensor Tag, Sensor Value, Message, Alarm and Actions button.



5. **AQI:** The AQI card is displayed on the Device page provides the zone AQI.
6. **Device Card:** The number of active alerts and the device mode are provided on the card. The colour of the card will change corresponding to Alerts and Device Modes.

2.3.2 Sensor Screen



Clicking on a device card directs the user to the Sensor page, which displays the connected sensors as sensor cards. Each sensor card provides the following information,

1. Sensor name and their minimum, maximum, and average values in the past **15-minutes**.
2. The **instantaneous value, along with the measuring unit**, is prominently shown in the **centre** of the card. The card colour changes to indicate alert conditions.
3. Clicking the AQI card displayed on the Sensor page, a graph displaying AQI readings for the past 24 hours in hourly intervals will be shown. This graph will help to observe the trend of AQI over time and identify patterns in the data.

4. Clicking on a **sensor card** opens the **Trends** screen, presenting a sensor data graph with date and time on the X-axis and sensor value on the Y-axis. Alarm limits are represented as lines on the graph. Users can customize and select the duration and grouping intervals of the trends to view the trends for the period of concern.

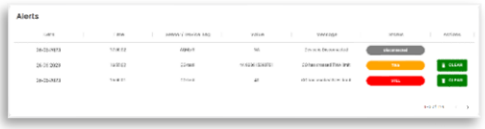
To return to the Device card, the user can click on the "Back to Data Logger" button.

2.3.3 Alerts

2.3.3.1 Functionality of Alerts

When the sensor values exceed the set limit, the following indications are provided by the software:

The dashboard grid reflects the real time safety with colour and status changes



Alerts information added to the Active Alerts Table

All logged-in users will see the alert pop-up on the application.

The designated users receive email and text message notifications

Latched alerts remain in the Active Alerts column until they are cleared by providing the reason for the alert while unlatched alerts are automatically cleared when values return to normal.

Latched or unlatched condition is provided while adding the sensor by the System Specialist.

2.3.3.2 Types of Alerts

All Alert limits specific to each type of contaminant are set as per industry standards by the system specialist and cannot be edited beyond the set limits.

AQMx web application supports various types of alerts, each represented by a distinct colour.

Alert	Color	Description	Suggested Action
Critical	Red	Most Severe alert	It is strongly advised to vacate the location and follow the emergency response plan
Warning	Yellow	Possible dangerous situation	Immediate attention required to prevent the situation from becoming a critical condition
Out of range	Violet	Malfunctioning sensor, a disconnected sensor or a	It is important to investigate the cause of the out-of-range alert and

		change in the environment being measured	take appropriate actions to ensure the safety and reliability of the system.
STEL	Red	Exceedance of the average Short Term Exposure Limit (STEL) that can cause acute health effects	It is advised to take a break of at least 60 minutes from the hazardous area to reduce the duration of exposure
TWA	Yellow	Exceedance of the Time Weighted Average (TWA) designed to prevent long-term effects of exposure to hazardous substances that can cause chronic health effects such as cancer, lung damage, and other illnesses	All exposure must be halted for the rest of the work day
Device Disconnected	Grey	Device has lost communication with the software	Possible due to network issue, device fault or wiring issues. Prompt action should be taken to rectify the issues

2.3.4 Bump Test

A bump test ensures proper functioning of sensors. If the sensor fails the bump test, calibration or replacement is required.
There are two types of bump tests:

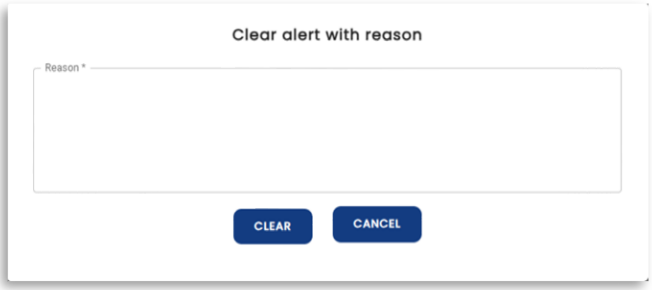
- **Zero check**: The sensor is exposed to zero concentration of the gas it measures. If the sensor output is within an acceptable percentage of deviation, it passes the test. Otherwise, it fails.
- **Span check**: The sensor is exposed to a known concentration of the gas. The sensor output should match the given concentration or be within an acceptable percent deviation.

During the bump test mode, the device doesn't actively monitor sensor data, including a one-minute period after the test. No alerts are triggered during this time. It's important to choose a suitable time for bump tests when absence of monitoring won't cause safety concerns. After the bump test, the device resumes normal monitoring operations.

2.3.5 Active Alerts

In Active Alerts, the Date, Time, Sensor Tag / Device Tag, Value, Message, Alarm type and Actions button are displayed. There are two types of alerts

a. **Latched** - Alarm are cleared **manually** when sensor data are in normal range. On clicking Clear button on action column, "Clear alert with reason" screen will be displayed. Enter the reason for the alert and click clear to clear the alarm from the Active Alert list.



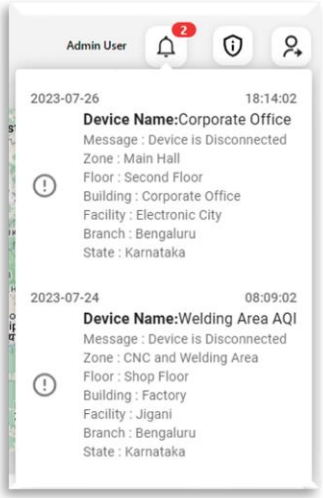
b. **Unlatched** - Alarms gets cleared **automatically** when sensor data are in normal range.

Only **Admin and Manager have privileges to Clear the Alert**.

Note: Alerts must be cleared only when sensor values are in normal range and cannot be cleared when alarm conditions exist.

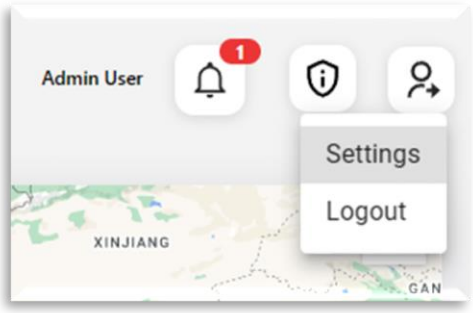
2.3.6 Notifications

Total number of **existing alerts** with sensor details (Location, Date, Time and Alert Type) can be viewed when the notification icon is clicked. On clicking the notification, the respective sensor card or device will be displayed.



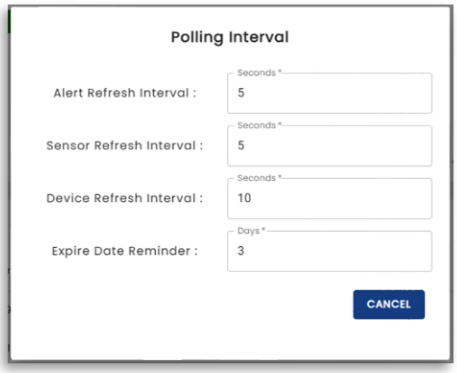
2.3.7 User Settings

The user's ID will be displayed on dashboard. When **Admin or Manager** clicks on the user image, **Settings** and **Logout** option will appear. For the **User** role, only the **Log Out** option will be displayed.



2.3.7.1 Settings

Upon clicking on the "Settings", the "Polling Interval" page will be displayed. **Admin and Manager** will be able to view the interval settings. The application will automatically refresh data based on the intervals that have been previously set.



The following intervals are displayed:

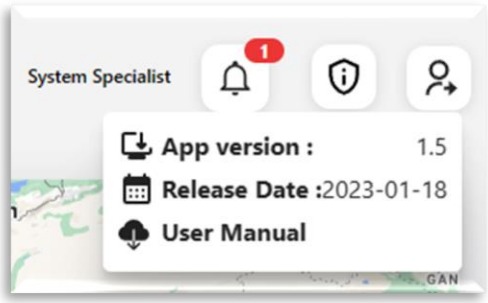
- **Alert Refresh Interval**:
  The Alert Refresh Interval determines the frequency at which the application refreshes alert data.
- **Sensor Refresh Interval**:
  The Sensor Refresh Interval determines how often sensor data is updated.
- **Device Refresh Interval**:
  The Device Refresh Interval determines the frequency of updates for device data.
- **Expiry Date Reminder**:
  The Expiry Date Reminder interval indicates the number of days prior to receiving a reminder.

2.3.7.2 Logout

When the user clicks on logout, the user will be logged out and taken to Login page

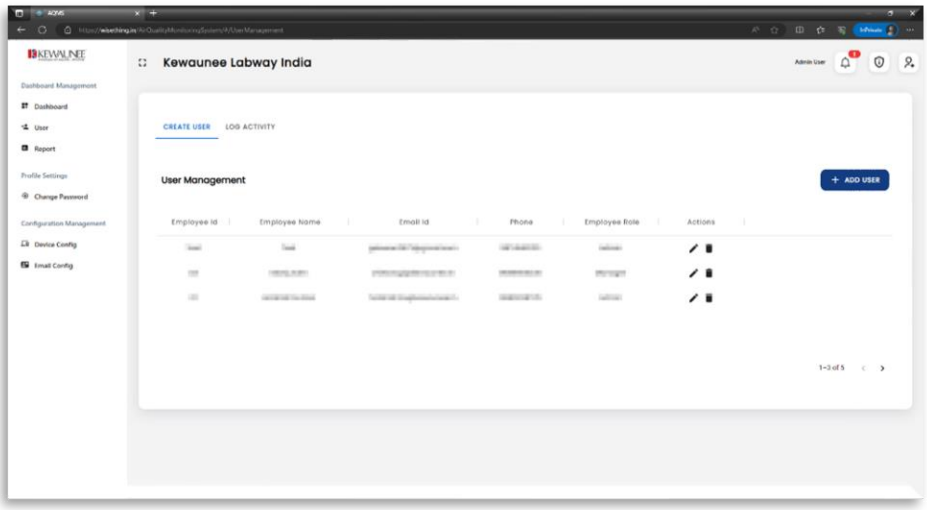
2.3.8 Information Button

On clicking the Information button icon, the Application version number and the Release Date can be viewed.



2.4 User Management

The User Management screen allows to manage user accounts and view user activity logs.



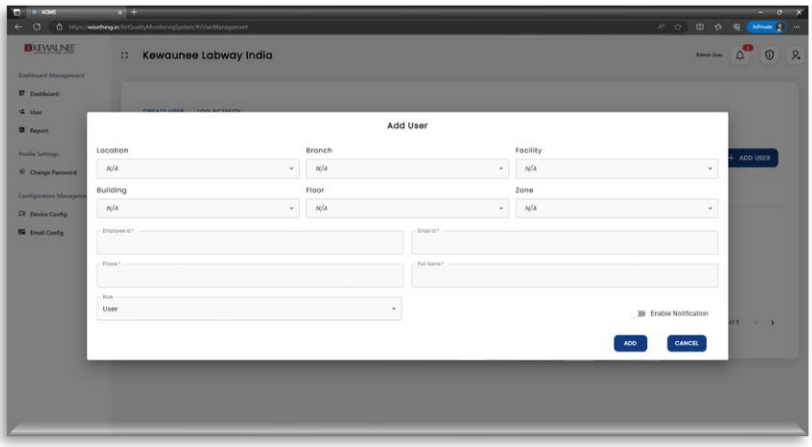
- **Admins** can **add, edit, or delete** any accounts, **change user roles**, and **view user log** activity of all accounts.
- **Managers** can view and edit **only User and Manager accounts**. They cannot add new accounts or access to Admin accounts are **restricted**.
- **User** roles **do not** have access to the User Management screen.

2.4.1 Create User Tab

In create user screen, new users can be created by clicking the "**Add User**" button and their access can be managed with the details provided in **User management**. The Admin will be able to view all the accounts added to the company. For **Admin**, **edit and delete** option will be displayed in action column while for **Manager** only **edit** option will be displayed.

2.4.1.1 Add User

In create user screen, click on "**Add User**" icon to enter the user details.

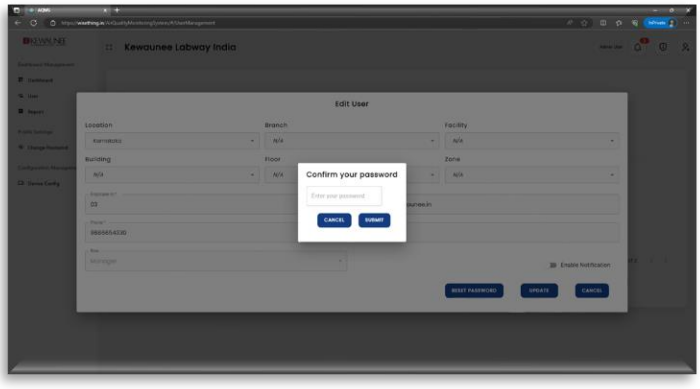


- Map the user to the required location level.
  Example: If the user is **mapped** to **branch level**, that particular user can view and receive messages only from **that branch**. The user will not be able to view the data or download the report from another branch
- Enter the employee ID, Name, E-mail ID, phone number and Role (Admin, User, Manager)
- Enable the notification to send alerts and reminder message to the employee's given phone number and e-mail ID
- Click Add to add the account.

2.4.1.2 Edit User

To edit an existing user, click the edit icon on Action column

- There is provision to modify the user's mapped location, employee ID, name, email, phone number, and role
- Click the Update button to save any changes made
- To reset the user's password (in case the user has been blocked or has forgotten their password), click on the Reset Password button
  - Confirm your password (Admin or Manager) and click Submit
  - A password reset link will be sent to the user's email address

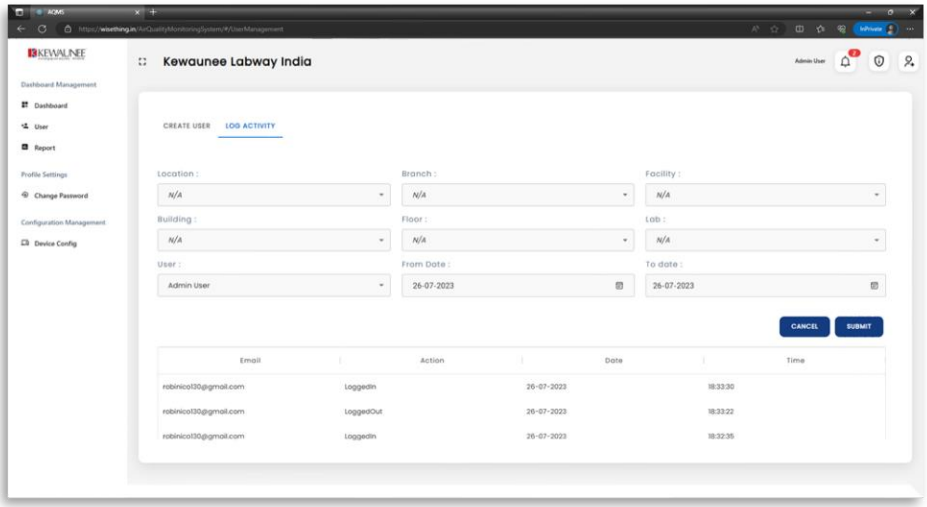


2.4.2 Log Activity

To view log activity, select the Log Activity tab and select the desired location, user, and date range using the 'From' and 'To' dates.

Selecting the location will filter the users listed to those under the location selected. The user can also view the activity of a **specific user**, by selecting the user, and date accordingly.

Once selected, click the Submit button to view the log activity. It will display all the login and logout details of the selected user during the specified date range.



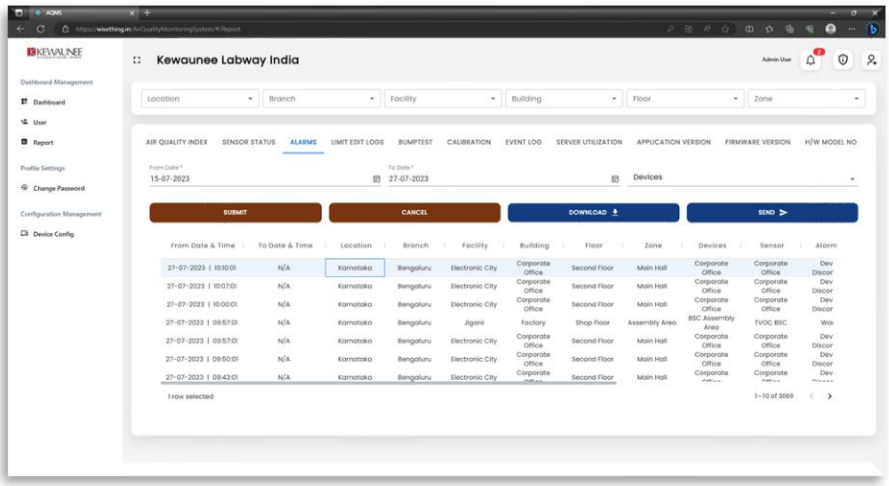
2.5 Report

AQMx web application generates **location-based, date-based and device-based reports** on screen that can be downloaded in excel format. Report of all or specific device / sensor in all or specific locations can be viewed. Reports can be downloaded or sent via mail in the excel format.
The various reports provided are detailed in the sub sections.

2.5.1 View, Download and Send Report

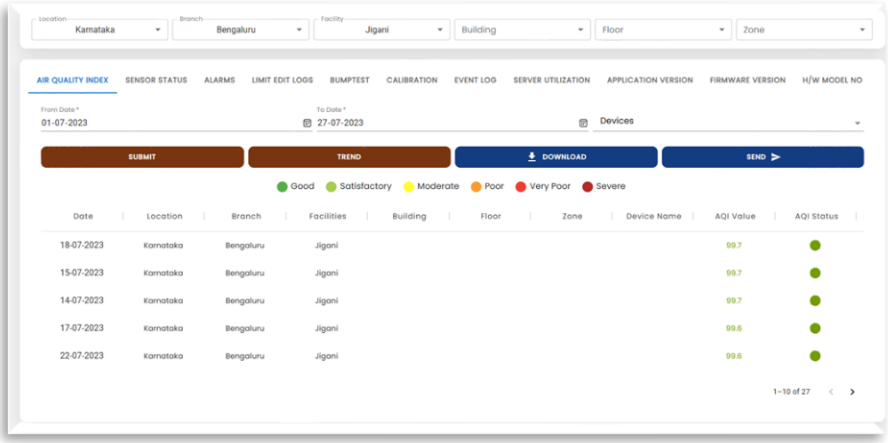
Select the location, type of report (*), from and to date (*) and device.

- Click Submit to view the report
- Click Download to download the generated report
- Click Send to email the report as an attachment to the logged in user



2.5.2 Air Quality Index Report

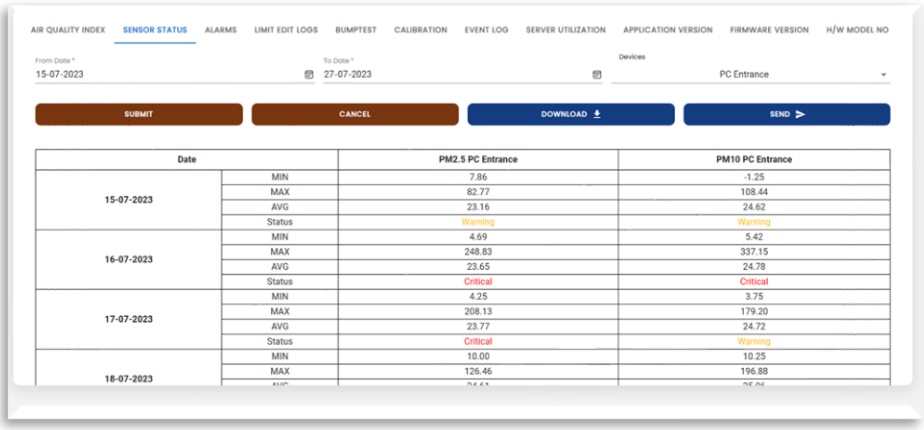
The Air Quality Report can be viewed by selecting the required location and the From and To date. Till branch level, the average of availabe AQI of different facility in that branch is displayed. From Facility level, the maximum of available AQI is displayed.



To view the AQI trend of the device, select a device from the dropdown and click on Trend. A pop-up graph with the device AQI trends can be viewed.

2.5.3 Sensor Status Report

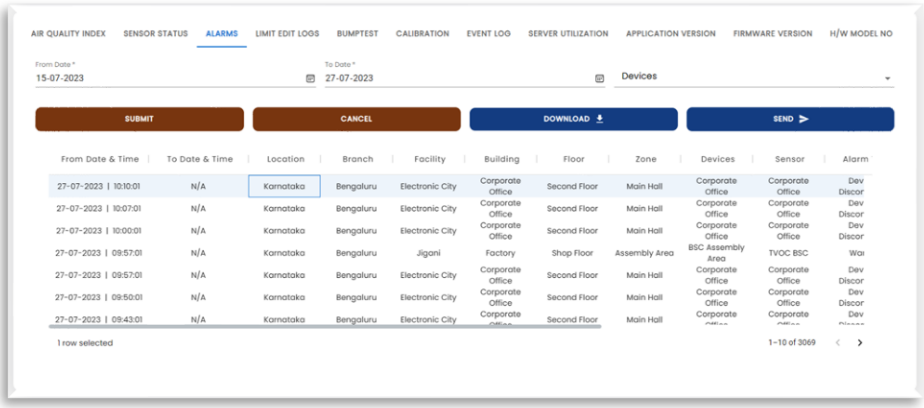
The Report of the minimum, maximum, average / day and status of all the sensors connected to the device can be viewed by selecting the device from the dropdown.



Date		PM2.5 PC Entrance	PM10 PC Entrance
15-07-2023	MIN	7.86	1.25
	MAX	82.77	108.44
	AVG	23.16	24.62
	Status	Warning	Warning
16-07-2023	MIN	4.69	5.42
	MAX	248.83	337.15
	AVG	23.65	24.78
	Status	Critical	Critical
17-07-2023	MIN	4.25	3.75
	MAX	208.13	179.20
	AVG	23.77	24.72
	Status	Critical	Warning
18-07-2023	MIN	10.00	10.25
	MAX	126.46	196.88

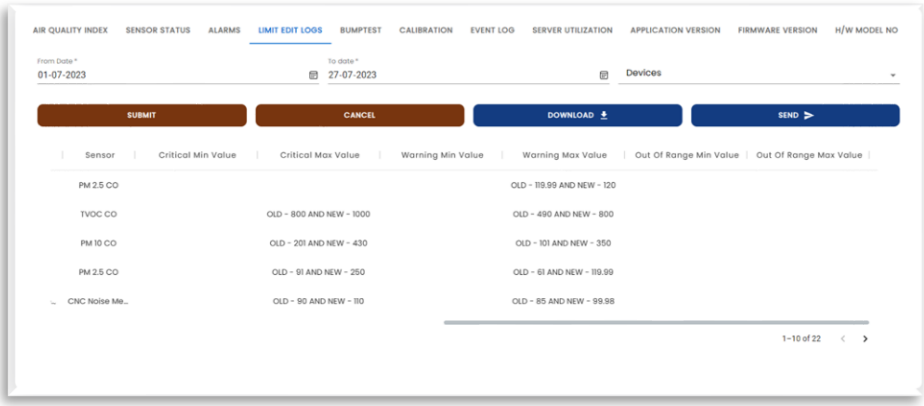
2.5.4 Alarms Report

Based on the configuration, all alarms that were triggered with details of the alarm duration, location, alarm type, message and the reason for the alert are provided.



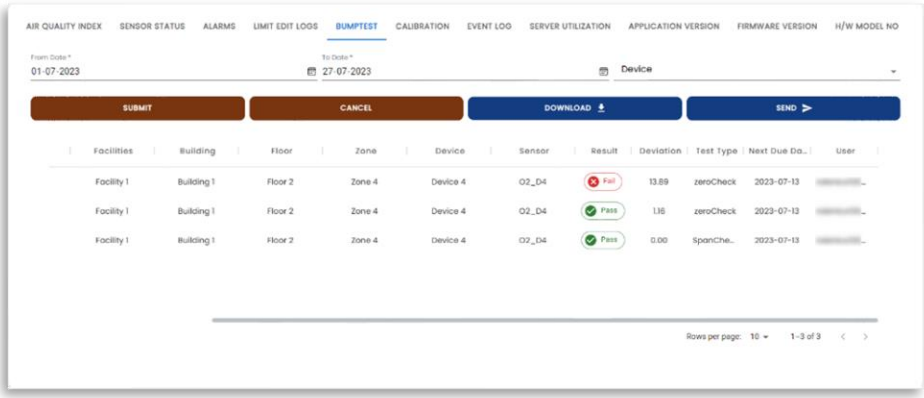
2.5.5 Limit Edit Logs Report

The Edit history of the alarm limits specific to the sensors including the user responsible for the change can be extracted.



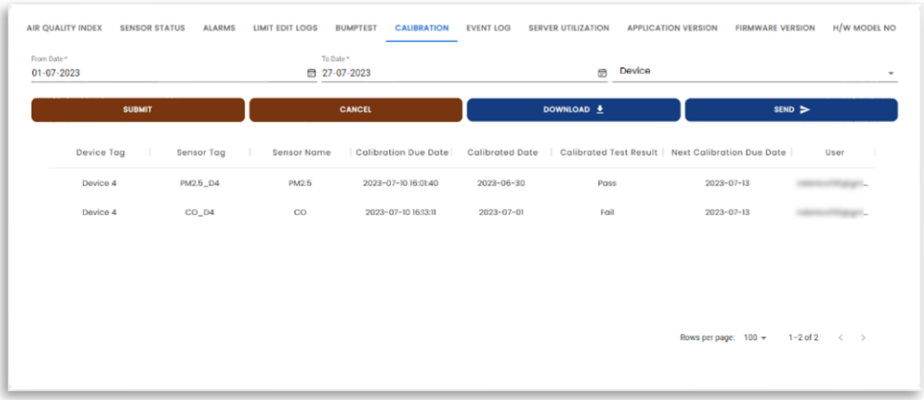
2.5.6 Bump test Report

A comprehensive report with Bump Testing details of the sensor name, location, date, bump test result, bump test type, deviation and the next due date can be obtained.



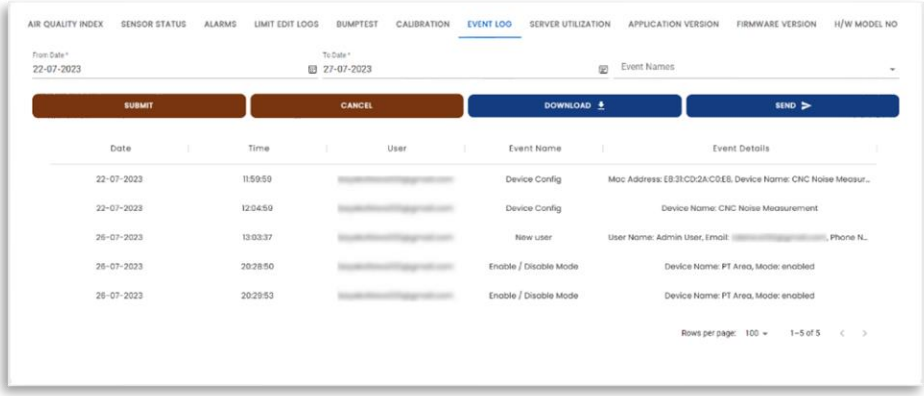
2.5.7 Calibration Report

A report with Calibration details of the sensor, date, calibrated due date, calibrated date, result, next calibration date and user who updated the details can be obtained



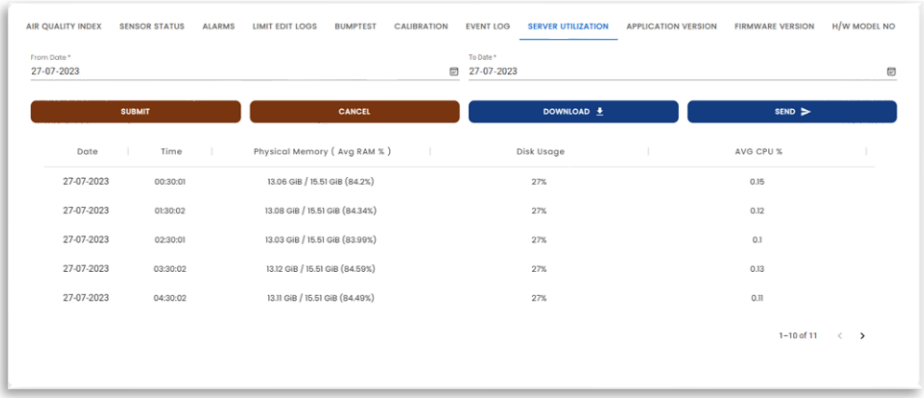
2.5.8 Event Logs Report

An exhaustive report of most changes done on the application can be obtained from the Event Log reports



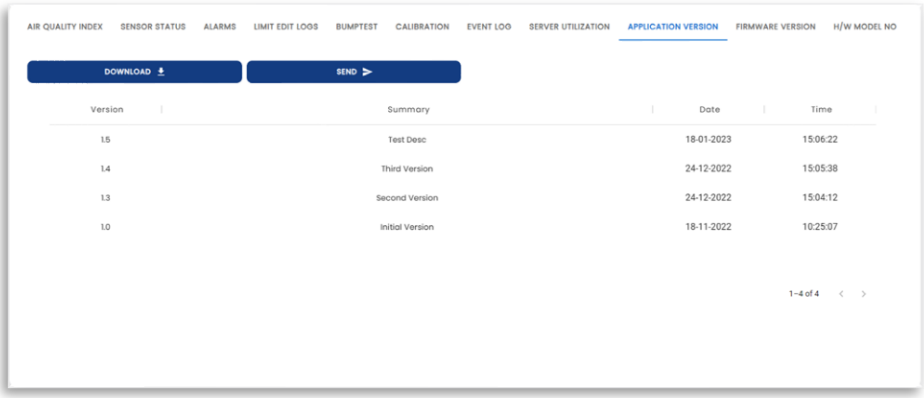
2.5.9 Server Utilization Report

Every hour's Physical Memory (Avg RAM %), Disk Usage, Average CPU percentage of server on selected days will be available.



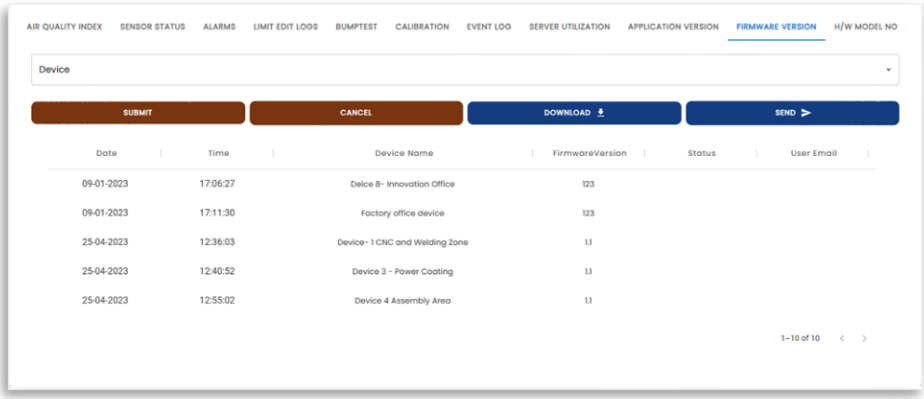
2.5.10 Application Version Report

The application version history with the date and time of the version updates can be viewed.



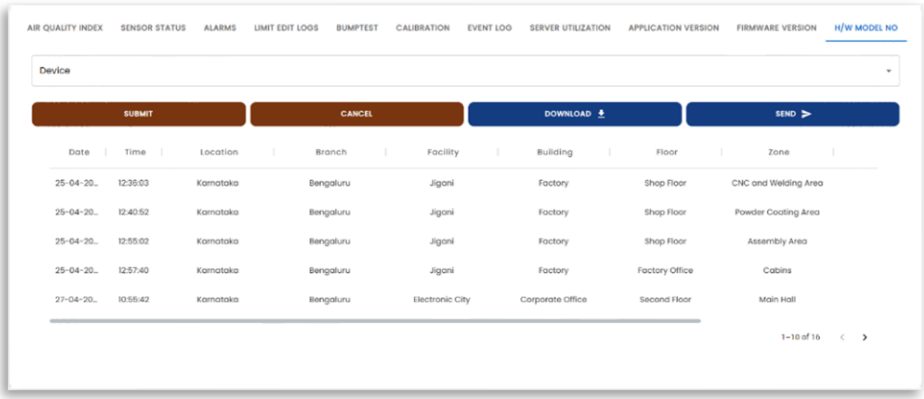
2.5.11 Firmware Version Report

Reports of the current firmware version running on the deployed devices including any update in the firmware files are provided.



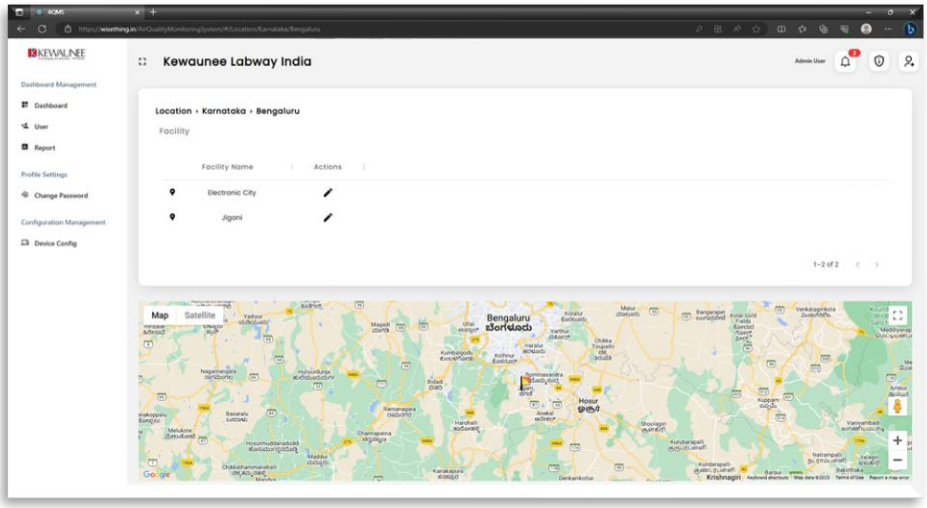
2.5.12 H/W Model Report

Reports of the Hardware model number of the deployed devices can be generated



2.6 Device Config

The Device Configuration screen allows Admin and Manager to edit a Location, Device, and Sensor details. The device modes changes, firmware upgrades, and software upgrades are also performed via Device configuration screen.

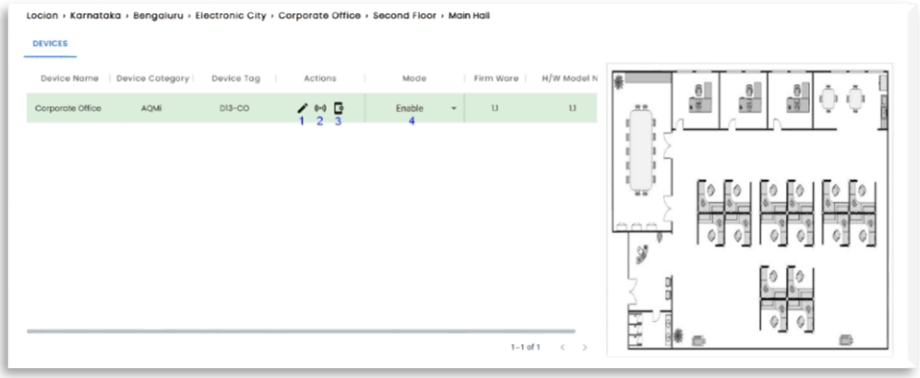


Once changes have been made, users can click on the "**Update**" button to save them. The below listed functionalities can be done in the Device config screen

2.6.1 Edit Location

To edit any Location details, click on edit icon. "Edit Location" screen will be displayed to edit the location name and corresponding location on the map.

- From **Location to Facility** level, the location on map can be edited by moving the flag icon.
- At **Building** level, the building tag, building name, number of floors, and building image can be edited.
- For **Floor and Zone** level, the floor name, floor image, and zone name and image can be edited, respectively.
- At Device level, the following can be viewed and edited
    1. Device Details
    2. Deployed Sensor Details
    3. Communication Configuration
    4. Device Mode

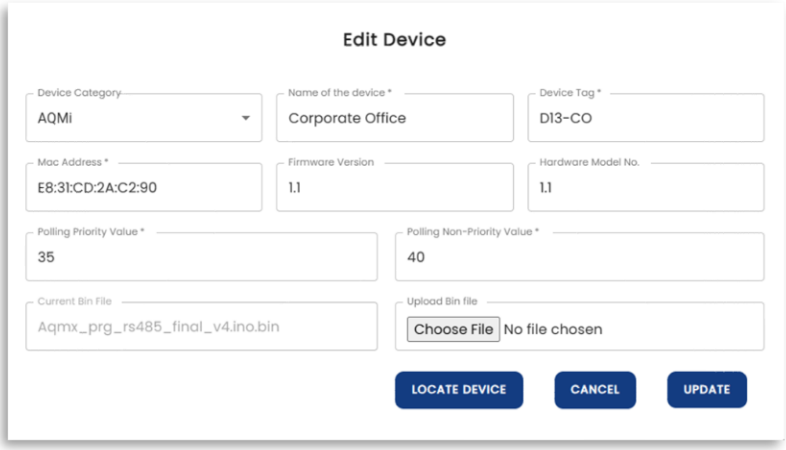


2.6.2 Edit Device Details

All devices within the selected zone can be viewed in Device screen. The users can edit device details by clicking on the edit icon in the action column. Adding new devices, sensors, and sensor limits is limited to system specialists.

In the edit device screen, users can modify or upload the following data:

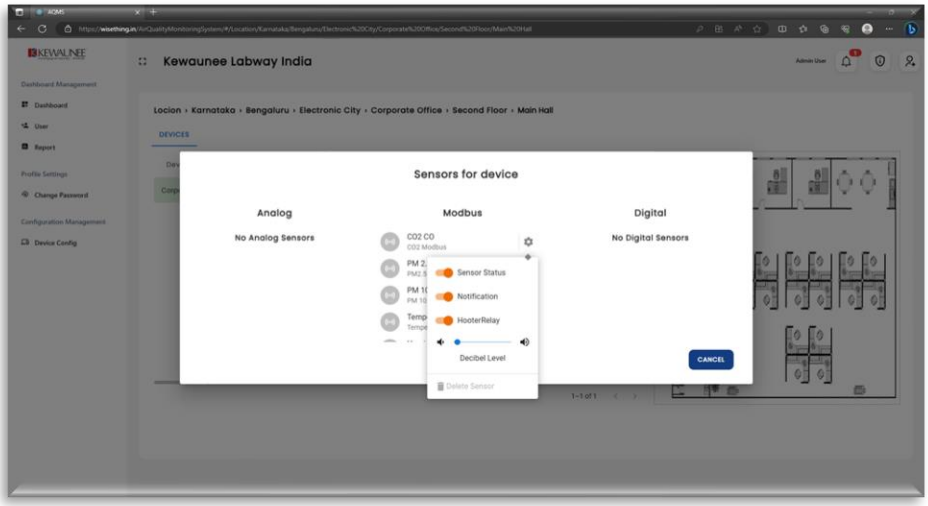
- Device category
- Name
- Tag
- MAC address
- Firmware version
- Hardware model
- Polling priority interval and non-priority interval - determines the frequency of polls to check for changes in sensor state
- Bin file - The user should upload new bin file here to perform the firmware upgrade of the device.



2.6.3 Edit Sensor Details

On clicking sensor icon near the edit icon on device page, the sensors connected to the device, categorized based on type of output will be displayed. Click on settings icon to edit the following data

- Sensor status – The sensor data will not be displayed when Sensor Status is disabled
- Notification - Alert notification and e-mail notification of sensor will be disabled when notification is disabled
- Hooter Relay - The relay connected to the Localized Hooter will be disabled, when Hooter Relay is disabled



Clicking on the Sensor will display following data

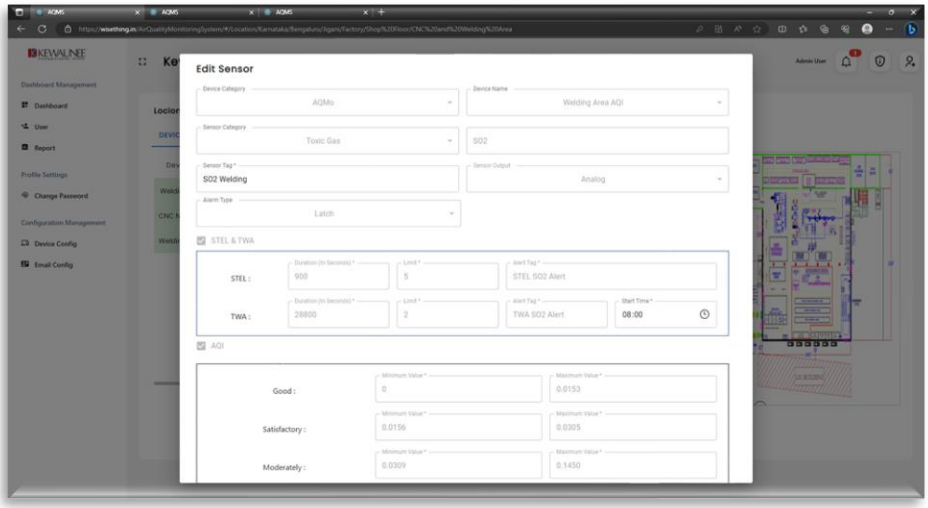
- Sensor category
- Alarm type
- Name
- Tag
- Polling interval type
- Sensor alert limit
- Output type
- STEL & TWA limits
- AQI limits (if provided while adding sensor).

The Admin and Manager can edit

- The sensor Tag
- Alarm type (latch, unlatch)
- Polling interval type (priority and non-priority)
- Sensor limits and messages

- TWA start time

In order to maintain the integrity and ensure proper functioning of the AQMx system, it is important to note that users cannot edit the sensor alert limit values above the ceiling limit, nor can they edit values below the floor limit. Only the **Admin** is authorized to set and edit the **TWA start time**.

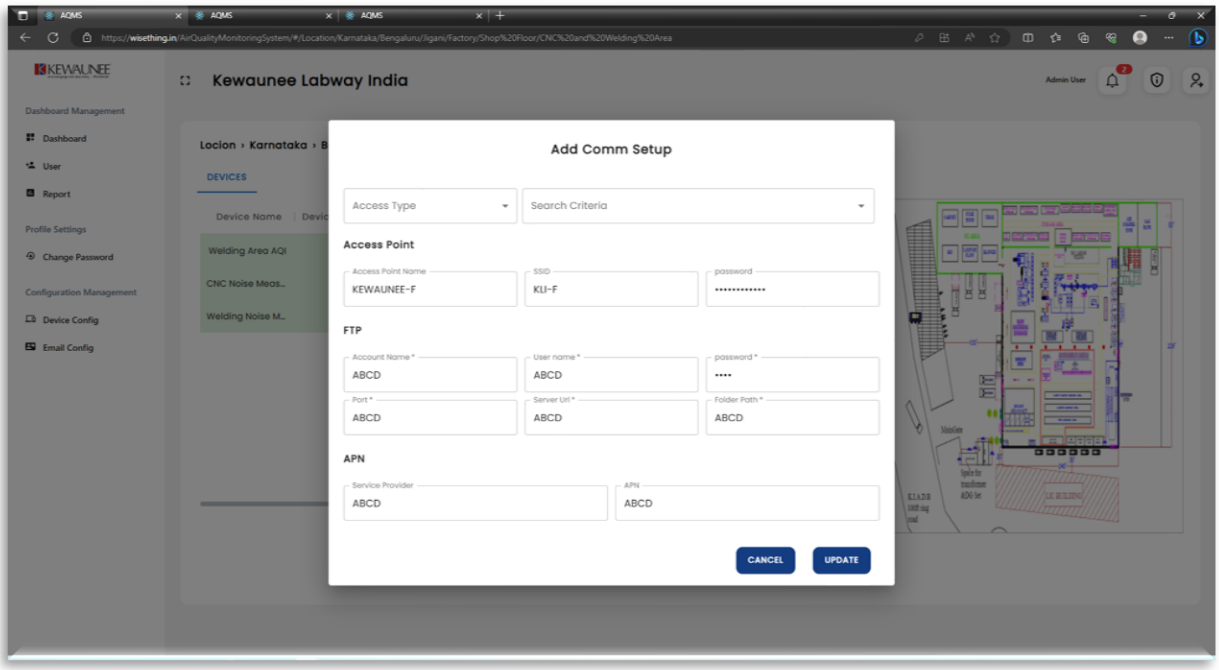


2.6.4 Edit Communication Configuration

On clicking network configuration icon located near the sensor configuration icon the following can be edited.

- **Access Type & Search criteria** – The added configuration details will be listed in the search criteria. Once it is selected, the configuration details will be automatically filled.
- **Access point** – The wi-fi network details to which the datalogger is connected, can be edited here.
- **FTP** – FTP stands for File Transfer Protocol. The location where the datalogger will send the backup data, can be edited here.
- **APN** – APN stands for Access Point Name. The mobile network data can be edited here.

Network configuration profiles can be added only by the system specialist. However, on selecting custom in Access Type the user can enter new Access point, FTP and APN details.



2.6.5 Device Modes

To change the device mode, navigate to the **Device level** in **Device Config** and click on the device mode under the Mode column. A pop-up message will appear to confirm the mode change. There are a total of 7 modes available

2.6.5.1 Enable Mode

The data logger will receive data from the sensor and send it to the server at set intervals and work as normal condition.

2.6.5.2 Disable mode

The data logger will be disabled. The data logger will not send any data from the sensors. Device card will be displayed in Grey with “Disabled" on the Dashboard.

2.6.5.3 Bump test Mode

Once the bump test mode is selected and confirmed, bump test screen will be displayed.

- Select the sensor. The previous bump test history will be displayed in the bump test table below.
- Place the sensor in bump test kit and ensure the bump test kit is ready.

- Select the type of test to be done (Zero check or Span check) and enter the duration. The duration should be greater than 60 seconds. For span check, select the percentage concentration of gas to be provided.
- Once the setup is ready, click start button. Once start is clicked, the other sensors connected to the device will not be monitored.
- The sensor output will be displayed in "Display value" and the percentage deviation of the read value with the reference value will be displayed.

Once the set duration is over, the bump test result will be displayed. Enter the due date and click submit to log the bump test. In the case the bump test fails, an email with the sensor details will be sent to the configured users.

The selected users will get a reminder notification when the bump testing is due as per the **Expiry Date Reminder** set in **Settings**.

Note: During the bump test mode, the device will not be actively monitoring the sensor data for anomalies i.e., there will be no alerts. This includes a one-minute period post the completion of bump test.

2.6.5.4 Calibration mode

The sensor calibration screen will be displayed, where the calibration details can be added. The device will function normally like in the enable mode. The calibration history of the sensor can be viewed from the calibration table below.

- Select the sensor tag
- Enter the test result, calibration date and the next calibration due date
- Click the submit button.

The selected users will get a reminder notification when the calibration is due as per the **Expiry Date Reminder** set in **Settings**.

2.6.5.5 Firmware upgradation

To upgrade the firmware of the device,

- Upload the Bin file in "**Edit Device**" screen, update the firmware version number and click update.
- Select the firmware upgradation mode from the device config screen and confirm the mode change.
- The firmware upgradation will get started.
-

Please note that the device should be connected to the server for firmware upgrade and the device will not be monitoring the sensor values and there will not be any alerts during firmware upgrade.

2.6.5.6 Configuration

After making any update in the device or the sensor details, the device should be put in Configuration mode to update the details in the datalogger. In Configuration mode, the device will not be monitoring the sensor data and there will not be any alerts during this mode.

2.6.5.7 Debug

To debug the Network, RTC, SD card issues in the device, the device should be put in debug mode in the device config screen.

2.7 Profile Settings

2.7.1 Change Password

In the "Change Password" screen, users can update their passwords. To do so, follow the steps below:

- Enter the Old password.
- Enter the New Password.
- Re-enter the new password in the Confirm Password field to confirm it.
- Click on the "Submit" button to save the new password
- Login with the new password for the next login.