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vyvo™



Monitoring and Reporting  
Air Quality with  
Vyvo Technology  
Wearable Device



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## Air Quality Index: An Overview

- An **Air Quality Index (AQI)** reports air quality in reference to air pollution levels and associated health effects that might be of concern to the population.
- **AQI** measuring stations are often placed in areas with high population density to monitor air quality where people live, work, and spend time outdoors
- These stations monitor various air pollutants such as particulate matter, ozone, carbon monoxide, sulfur dioxide, and nitrogen dioxide.
- Should appropriate agencies expect an elevated **AQI** for a given day, they can issue warnings for at-risk individuals to stay indoors or to use a mask when outside.

## Drawbacks of AQI

- The accuracy of **AQI** measurements decreases as the distance from the monitoring station increases.
- Individuals living farther away from monitoring stations may experience air quality conditions that differ, perhaps significantly, from the **AQI** reported for the nearest station.
- Standard **AQI** reports have no way to account for the indoor air quality (IAQ) an individual may experience.



## Indoor Air Quality Factors

- Gasses that contribute to poor indoor air quality include volatile organic compounds (VOCs), total concentration of all VOCs (TVOC), CO<sub>2</sub>, sulfur-based odor and other odors.
- Ethyl alcohol (EtOH, also known as ethanol) is a usual standard type of VOC for air quality evaluating, so its result is useful as a reference.
- Long-term high CO<sub>2</sub> concentration is also harmful to health.

## Outdoor Air Quality Factors

- Gas compounds that contribute to poor outdoor air quality are nitrogen dioxide (NO<sub>2</sub>) and ozone (O<sub>3</sub>).
- NO<sub>2</sub> is a pungent gas that, along with fine airborne particulate matter, contributes to the reddish-brown haze characteristic of smoggy air.
- Research shows that O<sub>3</sub> and NO<sub>2</sub> are highly correlated in most city environments.



## Monitoring AQI with Microsensors



- Microsensors such as [microelectromechanical systems](#) (MEMS), chemiresistors, and microcontroller units (MCUs) can be used to detect pollutants.
- [MEMS](#) devices are tiny electromechanical systems that integrate mechanical and electrical components on a microscale. They typically consist of micrometer-sized structures, sensors, actuators, and electronics, all fabricated using microfabrication techniques.
- [Chemiresistors](#) detect chemical compounds by measuring changes in electrical resistance. This change can be proportional to the concentration of the target compound in the environment being monitored.
- [MCUs](#) are compact integrated circuits (ICs) that contain a microprocessor core, memory, input/output (I/O) peripherals, and other essential components required for embedded systems; they are essentially microscopic and self-contained computers.

## Enabling A Personal AQI with BioSense Watch

- BioSense™ Watch from Vyvo Technology is the world's first smartwatch with on-board air quality monitoring, specifically the AirSenseM1 air quality module.
- This module incorporates three distinct sensors to enable real-time measurements of indoor air quality (IAQ), outdoor air quality (OAQ), general air quality (GAQI), and, for good measure, ambient temperature and humidity.
- When not worn, BioSense Watch can also act as a stable air quality monitor, such as when placed on a kitchen counter.



## Measuring Indoor Air Quality

- An Indoor Air Quality measurement with BioSense Watch reports an overall score, TVOC, EtOH, and perceived temperature and humidity.
- TVOCs are responsible for the odor of scents and perfumes as well as pollutants, and are found in common household sources, including tobacco smoke, paint, nail polish, adhesives, and household cleaners.
- If EtOH vapors accumulate in enclosed spaces or are released in high concentrations, they can contribute to indoor air pollution. This is especially true in poorly ventilated areas or when using products containing high levels of ethanol, such as certain cleaners or solvents.
- CO2 concentration cannot be directly measured by the MEMS MOX sensor. However, there is a strong correlation between CO2 and TVOC levels caused by indoor human occupancy. Therefore, we calculate estimated CO2 (eCO2) using our robust, patent-pending algorithm using this correlation.
- Indoor Air Quality is measured on-demand only.

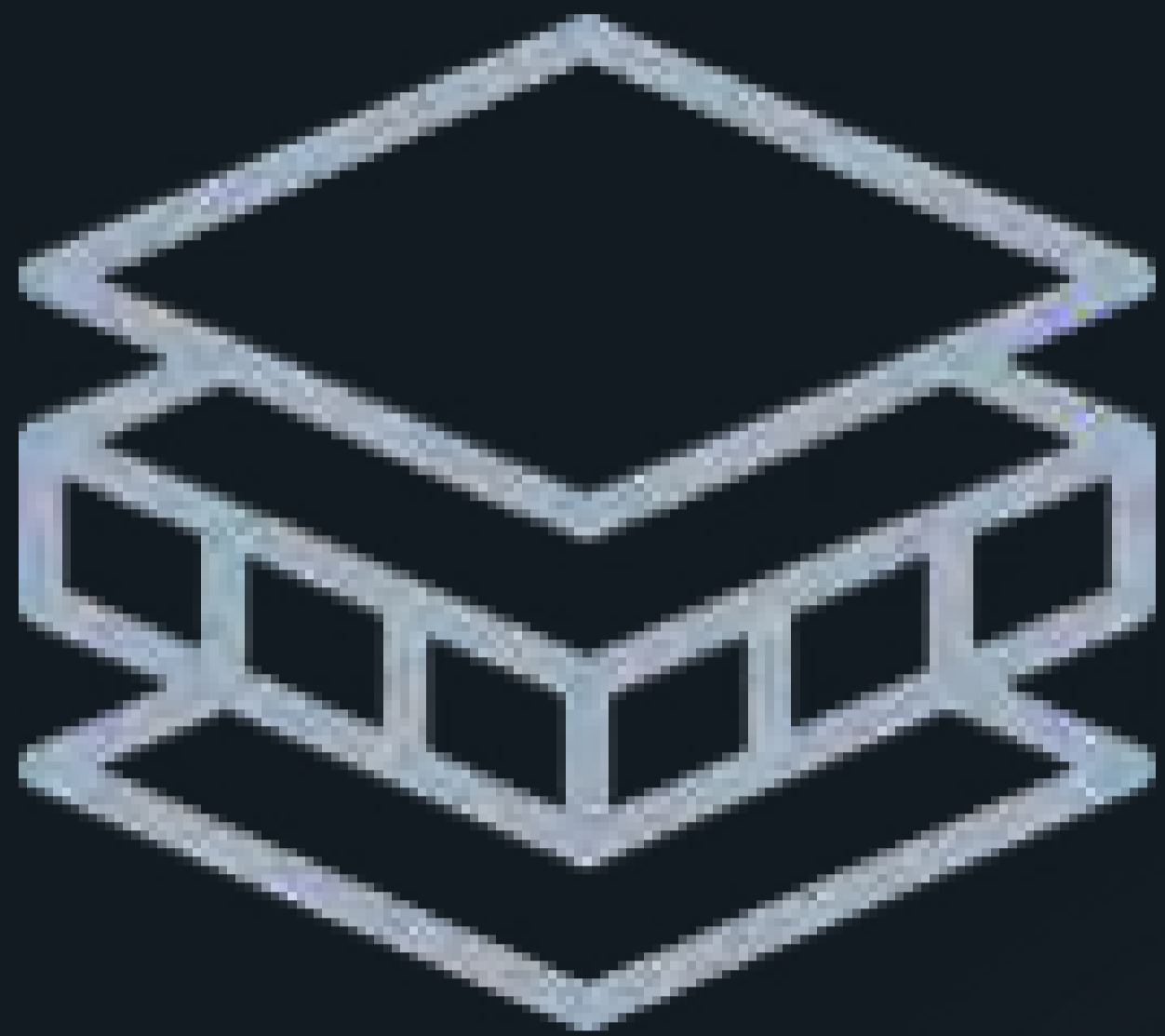




## Measuring Outdoor Air Quality

- An Outdoor Air Quality measurement with BioSense Watch reports an overall score, ozone, EPA AQI, and perceived temperature and humidity.
- Ozone is not emitted directly into the air but is formed by chemical reactions between oxides of nitrogen and VOCs in the presence of sunlight.
- O<sub>3</sub> can have significant health effects, particularly on the respiratory system.
- The EPA's Air Quality Index (AQI) provides an overall assessment of outdoor air quality based on the concentrations of several pollutants, including ground-level ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrogen dioxide.
- To adapt BioSense Watch to a possibly fast-changing and fluctuating circumstance, the EPA measurement used combines level 1 and 2 of the original EPA measurement.
- Outdoor Air Quality is measured on-demand only.





## Ideal Middle Ground: General Air Quality

- BioSense Watch users will often be in fast-changing circumstances, frequently moving between indoor and outdoor settings.
- The defining line between “indoor” and “outdoor” can be hard to distinguish, such as sitting inside but next to a widely opened window.
- To address these situations and provide an all-around measurement, Vyvo Technology developed a General Air Quality Index (GAQI).
- GAQI is the best possible representation of the air quality immediately around the device user at any given moment. It reports an overall measurement; ozone; EPA; TVOC; eCO<sub>2</sub>; and EtOH.
- Just as BioSense Watch automatically measures wellness data, it will also automatically capture AQI data and report a general index every 30 minutes.
- This unique metric reports an overall air quality based on all the results from the sensors, considering all measured gasses, IAQ, AQI, temperature, humidity, etc.

The real-time and very personal environmental awareness made possible by the first-of-its-kind AQI monitoring in a smartwatch helps users make informed choices to protect their wellness. There’s no substitute for knowledge, and this breakthrough feature is one more way Vyvo Technology supports healthy lifestyle choices.

Some features are not available in all markets. Vyvo Technology Helo products and services are designed to support wellness and are not intended for diagnosing, curing, mitigating, treating, or preventing any diseases or other medical conditions and users should consult with a doctor or other qualified healthcare professional before making any medical decisions.



# Your Personal Air Guardian

The first smartwatch with  
built-in air quality sensors



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