

# Smart Air Quality Alert System

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## The Problem

The citizens of Delhi, grappling with the persistent challenge of hazardous air quality, experience the detrimental effects of pollution on a daily basis, especially during peak pollution seasons (Winter) when stubble burning is practiced across North India around the capital. Breathable air becomes a precious commodity as individuals navigate their daily routines, impacting their health, well-being, and overall quality of life. Also, the regional government tries to hide the actual extremely high readings by tampering with the air quality monitors in weather stations across the capital region.



## CAPITAL'S NIGHTMARE

Stubble burning could contribute anywhere between 12% and 60% to Delhi's air pollution

### One ton of stubble, on burning, releases

2 kg of SO<sub>2</sub>  
3 kg of particulate matter  
60 kg of CO  
1,460 kg of CO<sub>2</sub>  
199 kg of ash

### Health Impact

- Winter crop-burning triggers heavy pollution in Delhi
- Can aggravate and trigger respiratory diseases
- Results in loss of soil nutrient and kill soil organisms



Our project aims to address this pervasive issue by providing a nuanced and localized solution: an air quality alert system. By employing an SGP30 gas unit sensor and GPS technology integrated into M5Stick devices, we aim to deliver accurate, real-time air quality data, empowering residents to make informed decisions about their movements and activities. This refined approach not only prioritizes the immediacy of the air pollution problem but also demonstrates our commitment to creating a tangible and impactful solution for the people of Delhi.

Additionally, the collection of precise location data, allows us to create a comprehensive dataset on the Qubitro platform, which, when presented on a map, empowers users to proactively plan their day, avoiding areas with elevated air pollution levels for improved well-being.

The challenge lay in seamlessly integrating the air quality data from the SGP30 gas unit sensor and the location data from the GPS sensor, ensuring synchronization and accuracy in the datasets. Furthermore, the integration with the Qubitro data platform introduces a need for robust data transfer mechanisms, requiring careful consideration of data formatting, transmission protocols, and secure connectivity to create a comprehensive dataset that effectively maps and tracks air quality across various locations visited by the user.

### State of the Art

We planned to first gather air quality data from the gas sensor and alert the user when it goes beyond the threshold. Then we would also save that data on Qubitro along with the lat lng (geospatial) data of that place which would then be used to map all the areas along their air quality. By doing so over time the user could avoid localities that have higher pollution and can also observe at what time of the day the spike happens in the VOC gas concentration.



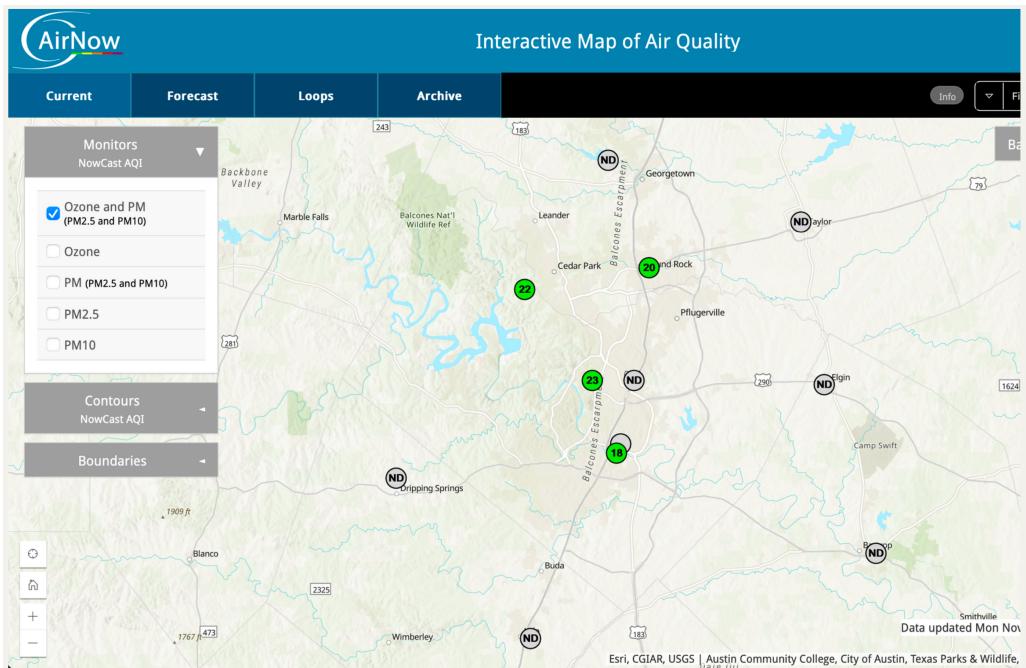
**Amazon Smart Air Quality Monitor – Know your air,...**  
**\$48.99**  
[Amazon.com](#)  
 Was \$69.99  
 Free shipping

**Moyic Mini CO2 Detector, Multi-Function CO2...**  
**\$26.99**  
[Walmart](#)

**Temtop M2000 2nd CO2 Monitor Portable Air Qualit...**  
**\$179.98**  
[Temtopus.com](#)  
 Free shipping

**Air quality Monitor for Home TVOC HCHO PM2.5...**  
**\$68.63**  
[Bosean official](#)  
 Free shipping

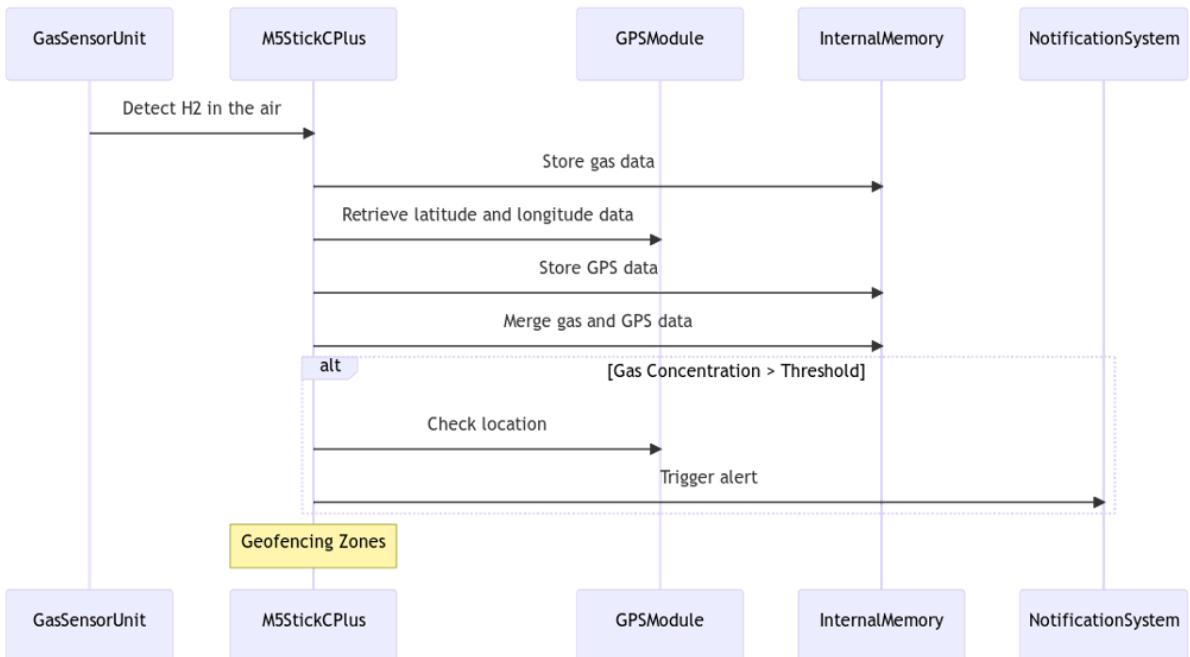
Currently, no device in the market can read both (lat-long, air-quality data) and transfer the readings to a data platform. Websites that provide local air quality data do not provide accurate readings in the user's locality as most of them are spread across the city in different areas.



The smog levels over Delhi, which is 1.90 times as big as New York, are not the same across the region. So it would be ideal if the user could get real-time readings around his place rather than the average.

## Design

Initially, we wanted to save data on the internal memory of the M5Stick for predefined durations as we didn't have the SD card slot model of the M5Stick.



But after your suggestion to use Qubitro to transfer the data, we created projects for both the sensors to individually transfer data from each of our devices.

## Projects

Search project... New Project

ET Owner Total Device 2 created 1 week ago by Ujwal Kandi

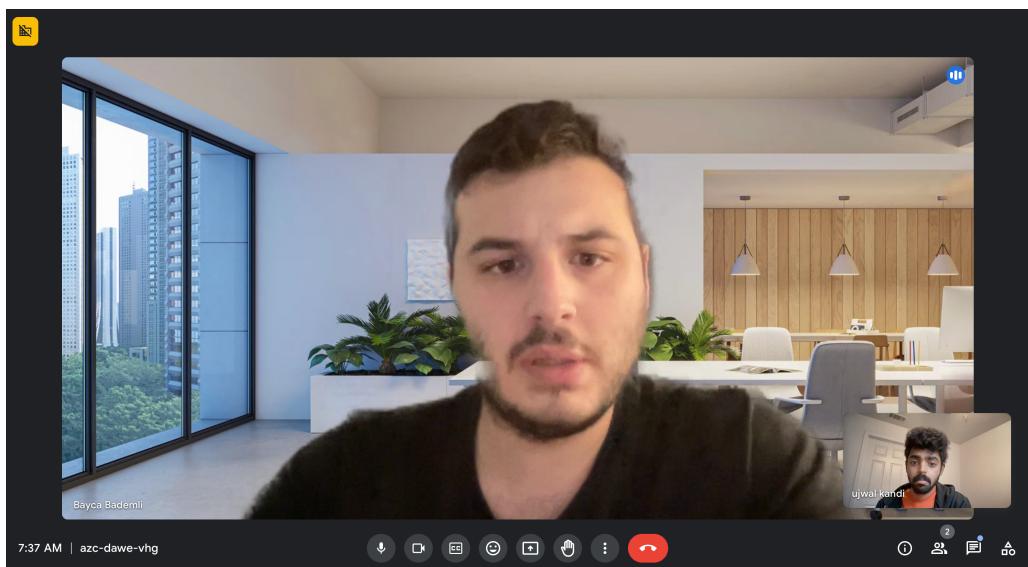
We initially tried sending random data in JSON format and then the button clicked to the platform.

TIME	SENSORDATA	BUTTONCLICK
[+] Nov 22, 2023 at 9:19:29 PM GMT-05...		1
[+] Nov 22, 2023 at 9:19:29 PM GMT-05...		1
[+] Nov 22, 2023 at 9:19:29 PM GMT-05...		1
[+] Nov 22, 2023 at 9:19:29 PM GMT-05...		1

Then we were able to successfully transfer the TVOC data to Qubitro.

TIME	SENSORDATA
<input type="checkbox"/> Nov 22, 2023 at 9:58:44 PM GMT-0...	17

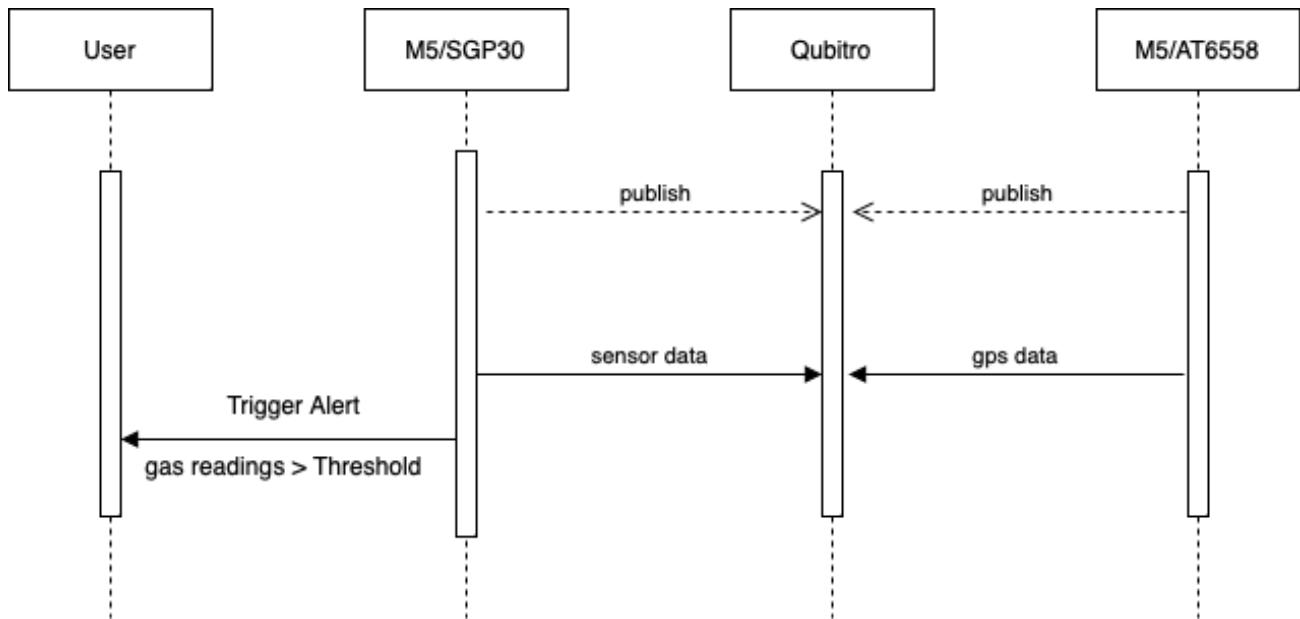
Now the data from both sensors would be stored in individual projects which can be combined on Qubitro's Analytics section where it can be presented in real-time. We tried to reach out to Qubitro's engineering team after I read on a forum that they offer one-week access to their enterprise version to students. But, he said that he could provide it next week due to an ongoing scheduled deployment on their site.



So we implemented the Air quality sensor first where we set the threshold that was issued in the WHO report. Then we included a beep alert when the readings exceeds the threshold. Once we were successful we also added an alert message on the LCD of the M5Stick.



Below is our updated diagram which is way more efficient in handling the real-time data than our initial design.



## DEMO and Outcome Assessment

### Source Code

# UjwalKandi/Smart-Air-Quality-Alert-System



Air Quality Alert System built on M5StickC Plus integrated with AT6558 and SGP30 sensors

1  
Contributor

0  
Issues

1  
Star

0  
Forks



## Air Quality Alert System - TVOC/eCO2 (SGP30) - M5StickC Plus:

We were very thrilled once we had our air quality module working. We initially blew air over the sensor then we checked the readings on the car exhaust but then chose an electric hair dryer for the demo for a reason. Turns out that the hairdryer is the most polluting appliance in our homes as not only does it release the highest amount of VOC gases per unit of time, but it also is the source of the most harmful of them all, Benzene. It is carcinogenic and is known to cause leukemia, especially acute myelogenous leukemia.

It is also present in the vehicle exhaust gas along with other VOCs and the SGP30 module is the ideal component for measuring it. During the demo as soon as I sensed the burnt smell (ultrafine particulate matter) from the hair dryer, the readings skyrocketed reaching a max of around 25000 ppb which was way above the official WHO threshold of 1000 ppb that we set on the module.





Below are the initialization and demo recordings:

[https://drive.google.com/drive/folders/1FDKUVEojaZOr3bjNNi9YPIs834xGNFtk?  
usp=share\\_link](https://drive.google.com/drive/folders/1FDKUVEojaZOr3bjNNi9YPIs834xGNFtk?usp=share_link)

#### **BDS/GPS( AT6558 ) - M5StickC Plus module:**

Initially, we thought that the module was not working as it would not react or give any reading to the M5Stick. We then realized that the module took time to initiate. We observed that the code initialization time or delay was between 15 to 20 minutes each time but once the GPS module started getting geospatial data, after connecting to the satellites, it was very reliable in providing the exact location.

We recorded the coordinates for a few places inside the same building and we could see a slight change (of a few meters) in all of our recordings. We were able to connect to Qubitro but couldn't send the data like in the case of SGP30.

Below are the readings that we recorded overnight after we connected the M5Stick to my phone for power and wifi:

[https://drive.google.com/drive/folders/1jruZfx6hJODgG4\\_MCR4GyV-R-iHvm0bm?  
usp=share\\_link](https://drive.google.com/drive/folders/1jruZfx6hJODgG4_MCR4GyV-R-iHvm0bm?usp=share_link)



## Challenges Faced

Connectivity  
Issues

Transmitting  
Data to Qubitro

Inconsistent  
Sensor  
Performance

Initialization  
Time

We solved the initial connection issues by troubleshooting the loop function and by printing comments when each code block was executed.

The initialization time for both modules was the cause for most of the delay as it would take somewhere between 10 to 20 mins to give the real-time readings, but we finally figured that

out and waited each time after making tweaks to the code.

There were some instances when we experienced lag in seeing the change in the readings that we got from the SGP30 sensor. But we later fixed that by introducing a delay.

Though we were able to overcome all the issues with both modules, we couldn't figure out the Delay duration between each signal transfer in the code for the GPS module which might be the reason that we couldn't send the data to Qubitro though we connected to the platform.

## Summary

**Guiding Users:** Beyond data analysis, our project practically guides users to areas with better air quality, enhancing their daily choices.

**Environmental Research:** The project's potential extends to broader environmental research, contributing valuable data for scientific investigations.

**Community-Driven Data Collection:** Emphasizing a community-driven approach, users actively contribute to a collective understanding of air quality.

## Contributions

Samridhi Seghal - Worked on the GPS module along with connecting the project data to the Qubitro platform.

Ujwal Kandi - Worked on the Gas Sensor Unit along with connecting to the Qubitro platform.

Worked together on the project pitch, presentation, and demo. Also worked together on finding similar projects, troubleshooting, and Code refactoring.