Ethan Bott and Lauren Roach

SRS Template

Revision History:

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| --- | --- | --- |
| **Product Owner** | Minneapolis Health Department |  |
| **Required Approvers** | Jennifer Lansing | Jenni.Lansing@minneapolismn.gov |
| **Required Approvers** | Kelly Muellman | Kelly.Muellman@minneapolismn.gov |
| **Required Approvers** | Noah Bowlin | noah.bowlin@minneapolismn.gov |
| **Required Approvers** | City of Minneapolis IT staff |  |
| **Project Advisor** | Bryan Runk, Geocomputing Scientist | [runck014@umn.edu](mailto:runck014@umn.edu) |
| **Project Advisor** | Luke Rosen, GIS TA |  |
| **Lead Spatial Data Scientist** | Ethan Bott | bott0137@umn.edu |
| **Lead Spatial Data Scientist** | Lauren Roach | roach258@umn.edu |

# Overview

*Objectives*

* Build a full stack system that

1. Calls data from the PurpleAir Monitoring database via an API to
   * + A postgres/postGIS database that stores current and historical PM 2.5 data
     + A public visualization dashboard in real-time that draws from the new database and
     + To the MN public health core accounts on a daily basis
2. Allows users to
   * + Share their data within their team and share it publicly
     + Understand air quality measures in their location through health education data accompaniments
     + Generate reports about categorical air quality measures displayed on the interface
3. Analyzes data
   1. Time
      1. By time of day
      2. By week/month
      3. By season
   2. Space
      1. Identify block groups (including their demographic statistics) that are being impacted by poor air quality.
4. Automates quality assurance and quality control procedures to generate varying levels of data:
   1. Generate Tier 0 (raw data), Tier 1 (calibrated data), and Tier 2 (QAQC data), Tier 3 (spatio-temporal interpolations and zonal statistics)
5. Shares data to City of MPLS
   1. A REST API
   2. A GUI

* Provide a front end interface that both researchers/scientists and local residents can utilize

*Problems*

* **Air quality data access-** Even though 70 PurpleAir sensors are installed throughout Green Zones in the city of Minneapolis, there is no resource available for residents or local researchers to access this data.
* **Understanding PurpleAir data-** Data without context are not easily understood or interpreted by individuals outside the field of air quality expertise. Cleaning, analyzing, and visualizing this data is important to make the data actionable for residents, policy makers, public health officials, researchers, etc.
* **Data storage costs** - Costs can balloon if data is collected by the second versus every 10 seconds. Costs can go up with the possibility of hosting historical data as well.
* **Ease of use** - The sensors are relatively easy to use and maintain by the community. This system will continue to maintain that ease of use through the front end interface.
* **Data analysis** - Automate analysis of real time data without sacrificing data integrity is a complex process.

*Who it directly affects*

* The community of the City of Minneapolis
  + This system will provide a means for accessing air quality data and understanding the implications of that data
* Researchers both public and private
  + This system will provide a means for accessing and downloading air quality data in Minneapolis in a user friendly way
* Community scientists and policy makers who are collecting and using the data
  + This system will provide a means of access as stated above, plus brief analysis of the data
* The City of Minneapolis
  + This project provides an opportunity for the city to utilize and present Purple Air data collected within the city by outsourcing this system creation

*Why important to solve for QA/QC*

* Raw data from Purple Air lacks community context and public health analysis
* It is important that this data be available to the residents and researchers within the community
* Constantly requesting Purple Air data, cleaning it, and creating an end product is labor intensive, time consuming, and outside of the scope of the City of Minneapolis Health Department
* Automating this process by creating this proposed system ultimately presents the data in an understandable, real time, and user friendly fashion

*Guiding Obsessions*

* Provide a clean and user friendly interface that allows for simple data analysis and extraction of Purple Air data without sacrificing data integrity
* Automation of the QA/QC process
* Provide analysis of air quality data to empower the community residents and leaders to make informed decisions regarding public health and safety

## Motivation

* To empower the Minneapolis community to protect their health and safety from potentially dangerous levels of PM
* To make Purple Air data actionable for residents, policy makers, and public health officials
* To create a beautiful and robust user interface that presents data cleanly and clearly
* To educate users about public health implications of air quality
* To partner with the City of Minneapolis to allow officials to make educated decisions based on data and science

## Definitions

**Particulate Matter 2.5**: The term fine particles, or particulate matter 2.5 (PM2.5), refers to tiny particles or droplets in the air that are two and one half microns or less in width. Like inches, meters and miles, a micron is a unit of measurement for distance. There are about 25,000 microns in an inch. The widths of the larger particles in the PM2.5 size range would be about thirty times smaller than that of a human hair. The smaller particles are so small that several thousand of them could fit on the period at the end of this sentence.(1)

**PurpleAir:** PurpleAir is a company that produces air quality sensors that collect data on particulate matter (PM), temperature, humidity, and pressure. Laser counters count PM in real time and the data are updated every two minutes. The data is stored by PurpleAir. (2)

**API:** Application programming interface (API) is a means for two different applications to communicate to each other. Web APIs allow requests of data to be performed across servers.

**Graphical User Interface (GUI):** An operating system based on graphics that uses pictures, icons, menus and a mouse to interact with the system.

# Scope

# Functional Requirements

* Hardware / Firmware
  + PurpleAir Sensors
    - PM 2.5
    - Humidity
    - Pressure
    - Temperature
* Software
  + Live streaming web page through Esri’s ArcOnline
    - Allows users to interact and analyze data in a simple manner
      * Users can download data through API or through csv format
    - Allows user to download specific sets of data

## Non-Functional Requirements

* Usable by the general MPLS community
* System working 99% of the time
* Security from the City of MPLS and GEMS for data storage and transfer
* Present work and introduce system to the community

## Out of Scope Requirements

* Analyze all questions that the City of MPLS is interested in exploring with the available data
* Maintenance past May of 2023
* Determine sources of worsening air quality
* Peer reviewed analysis of data to properly inform policy makers

These are requirements that we are deeming out of scope for this iteration of the project. We list them here in order to be unambiguous and entirely clear with respect to project scope.

# Persona Acceptance Criteria

**As a developer I …**

* Require access to the PurpleAir database so that I can perform an API request
* Require database storage so that I can build a historical database

**As an Analyst I…**

* Require that the data be clean so that I can properly run analyses
* Require the data be ready to download so that I can manipulate the data for specific analyses

**As an end user I**

* Require that the website be easy to read so that I can understand the general lay of the land quickly when the site first open
* Require that the website be easy to use so that I can visualize the data with just a few clicks
* Require that the website contain the data that is relevant to my health and safety so I can make the appropriate decisions based on what the data is telling me

# Open Questions

* Who is paying for the storage of the data?
  + How much will that cost?
* How will the front end aspects differ:
  + For scientists?
  + For community members?
* Will UMN students be able to transfer accounts from UMN accounts to the City of MPLS?
* Will UMN Students have access to City of MPLS servers and accounts?
* How will we effectively and efficiently harmonize code with another team working in parallel to provide the best interface and product?

# Dependencies

* Data storage through GEMS?
* Access to city of MPLS servers
* Transfer of end product from UMN ESRI accounts to City of MPLS ESRI accounts

# References

1. Department of Health. ( 2018). *Fine Particles (PM 2.5) Questions and Answers*. New York State. Retrieved February 8, 2023, from https://www.health.ny.gov/environmental/indoors/air/pmq\_a.htm#:~:text=The%20term%20fine%20particles%2C%20or,25%2C000%20microns%20in%20an%20inch
2. PurpleAir. (2023, February 3). *What do purpleair sensors measure, and how do they work?* PurpleAir Community. Retrieved February 8, 2023, from https://community.purpleair.com/t/what-do-purpleair-sensors-measure-and-how-do-they-work/3499

# Appendix

1. Potential front end product could look similar to Air Quality Chicago’s site, but with more functionality: [Air Quality Chicago](https://airqualitychicago.org/results/)