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1.0 Executive Summary

AeroSense Solutions is a data company that collects and displays real-time air quality index (AQI) data and utilizes machine learning to predict future AQI. Our product is free to access via a website for the public, and we monetize our business by selling Application Programming Interface (API) plans to companies and organizations that want to access our data and insights.

Our product is a web-based platform that provides users with real-time and predicted AQI data for any location, starting with Malaysia. The platform includes a variety of features to help users understand and manage their exposure to air pollution, such as air quality maps, real-time and forecasted index, health alerts, and recommendations, along with API access for businesses and organizations.

Our goal is to become the market leader in health data and solutions, starting with air quality before venturing into other areas such as water pollution, waste management, forest management, and even agriculture. In one year, we aim to achieve full coverage for Malaysia. In three years, we aim to expand our air quality coverage towards Southeast Asia (SEA). In five years, we aim to be the leading provider of air quality data and insights. Our data will be used by individuals, businesses, and governments to make informed decisions about protecting and improving public health and the environment.

Our target market includes three main sections. The first section is about individuals or the public who are concerned about the air quality index. The second section is about businesses and organizations that would be interested in purchasing air quality data via API plans for further usage. The third section is big companies or governmental agencies that would be interested in acquiring our company.

Several other companies provide air quality data and insights, but mainly from non-profit organizations or environmental agencies of different countries. The main competitor

similar to our structure as a private company is a Switzerland company, IQ Air, which covers worldwide air quality index with a forecasting system. However, our competitive advantage is to provide more accurate data for both real-time and forecasted values. This allows us to provide our users with more valuable information than our competitors.

In terms of the management team, our company aims to double down on building an effective and efficient engineering team to provide the best product and service before expanding other departments such as the marketing and sales department, customer support department, and others.

In terms of the financial aspect, our company projects to generate RM1 million in revenue in our first year of operation, and aims to break even and start gaining profit in our third year of operation. We expect to reach profit maximization at Year 6, around RM3 million annually in revenue, along with a revenue projection of up to RM20 million in 10 years.

2.0 Company Description - AeroSense Solutions

Air quality has been worsening all over Earth leading to disastrous outcomes for us humans and our planet. Various initiatives have been executed to reduce its impacts by promoting a greener place. However, the reality is that the situation is getting worse. Pollutants in China have greatly damaged residents' respiratory systems, digestive tracts, and even life expectancy (Hu & Guo, 2021). Meanwhile, pollutants like PM 2.5 have been on the rise in Thailand since 2018, reaching an unhealthy level (Chirasophon & Pochanart, 2020).

The rise in green technology and the green economy have provided innovative solutions to mitigate emissions primarily in operational practices (Mikhno et al., 2021). The pressing issue has stimulated sustainable practices in organizations internationally with the mutual goal of sustainable development. However, green technology in Malaysia is yet to be fully implemented with smaller firms lacking the financial resources to adopt and comply with regulated conditions (Kasayanond et al., 2021).

As a developing nation with rapid industrialization and infrastructural growth, Malaysia has ranked in the top 60 countries globally with the worst air quality (IQAir, 2023). The awareness of air quality relative to its impact on human health is often overlooked as urban centers have yet to achieve sustainable levels of air quality standards (Usmani et al., 2020). When exposed to poor air quality for a prolonged period, individuals face the risk of experiencing fatal diseases such as respiratory-related problems and premature death (Tajudin et al., 2019).

Our innovative AI technology aims to track the Air Quality Index (AQI) in specific locations and collect big data, which can be used in creating strategies focused on reducing AQI.

2.1 Mission

At AeroSense Solutions, our mission is to raise awareness of air quality by tracking real-time and future levels of AQI and providing it to consumers who can make a difference. This is to ensure Malaysians are informed about air pollutants, and their concentration levels and can take action for their health. Real-time and forecasted data will provide each individual with the right information to make informed decisions.

2.2 Vision

Our vision is to evolve into a multinational transformative data company that provides the world's environmental data, starting with the air quality index with cutting-edge technologies to the world. Starting with Malaysia, we aim to expand to Southeast Asia (SEA) and later globally to improve every single individual's life and health on Earth. Forming beneficial alliances with big data companies, governmental agencies, and like-minded organizations is our end goal as we can collaborate in incorporating data and analytics into powerful actions that will help improve AQI levels.

2.3 Value

The value we bring is a combination of artificial and human intelligence in the form of effective AQI data collection and analysis, transforming insights into actions. This can provide essential information to multiple stakeholders, such as governmental agencies, data companies, real estate developers, hospitals, insurance firms, and most importantly, the general public. Due to the large number of negative effects caused by bad AQI levels, it is necessary to focus on and fix these issues in the short term and long term. Our technology protects public health by giving them real-time information and identifying high-risk areas. Early warning systems, healthcare advice, and environmental laws can be generated as well, improving quality of life in our most distressing environmental situation.

2.4 Company goal

Our company aims to collect air quality data from all major points in Malaysia and compile it in a seamless online platform that is accessible to the public.

Beginning with data collection and analysis, we aim to grow to a huge team of individuals and consultants from various disciplines. The company will continue to offer the data platform, along with special packages and individualized support. Our goal is to become a market leader in world health data and solutions, starting with the Air Quality Index (AQI).

2.5 Target market

- Primary market

This will be aimed at the general public and will only provide access to basic and general AQI data in Malaysia. We aim to raise awareness around air quality for Malaysian citizens.

- Secondary market

This will be aimed toward companies and organizations that would purchase our Application Programming Interface (API) plans to retrieve our air quality data for their usage in machine learning or data analytics

- Potential merger & acquisition

With our aim of social welfare and sustainable profits, we aim to get acquired by governmental agencies such as the Malaysian Department of Environment (Air Management) and Ministry of Natural Resources, Environment, and Climate Change or even the top global technology companies such as Google and Amazon.

2.6 Industry

Our company will be positioned in the AI and data industry, emphasizing air pollution and environmental sustainability.

The global air quality monitoring market is expected to grow from $12.2 billion in 2022 to $19.1 billion by 2028 (IMARC, 2022). This growth is being driven by the increasing demand for air quality monitoring solutions from governments, businesses, and consumers.

The demand for air purification systems is also growing. The global air purifier market is expected to grow from $15.8 billion in 2022 to $30.6 billion by 2028 (2023). This growth is being driven by the increasing awareness of the health risks associated with air pollution.

3.0 Product Research and Development

The process of product research and development is crucial for companies to innovate and bring new products to the market. Best practices in New Product Development (NPD) can help companies replicate success, improve NPD vitality, and enhance the maturity of the NPD process (Kahn et al., 2012).

In terms of methodology, research, and development (R&D) is commonly used to produce new product designs. R&D is an effective method for developing new products in a specific area of expertise (Marlina & Khoiriyah, 2023). The Rowntree model, which focuses on product development, is often used in R&D projects. It involves planning, preparing, and editing stages to ensure the effectiveness of the final product (Marlina & Khoiriyah, 2023). Below Figure 1 is the product and research development model that our company, AeroSense Solutions would follow:

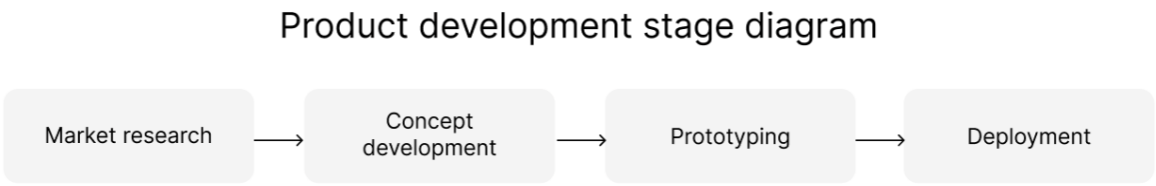


Figure 1: Product development stage diagram

3.1 Market research

Market research provides valuable insights into customer needs, preferences, and market trends. This information is essential for identifying opportunities and developing products that meet customer demands (Veryzer, 2005).

3.1.1 Competitor analysis:

The main competitor in this industry is IQ Air, an international brand that focuses on the air pollution index while offering various products such as air monitors, air purifiers, and face masks.

IQ Air's Strength: It provides both web applications and mobile applications, which maximizes user experience for all devices.

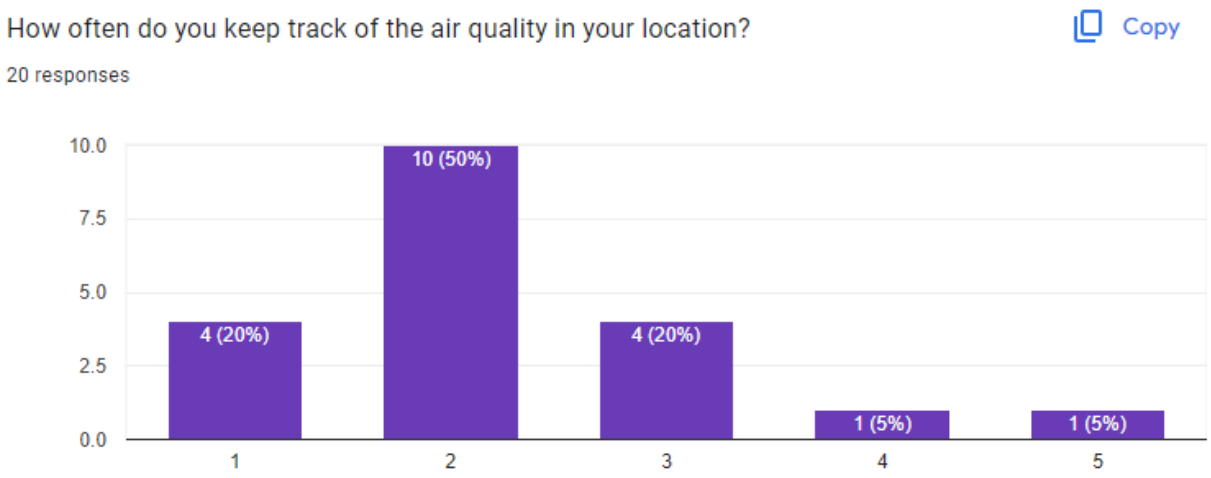
IQ Air's Weakness: The data presented such as the air pollution index and PM score are retrieved from various external sources. Since every data contributor might have a different calculation process, this data collection method may result in data inaccuracy and data lagging.

Our Opportunity:

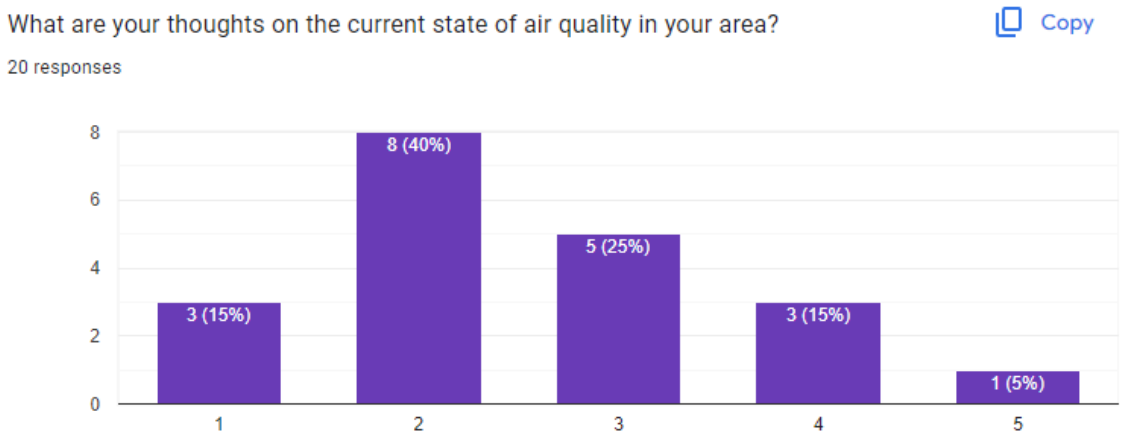
To provide accurate data, our company aggregates data from both external sources and our physical sensors to provide an average output that represents the current air quality in any area. Our technology ensures both real-time and predicted data are accurate with a minimum lagging window.

3.1.2 Customer Insights

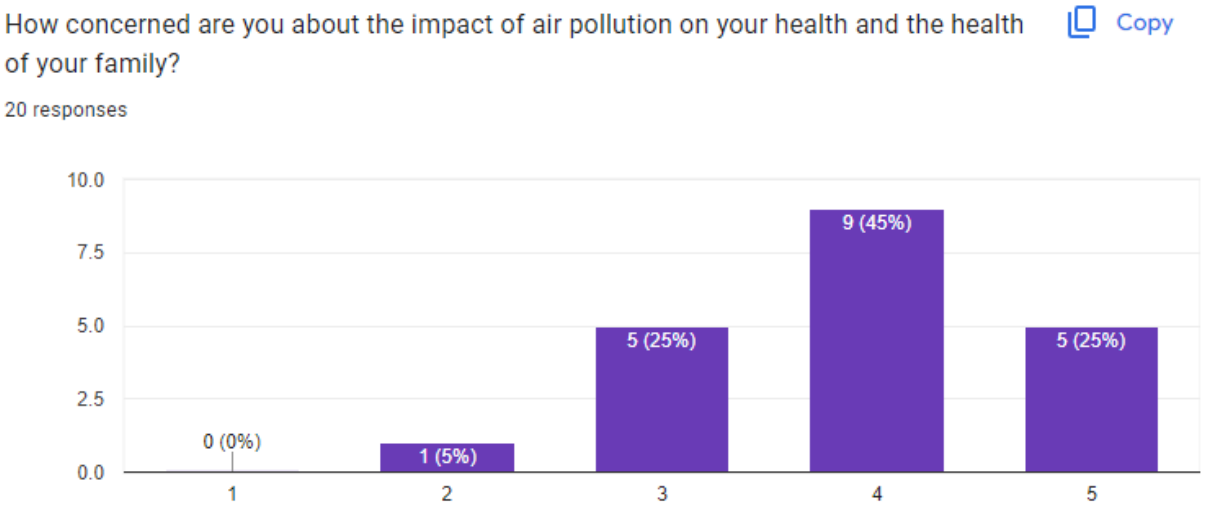
We have conducted several customer surveys to learn more about the needs and pain points of our target market. The survey was carried out using Google Forms, with a total of 20 participants. The questions are based on a 5-point Likert scale and Yes/No answers.



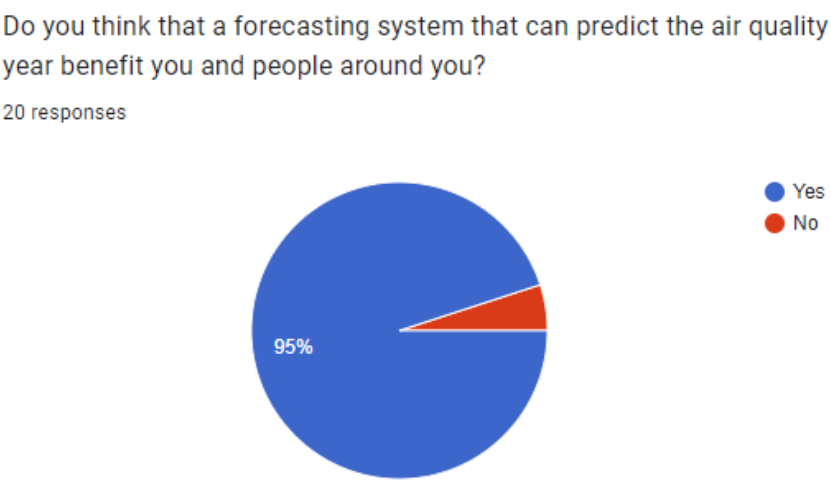
Question 1: The majority of the respondents hardly keep track of the air quality in their location, with 50% voting for 2 points.



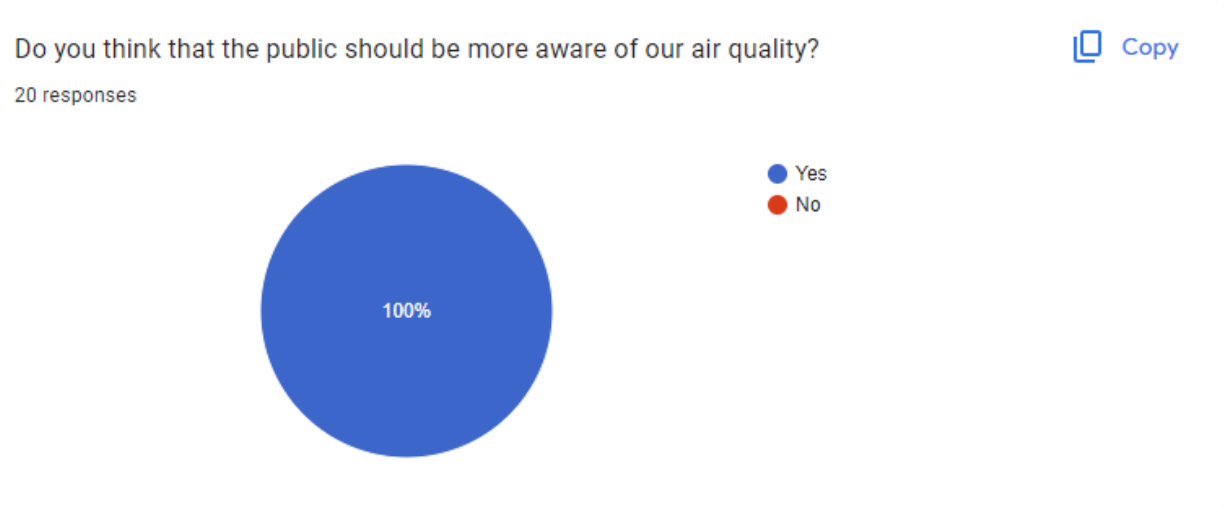
Question 2: The majority of the respondents think that the air quality in their area is bad, with 40% voting for 2 points.



Question 3: The majority of respondents are concerned about the impact of air pollution on their health, with 45% voting for 4 points.



Question 4: The majority of the respondents think that integrating a forecasting system to predict the air quality index would be beneficial for everyone, with a total of 95% voting for “Yes”.



Question 5: All of the respondents think that the public should increase their awareness of Malaysia's air quality.

In conclusion, our respondents believe that having a comprehensive air quality index along with an accurate forecasting system would spark the interest of our citizens to stay aware of our air quality. The main problem is the lack of reliable sources, resulting in a low frequency of tracking air quality among Malaysian citizens, even though they are concerned about their health.

3.1.3 Problem statements

Based on the above competitor analysis and public survey, we can conclude with three problem statements:

- Lack of accurate data to present air quality index in Malaysia
- Lack of proper public awareness regarding air quality in Malaysia
- Lack of proper business use-case of air quality to improve health and well-being

3.2 Concept development

This section outlines the main concept of our main process pipeline, containing idea generation, systems and processes, and value proposition.

3.2.1 Idea generation

Besides showing real-time data on air quality, we aim to develop an air pollution index prediction system that uses machine learning to analyze historical data on air pollution levels and patterns. The system is designed to be accurate, timely, and cost-effective.

3.2.3 Systems and processes

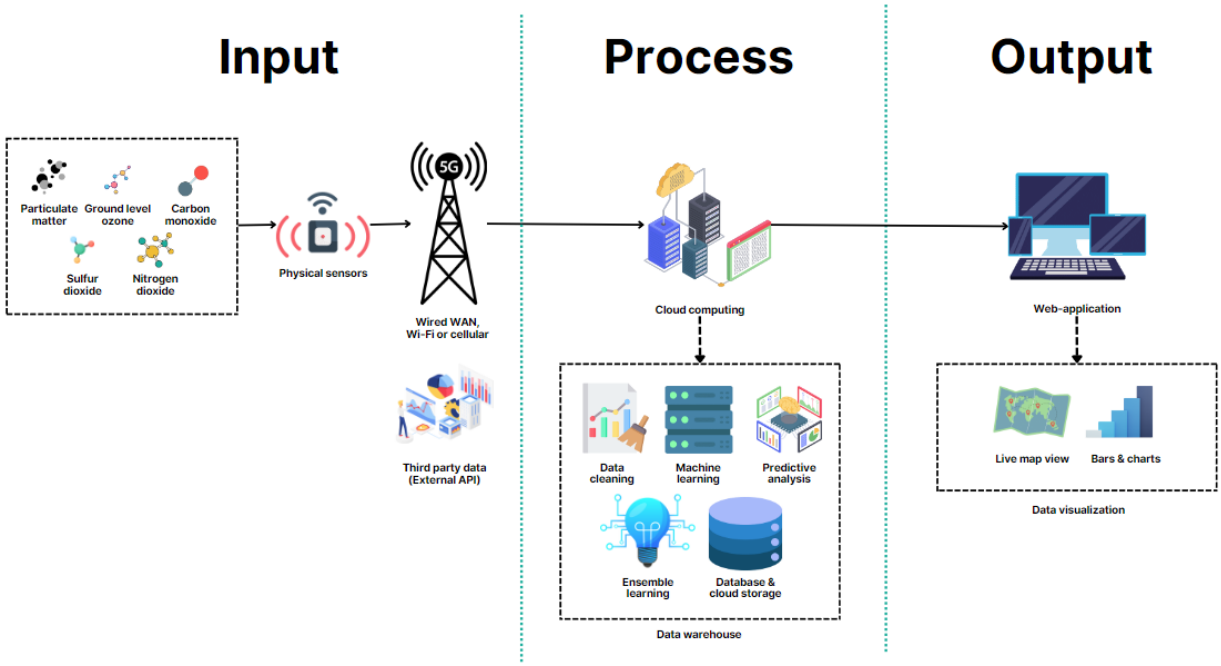


Figure 2: Systems and processes

- Input

To improve data accuracy, there would be two endpoints for raw data collection, which are our company's physical sensors, and third-party data sources. These two data sources will be aggregated and processed.

- Processing

All data processing workflow would be done via cloud computing, such as Amazon Web Service (AWS). During data processing, all data would be cleaned to remove potential system errors before being fed into our machine learning algorithms. Ensemble learning is then used to combine the predictions of multiple individual machine learning models to provide an average value for maximum accuracy (Yang et al., 2010).

- Output

All process data will be presented as useful information using a live map view, time-series bar chart, and many other visualization tools. On the business spectrum, our processed data can be purchased by any company or organization via API plans.

3.2.5 Value proposition

Our company, AeroSense Solutions, focuses on increasing public health awareness regarding air quality, which relates to the 13th goal in Sustainable Development Goals, climate action. Below are the values that assure our company stays afloat of the current competitors in the market.

Education: To educate the general public on the current and future quality of air.

Health & Safety: By providing accurate and timely predictions of air pollution levels, people can make informed decisions about their activities and exposures, which can lead to improved health and quality of life.

Climate action: From individuals to companies to government bodies, all parties will understand the current air condition and take necessary actions for a better future.

For a more detailed explanation of systems and processes, refer to Section 4: Data Warehouse.

3.3 Prototyping

- Feature 1: General air quality index (Data)

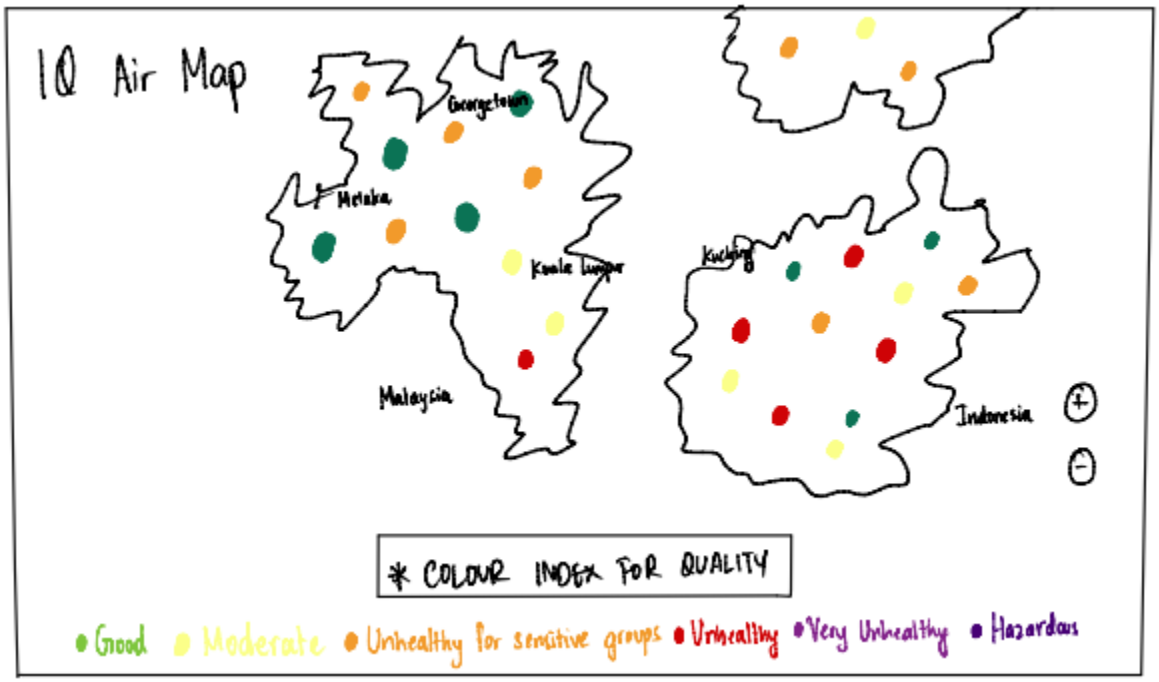


Figure 3: Prototype feature 1

The air quality index is shown with the standard U.S. AQI scoring system from 0 to 500. Users may grasp a brief understanding of the current air quality in every location across Malaysia, including their current location if the GPS is turned on.

Score	Air quality
0 - 50	Good
51 - 100	Moderate
101 - 150	Unhealthy for sensitive groups
151 - 200	Unhealthy
201 - 300	Very unhealthy
301 - 500	Hazardous

- Feature 2: Predictive slider (Data)

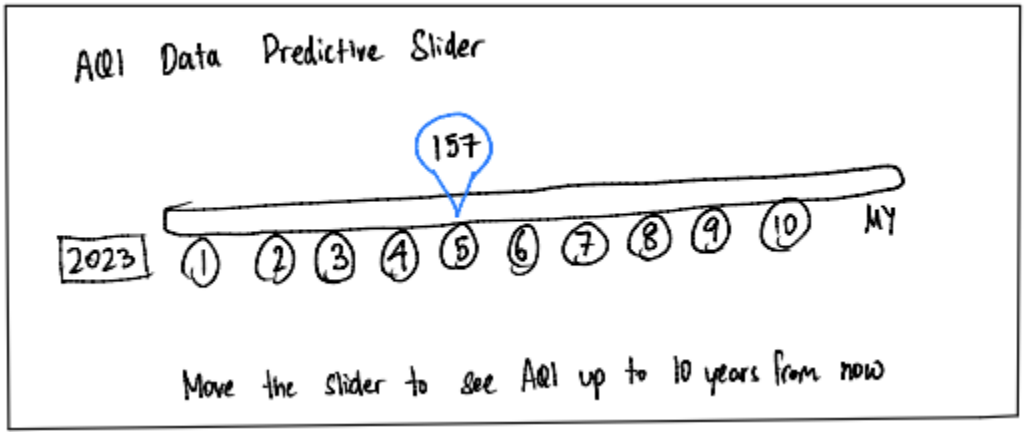


Figure 4: Prototype feature 2

This dynamic slider allows users to glance through how the air quality index would perform in every location in Malaysia up to the next 10 years. The predicted value is computed

based on our comprehensive forecasting analysis using Machine Learning and Artificial Intelligence.

- Feature 3: Concentration of air pollution (Data)

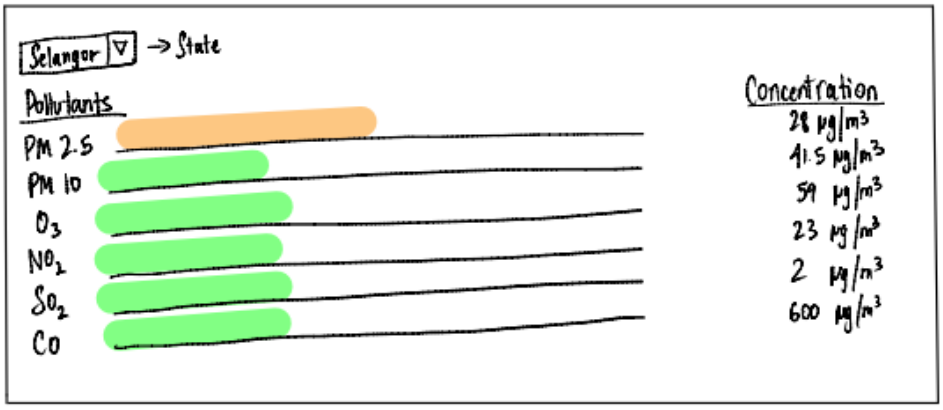


Figure 5: Prototype Feature 3

By selecting the score of each state, users may review the aggregated concentration of air pollutants across the given radius.

- Feature 4: Overview of air quality in a location (Information)

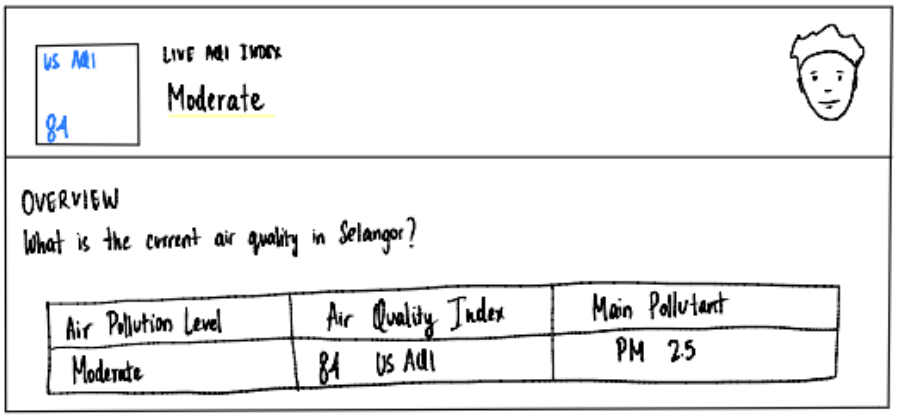


Figure 6: Prototype feature 4

This section contains all the main information regarding the air quality of a specific location. This allows the users to understand the air quality on a micro-level such as in certain neighborhoods, cities, and even states.

- Feature 5: Ranking system + Prediction across different locations in Malaysia (Information)

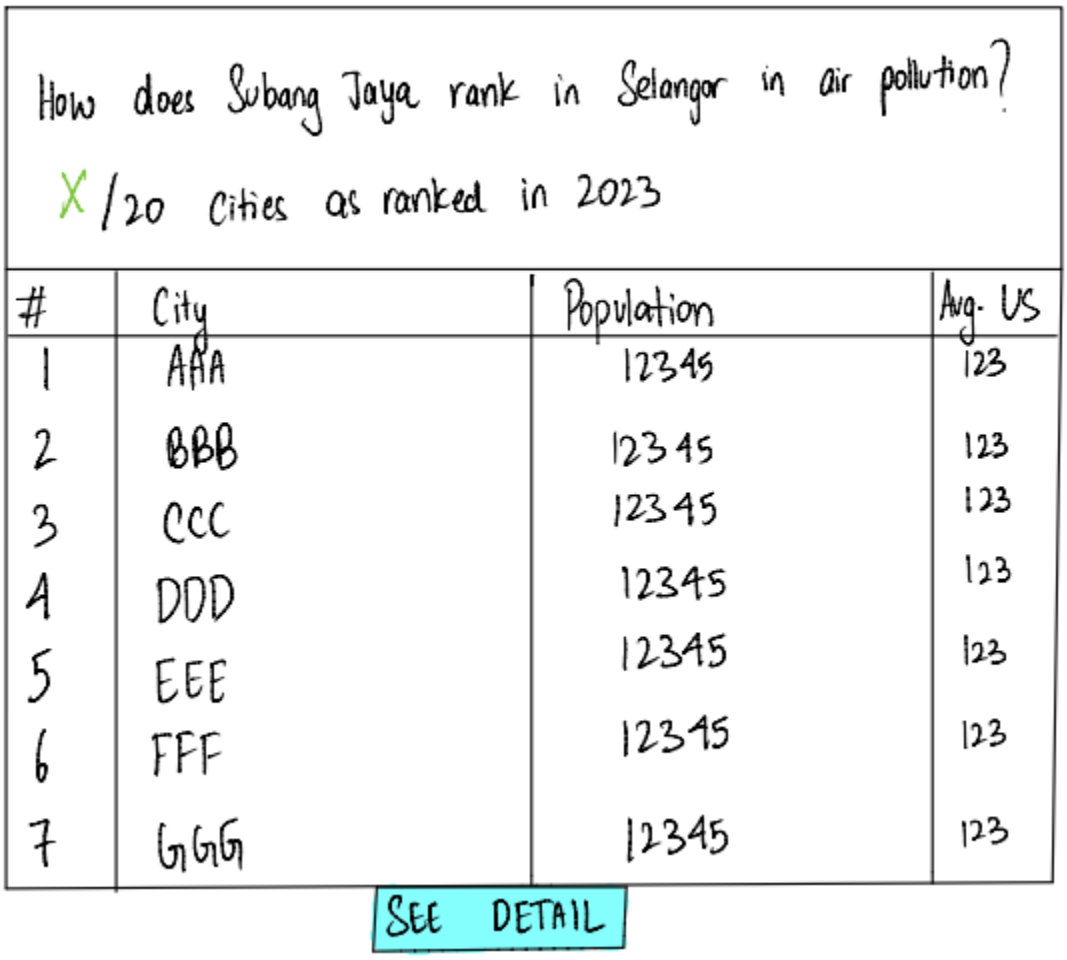


Figure 7: Prototype feature 5

The ranking system can be sorted by cities or states. Users may understand which location is the most polluted at the moment, and how they may perform in the upcoming years based on various factors taken in our Machine Learning process.

- Feature 6: Recommendation (Action)

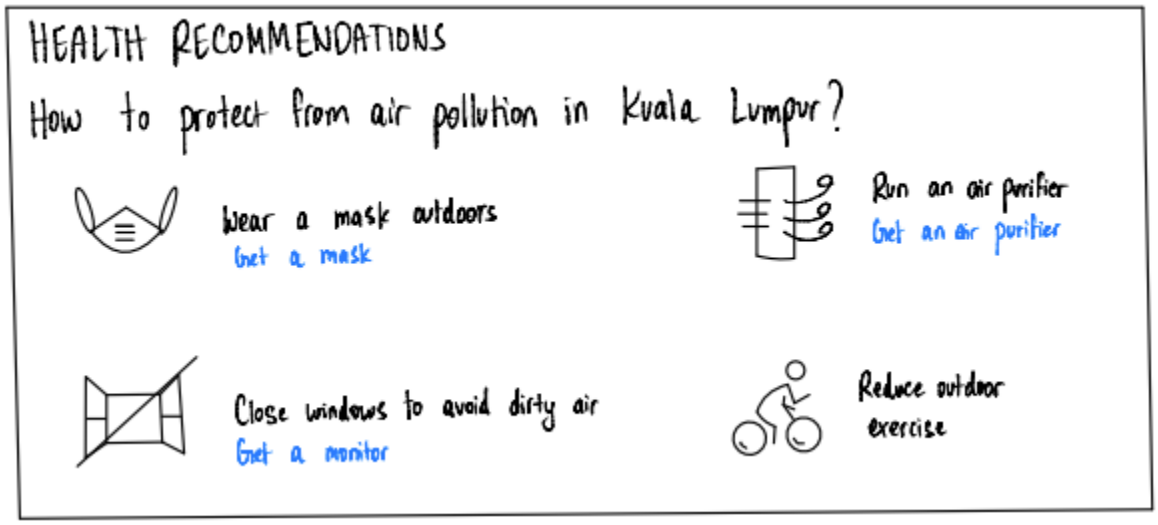


Figure 8: Prototype feature 6

This section contains several health recommendations for the public to implement. Users may understand the best action to carry out based on current air quality in their location.

3.2 Industrial product (Deployment)

3.2.1 Output for end-user

- Home page

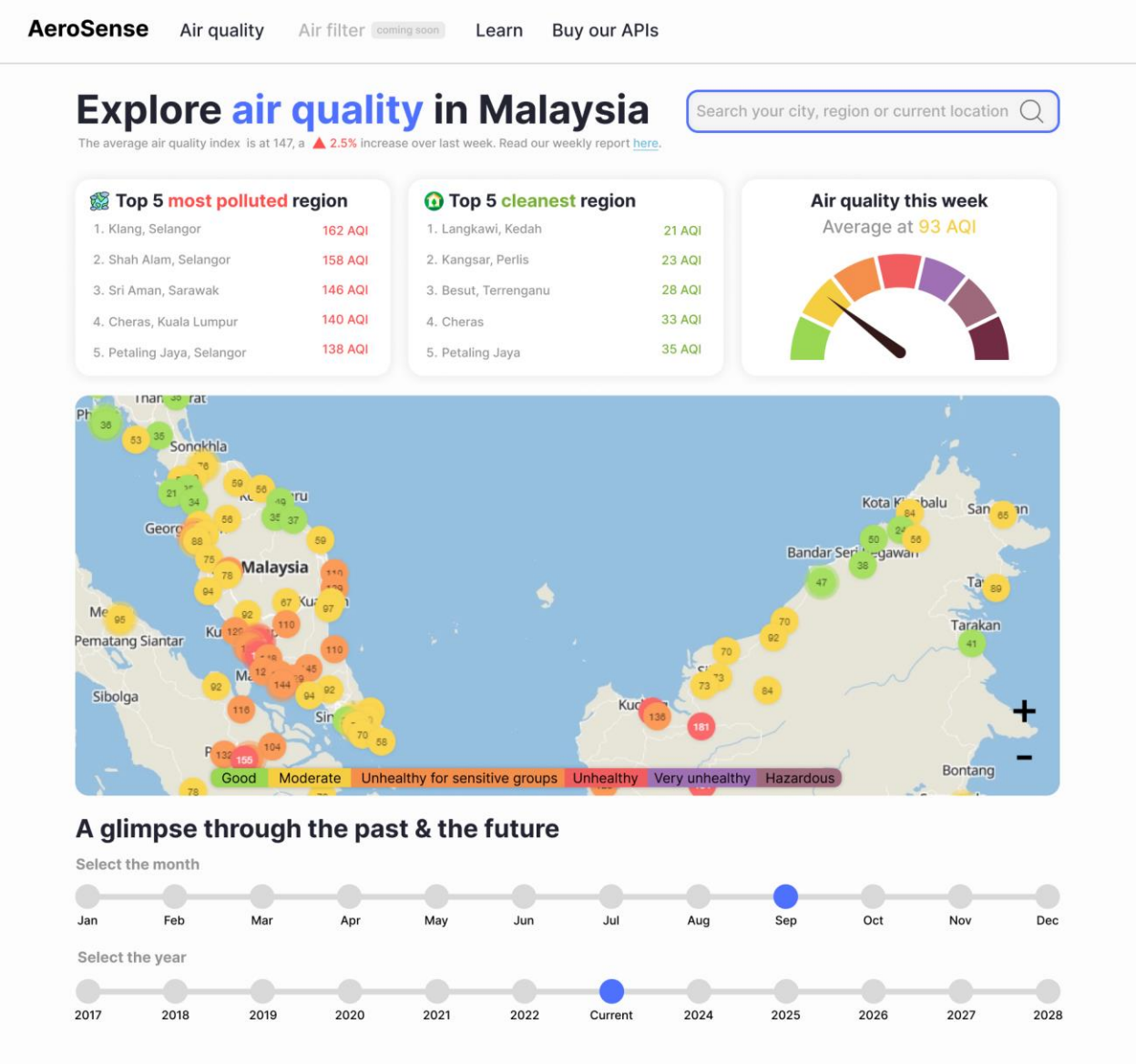


Figure 9: Home page

The “Home” page mainly shows important data and information regarding the air quality in Malaysia. The first section contains three cards:

Top 5 most polluted region	Showcase the top 5 locations with the worst air quality along with their AQI in listicle format.

Top 5 cleanest region	Showcase the top 5 locations with the best air quality along with their AQI in listicle format.
Air quality this week	A meter showing the average AQI in Malaysia, will be updated every 24 hours.

The second section contains a live map view showing the AQI score for every location in Malaysia. Users may zoom in to see the accurate value of any smaller region while zooming out would show the average score of the entire region such as the entire city or state.

The third section contains two interactive sliders where users may trace back the historical data or glance through the future output via our forecasting system. Any adjustment made towards the slider will change the AQI score of every location shown in the map above.

- Air quality page

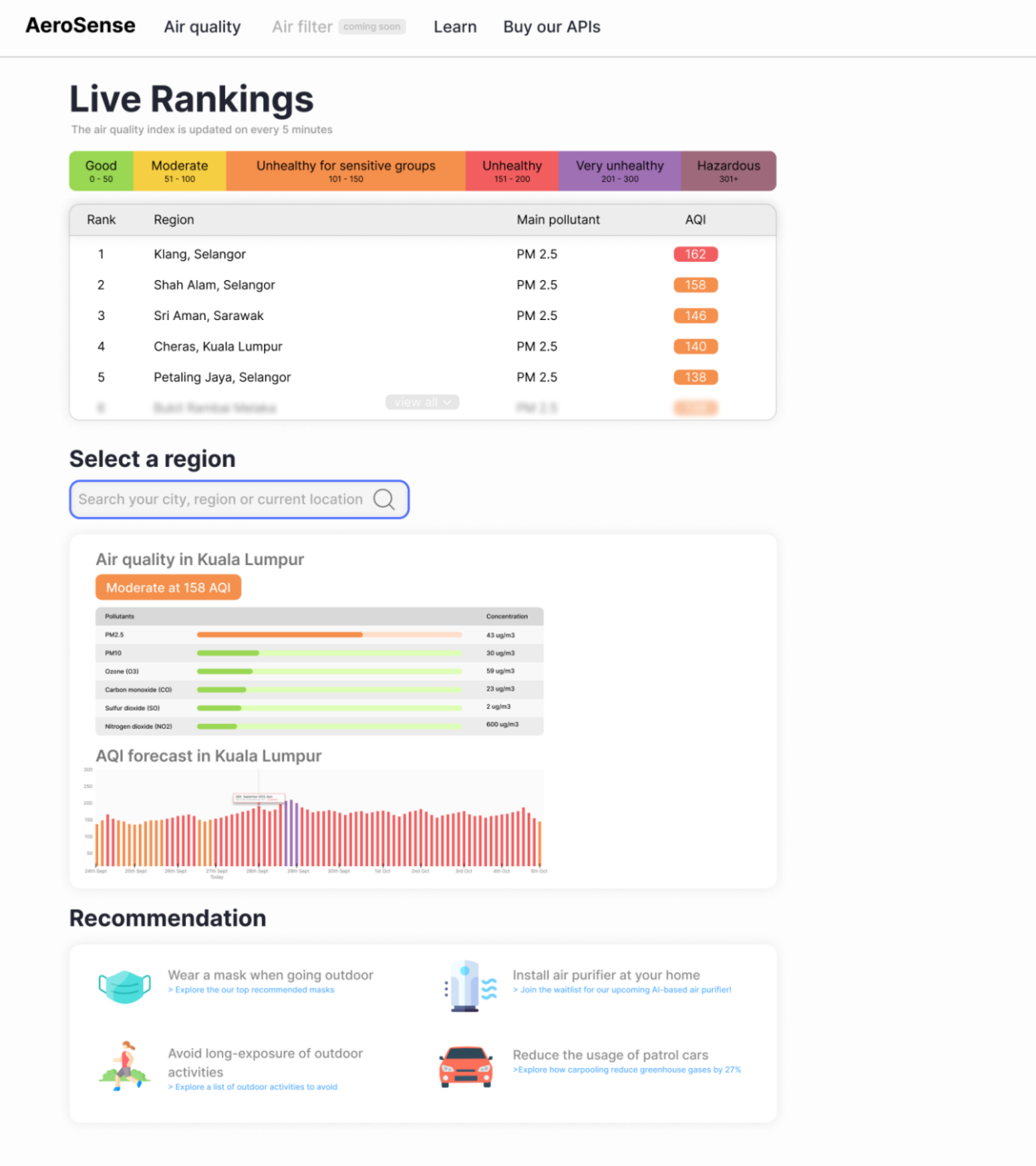


Figure 10: “Air Quality” page

The “Air Quality” page displays more detailed data and information for specific locations in Malaysia.

The first section shows a live ranking table of all locations, starting with the most polluted place, along with the main pollutant and AQI score.

The second section allows users to search for any location that they want to track, which contains two sub-sections:

Air quality in the queried area	Display the AQI score and the concentration of all individual air pollutants that contribute to the calculation of AQI
AQI forecast in the queried area	A time-series bar chart showing the performance of the AQI score within the past 72 hours, the current day, and the forecasted value of the next coming week.

- Learn page

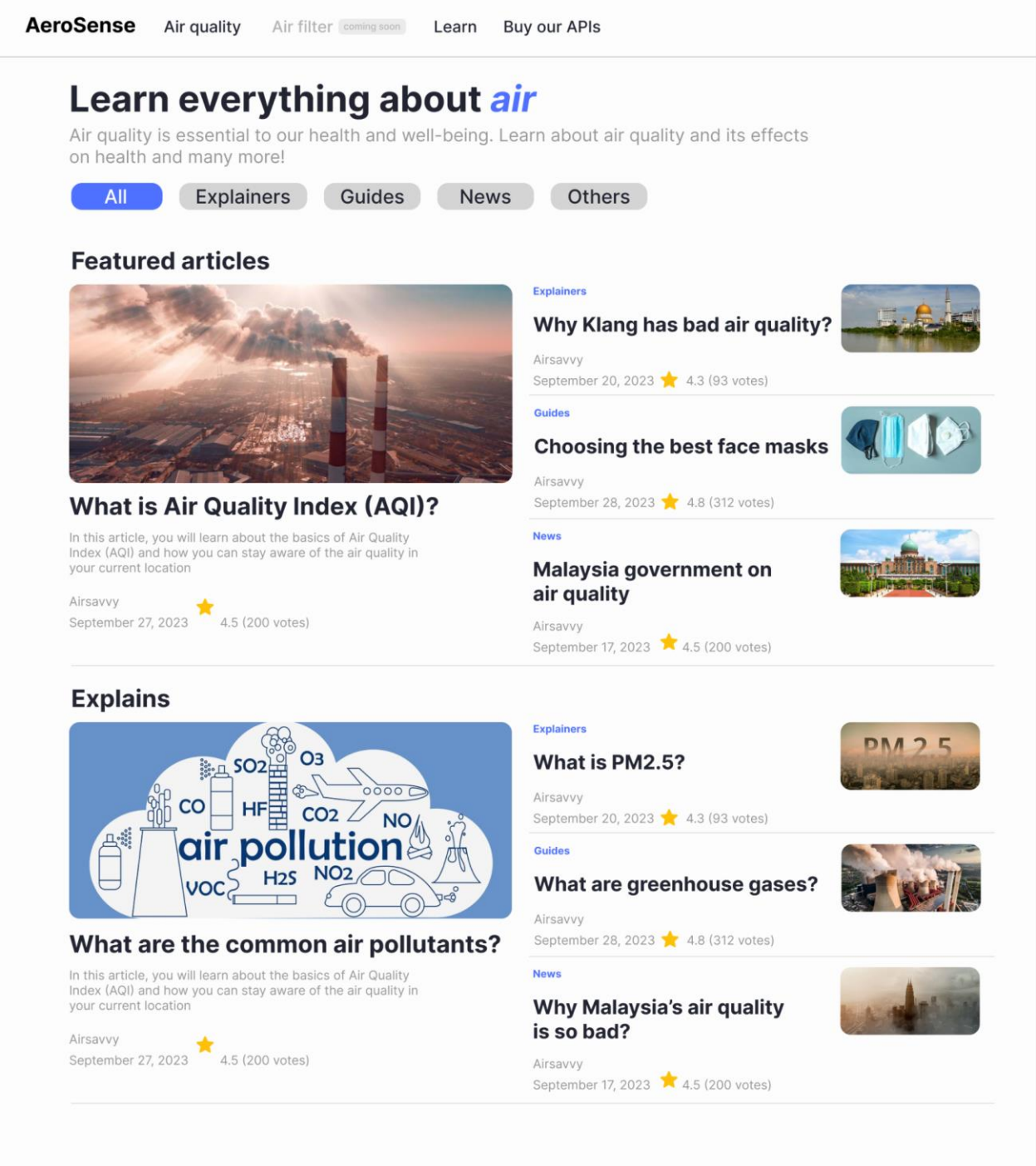


Figure 11: “Learn” page

The “Learn” page mainly serves as an educational ground for the public to learn about any information related to air and climate.

Currently, there are three main categories, while more categories will be appended in upcoming years.

Explainers	Focus on educating the audience with a basic understanding of air quality, the different types of air pollutants, their effects on health, and many more. Typically revolves around the topics of “What”, “Why”, and “How”.
Guides	Focus on educating the audience with practical advice on how to reduce their exposure to air pollution and improve air quality in their homes and communities.
News	Topics related to time-sensitive news such as incoming haze, government initiatives, and the reviews of the latest scientific journal.
Others	Any blogs and articles that do not belong to the above categories.

3.2.2 Pricing

Similar to most data companies, our data is free to view for the public. However, the actual business transactions are conducted via the trading of data through API subscriptions. API stands for Application Programming Interface, which is a set of rules and specifications that allow two software applications to communicate with each other. This allows other companies to integrate the data provided by our company into their applications and services. In July 2023, a report by Research And Markets showed that the global API market would rise from $744 million in 2023 to $3 billion by 2028, indicating a huge market growth for data companies.

Any interested parties may subscribe to our APIs to access the air pollution index data for various use cases, such as using it as a key attribute for their own data visualization

or predictive analysis. For example, a weather forecast application might need our data as part of their equation to forecast weather.

Users may opt for a monthly or an annual subscription model with three price tiers:

Pricing plans	**Standard**	**Professional**	**Enterprise**
Monthly subscription	RM1,299	RM3,299	Inquire for pricing
Annual subscription	RM1,299 x 12 = RM15,588	RM3,299 x 12 = RM39,589	Inquire for pricing
Monthly API credits	500K	5 M	Custom call credits
Rate limit	1 request/min	5 requests/min	30 requests/min
Forecast AQI points	Up to 30 days	Up to 12 months	Up to 5 years
Forecast Interval	Daily	Hourly	Minutes
Historical API	5 Days	300 Days	Custom
Commercial Use	Yes	Yes	Yes
Support	Basic email	Priority email support	Priority email support
Service Level Agreement (SLA)	No	No	99.9%

3.3 Research and development (R&D) strategy

To keep up with the ever-changing technology and stay afloat with our competitors, our company aims to allocate 20% of our monthly revenue to research and development.

Short-term plan (Next 5 years)	Long-term plan (Next 10 years)
Focuses on vertical product scaling by adding more resources to an existing system or process	Focuses on horizontal product scaling by expanding to more features to serve a wider market
Improve our product quality with a more sophisticated Machine Learning algorithm and forecasting system to improve data accuracy and data reliability.	Scale and build different data products by dabbling into water pollution, waste management, forest management, and even agriculture.
Continue building more features revolving around the air pollution index by introducing more indices such as CO2 and carbon emission	Creating new product lines such as selling consumer-level air quality sensors, monitors, and air purifiers, expanding a greater market share in the health and environment industry.

4.0 Data Warehousing & Supply Chain Management

4.1 Structure of data warehouse

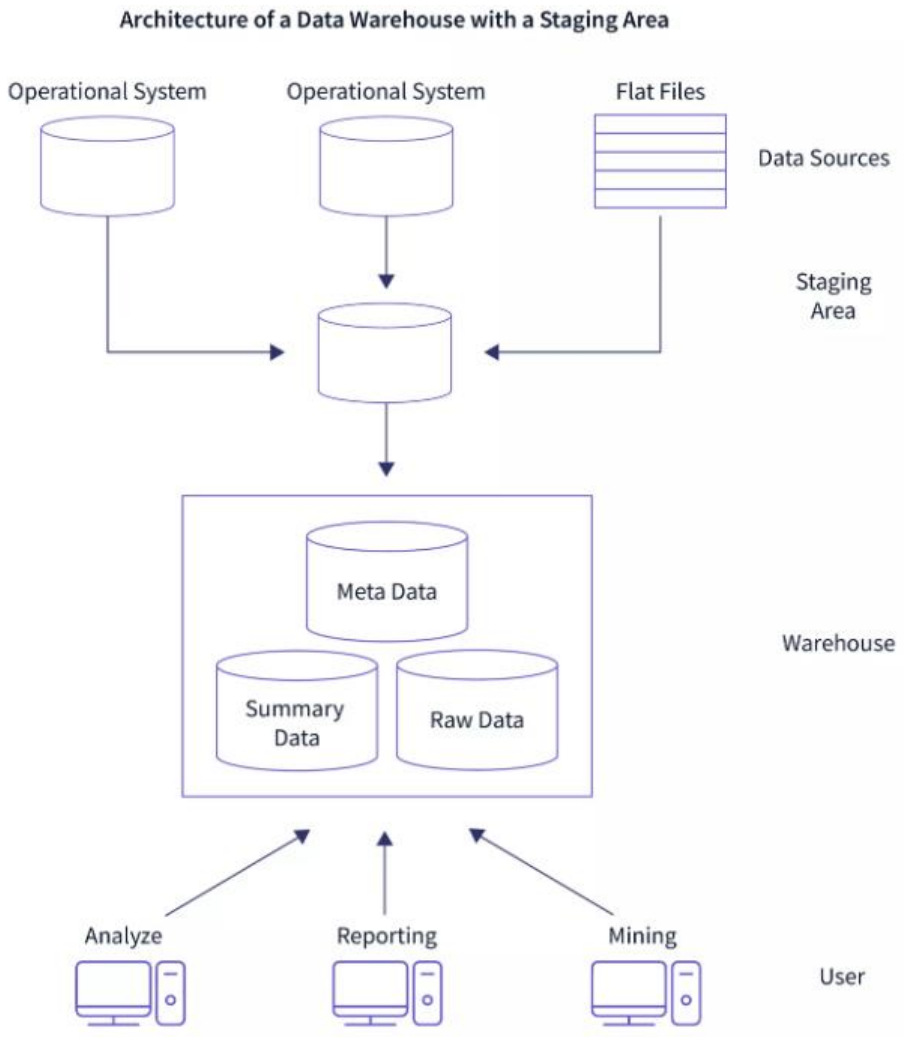


Figure 12: Data warehouse (Trivedi, 2022)

Data warehouse refers to a combination of systems that extract data via an Online Transaction Processing System (OLTP) to transform the data into insight by utilizing an Extract, Transform & Load (ETL) tool towards the end user for efficient querying and analysis which translates into supporting a decision based on the data collected (Al-

Nassar, 2014). However, the limitation would be that only structure data can be extracted from the data source (Wong et. al, 2002). Hence, the researchers recommended a framework called ‘Multi-Tier Image Data Warehouse’ to accommodate unstructured data. Thus, it allows data companies to collect as much data as possible. With the high volume of data pouring, the data must undergo an Extract, Transform, and load process within the staging phase. It allows the data to be cleaned and consolidated into a consistent format. Due to the non-volatile characteristic of the data warehouse, the ETL process is conducted in two flows:

- Data Source → Staging
- Staging → Data Warehouse

This procedure is followed to reduce data errors within the data warehouse as amending any data would require specialized team assistance. Two approaches were studied for users to retrieve data.

- The demand-driven approach imitates an organization to determine which information is required by the user (Winter et al, 2003).
- The supply-driven approach involves initiating the process by analyzing transactional source systems to redesign their logical data schemas (Winter et al, 2003).

The limitation of the demand-driven approach reflected the end user's unable to specify their objective, thus leading to unsatisfied information due to insufficient knowledge. While supply-driven approaches tend to overwhelm information structure which results in higher resource wastage in both time and productivity. Consequently, the researchers instead proposed a conventional demand-driven approach to overcome the drawback of both approaches, which would be utilized for data structure in our company.

4.2 Data Source

4.2.1 Real-time Monitoring Sensor

In the current market, there is a prevalent issue of overgeneralizing the Air Quality Index (AQI) within specific regions, notably in Malaysia. This problem is highlighted in Figure 13 and Figure 14, presented by an air quality provider. These figures reveal a sparse distribution of air sensor nodes on the map, indicating two possible reasons. Firstly, it could be due to the usage of low-cost sensors, or commercial-grade sensors attached to fixed towers or mobile laboratories (Shakhov et al., 2022).

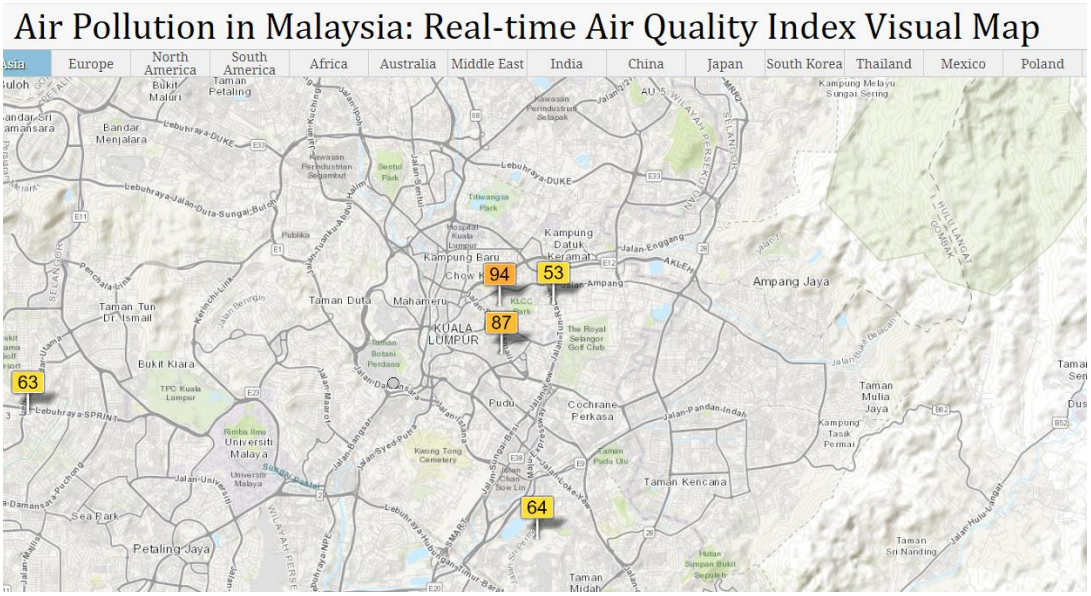


Figure 13: Screenshot of AQI

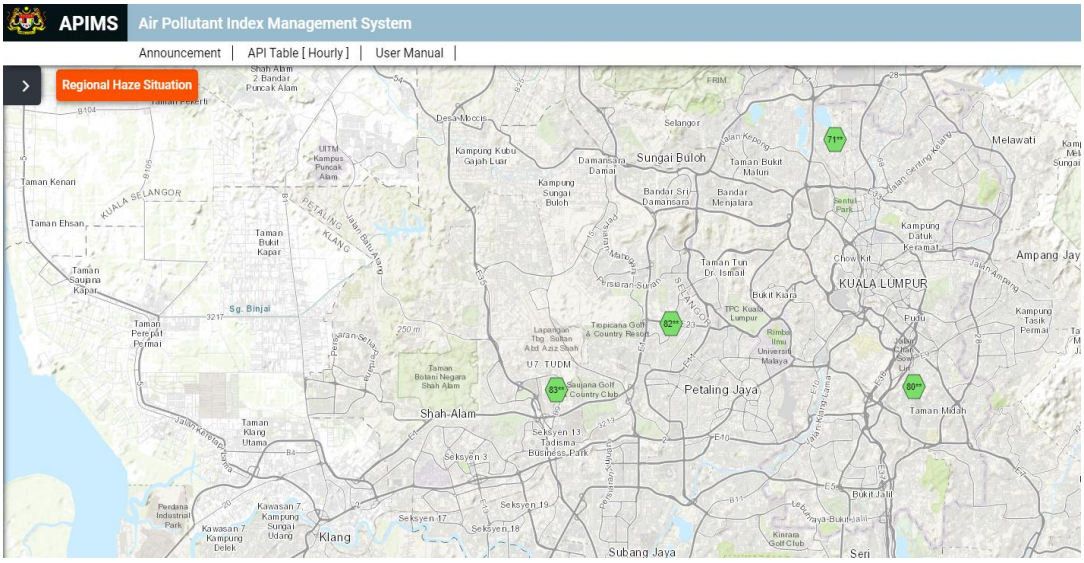


Figure 14: Screenshot of AQI

Shakhov et al.'s (2022) research paper focuses on tackling the problem of collecting low-quality data. Their research extends to increasing the quantity of data by deploying more air sensor nodes in a specific area. This approach enables analysts to extract, transform, and load (ETL) the data into valuable insights. The researchers also addressed the issue of using low-quality sensors as nodes, stating, "We use the assumption of probabilistic detection, meaning that a sensor node can detect air pollution events with a predefined probability."

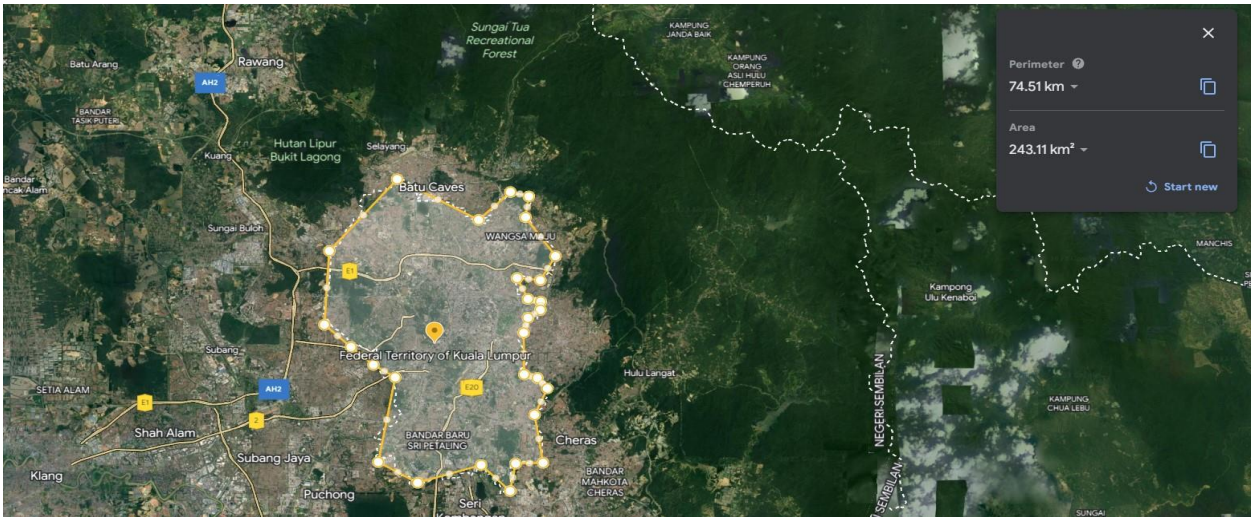


Figure 15: Our company’s initial phase for air quality index coverage

Based on Shakhov et al.'s (2022) research, our company plans to implement a strategy involving the deployment of a higher quantity of nodes within the Federal Territory as our initial phase. As shown in Figure 15, the estimated area to cover is 243.1 km². Based on the research by Shakhov et al, it is recommended to maintain a node-to-node distance of 150 meters to achieve high spatial awareness in our data set. Therefore, to meet this requirement, we aim to deploy an estimated 10,800 nodes within the territory. Additionally, nodes equipped with live monitoring features will be chosen to address temporal challenges effectively. However, due to the restricted budget of a startup company, the number of nodes, or air quality sensors might differ from a theoretical standpoint.

To further enhance data accuracy, our company intends to collaborate with Malaysian broadband companies (Maxis, Digi, Celcom, UMobile, and YTL) to utilize the 5G network infrastructure, as network speed will play a crucial role in data transmission.

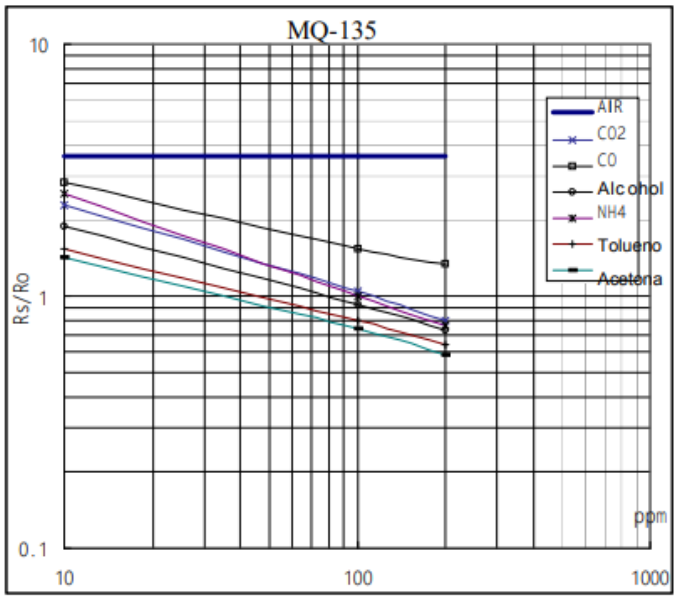


Figure 16: Rs/Ro ratio

Considering the recommendation to use low-cost sensors for AQI measurement, Karla et al. (2016) highlighted limitations in measurement accuracy for the MQ135 sensor (priced at RM6.70 for 50 pieces and above, RM8.40 at full price, Figure 17)). Figure 16 illustrates that the Rs/Ro ratio significantly decreases with higher PPM levels, indicating a decrease in measurement accuracy. Therefore, PPM measurements using this sensor may have a higher margin of error.

To improve accuracy and precision, our company plans to incorporate the PMS5003 air sensor model (Figure 18), which offers higher accuracy and precision but comes at a higher cost of RM60.00 per sensor. However, since our company prioritizes collecting accurate and precise data, the more expensive PMS5003 sensors will be installed at intervals of 2.25 km². This results in an estimated need for around 107 PMS5003 nodes, allowing analysts to assign different weights and transform data into information with higher accuracy.

Figure 17: MQ-135 sensor

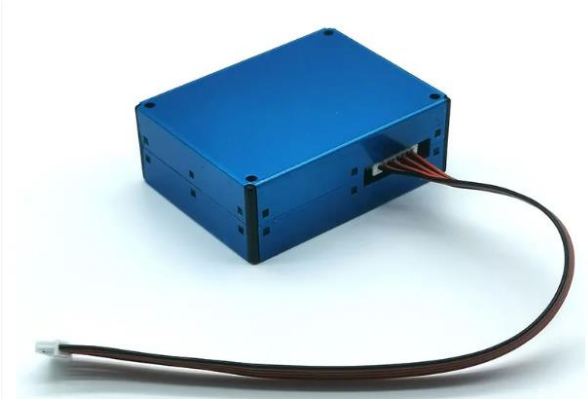


Figure 18: PMS5003 sensor

4.2.2 Third-Party Historical Dataset

During the initial phase, the company may experience an absence of historical data within the data warehouse. The main objective of the application requires vast amounts of historical data. It allows the machine learning algorithm to train the model to conduct prediction within the application. Thus, the company has opted to subscribe to an Application Programming Interface (API) from other data companies to gather historical data to fill in the gap.

4.2.3 Organization Department OLTP

Winter et al (2003) mentioned the purpose of data warehousing was to supply information to decision-makers. It builds a framework for the user to make decisive action based on the actual information. Thus, a transactional source system or operating management system would serve as a stream of data for the warehouse.

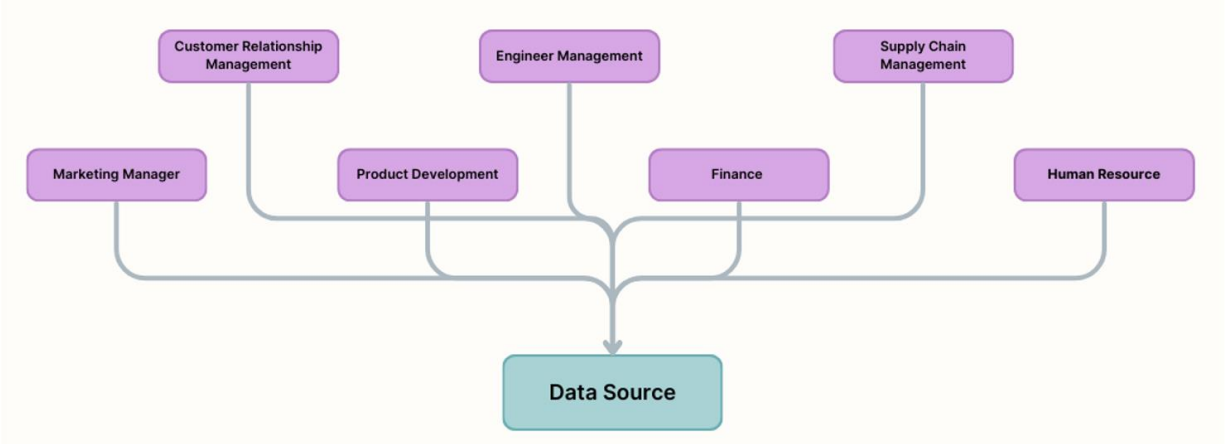


Figure 19: Operating management system

4.3 Cloud Warehouse

Before the emergence of cloud computing, organizations used to build data warehouses on their premises. In this traditional approach, organizations felt a strong sense of ownership as they built and managed the data warehouse internally. The responsibility of securing the data warehouse fell on the organization's cybersecurity team, leading to the belief that the data was secure (Golec et al., 2021). However, the research paper highlighted that skepticism prevailed due to the continuous evolution of security practices. The paper mentioned the European Commission's initiative, which facilitated the development of Codes of Conduct for data protection in the cloud. This effort resulted in the creation of two Codes of Conduct. The paper also referenced the "Guidance on mixed datasets," which emphasized robust security measures for cloud-based data warehouses (Golec et al., 2021).

Despite initial doubts, effectively allocating resources in the project's early stages is crucial for the company's financial health. Golec et al. (2021) highlighted various advantages of adopting a cloud data warehouse, including reduced hardware costs, lower maintenance expenses, and improved query performance. Therefore, it makes sense to choose a setup that is efficient and cost-effective, allowing resources to be redirected to the Research & Development team.

Selecting an appropriate cloud data warehouse for the startup requires a deep understanding of the industry. Since the current team lacks extensive knowledge in this area, the objective should be to hire engineers with specialized expertise in the field of cloud computing.

4.4 Data to Insights

Regarding transforming the AQI data into useful information, Zhou et al (2019) demonstrated a positive correlation between air pollution and respiratory disease. Zhou et al (2019) paper targeted the younger demographic (0 – 18 years old) within Guiyang, a tourism-oriented city without heavy air pollution. According to Zhou et al (2019) research ‘A total of 10,876 inpatients with respiratory diseases were included between January 1, 2009 and December 31, 2016. The median hospitalization duration was 8 days (ranging from 1 to 226 days). The medium economic cost of each hospitalization was 7777.4 Yuan (range from 143.73 to 258,277.3 Yuan).’. The statement stresses the air quality impacting the duration of hospitalization eliciting an increase in expenditure. On account of extended outdoor activity, children are exposed to greater periods of polluted air thus accumulating M2.5, PM10, and SO^2 per $\mu g/m^3$ (Zhou et al, 2019). Zhou et al (2019) research was based on the younger demographic, thus future research could be towards the working demographic to improve the demographic range from Zhou et al (2019). This research has reflected the importance of our air quality data and how it would transform into useful insights for various industries such as healthcare.

4.5 Insight to action

The section outlines the possible insights that companies and organizations may acquire by retrieving our air quality data via API plans. These plausible insights can be transformed into meaningful actions depending on the use cases of each industry.

4.5.1 Hospital

The effect of temporary hospitals due to the COVID-19 pandemic has shown the reaction of overloading of a significant influx of inpatients (Candel et al, 2021). The stay duration of an inpatient ranges from 5 to 36 days. Therefore, hospital occupancy over 100% was undesirable. Hospitals and medical companies may utilize our air quality index as part of the attribute for their predicting system to forecast the duration of inpatients with respiratory disease. It allows individual hospitals to have a forecast and better control of the medical inventory based on the prediction. In addition, the data analyst within the hospital organization would be able to analyze and predict the stay duration of each inpatient. This results in valuable information for hospitals to ideally set a standard for length of duration to increase inpatient turnover rate.

4.5.2 Insurance

Within the insurance industry, the fundamental operation revolves around actuarial analysis. In the context of medical insurance, calculating the probability of medical expense of every policyholder would be part of the insurance actuarial analysis job scope. As mentioned above, the prediction of inpatient length of stay could serve as a critical component of their actuarial analysis. Allowing the industry to receive a competitive advantage within the market. Insurance companies may purchase our API plans to feed their system with our air quality index to predict the future medical expenses of each individual and provide necessary adjustments toward the premium.

4.5.3 Real Estate Development

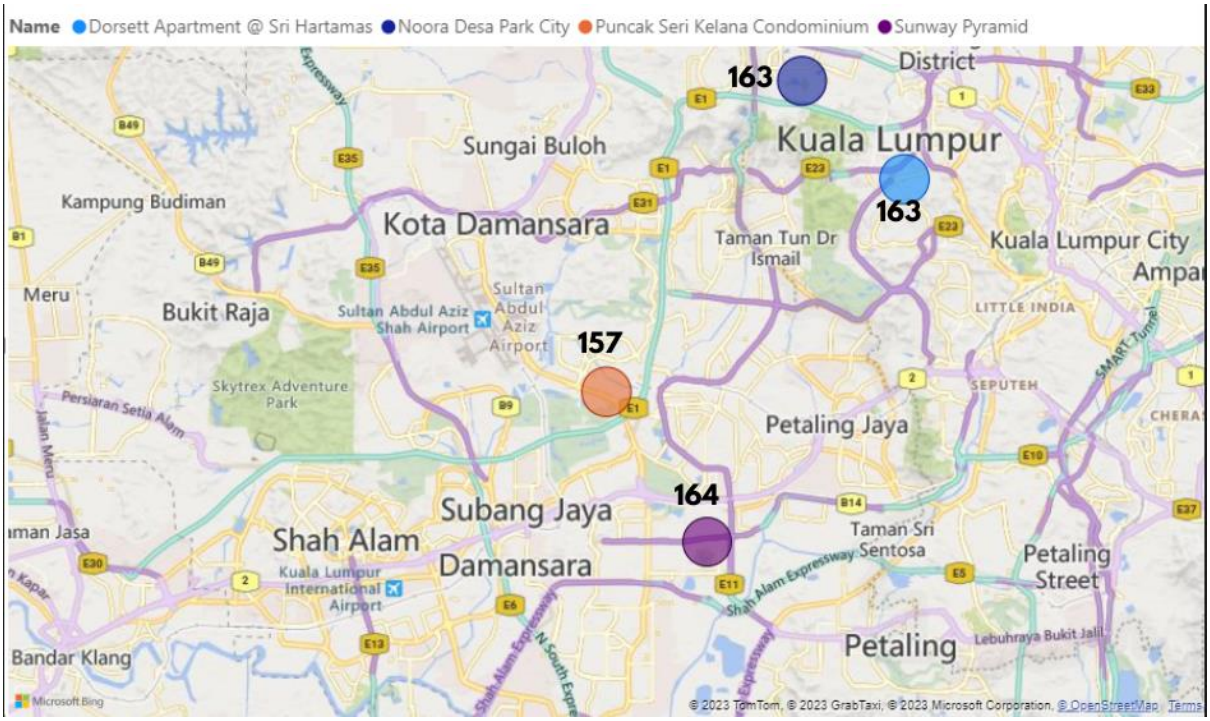


Figure 20: Usage of AQI for real estate developers

Developers could use our air quality index by subscribing to our API plans and creating an interactive application during sales events to showcase how the organization is aiming to create a pollution-free community. With the improved spatial accuracy, each developer could use the interactive map app to compare the air quality against their competitors. These strategies actively educate consumers to include AQI as a factor. With consumer enlightenment with AQI, family-oriented consumers would have a higher probability of selecting a developer with a health and well-being theme. A prototype example is shown in Figure 20.

4.5.4 Centralised Government Control (CGC)

In 2020, Zhang et al researched spatial heterogeneity across 30 provinces in China in relation to two attributes:

- Environmental control: Air pollution policy
- Informal regulation: Involving citizens taking litigation action

In the context of CGC, the company would be prioritizing enforcing air pollution policy by utilizing the company spatial AQI model. It allows the government sector to monitor the AQI with higher precision. Receiving real-time information and always alerted with a sharper AQI map allowing monitoring and identifying certain areas with the above recommended AQI standard to be investigated immediately. Furthermore, Zhang et al (2020) mentioned air pollution policy has a significantly negative correlation with air pollution. Implying that the air pollution policy does influence AQI from a commercial standpoint. It creates a means of justification for the government to fine organizations that exceed the recommended air pollution regulation along with ease of identifying the cluster.

Government agencies may utilize our data to pinpoint the highly polluted areas and may combine it with other area-tracking technologies to pinpoint the exact location that contributed the most air pollution. This data utilization would greatly assist the government to ensure local organizations are strictly adhering to any government policies regarding human health.

4.6 Pre-evaluation vs post-evaluation

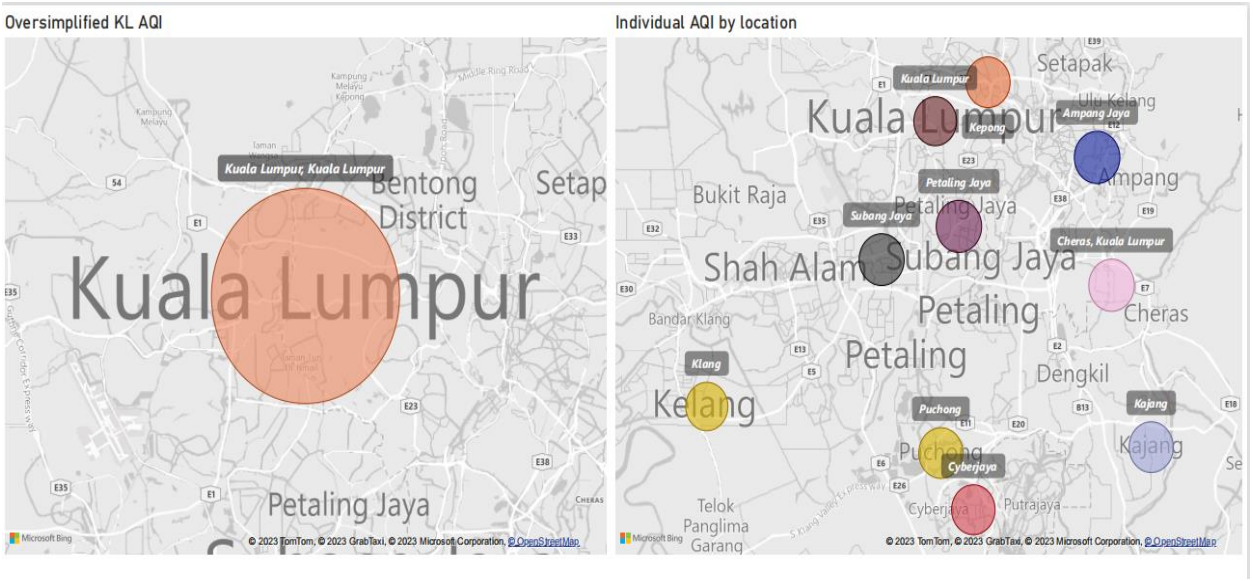


Figure 21: Pre vs Post-Evaluation

As seen in Figure 21, the left image indicates the area accuracy of the AQI sensor available within the market. Display a generalized area of AQI in a huge area. The image on the right is a prototype created by the company to allow investors to visualize it. It shows the forecasted implementation of our node within the federal territory and visualizes the node location and spatial accuracy to align with our vision and mission.

4.7 Data warehousing strategy

Short-term plan (Next 5 years)	**Long-term plan (Next 10 years)**
Improve customer targeting and segmentation by analyzing data from a variety of sources, such as customer demographics, purchase history, and website behavior to better understand their customers and target them with more	Identify new market opportunities by analyzing data trends and patterns, which allow us to identify new market opportunities and develop new products and services to meet those needs.

relevant marketing messages and products.	
Provide full coverage of both West and East Malaysia by expanding to a new state every quarter.	Expand our air quality index towards South East Asia or APAC region while serving a wide range of industries for our API product.
Improve data flexibility in the data warehouse to support a variety of data types and data formats. This will allow the company to ingest data from a variety of sources and use it for a variety of purposes. Increase data security to secure and protect the company's sensitive data, ensuring no malicious attack is conducted on both front-end and back-end systems.	Focus on scaling the data warehouse to meet the growing needs of the company, such as increasing the size of the cloud server and cloud database to handle more data and more users without sacrificing performance.

5.0 Organization Structure

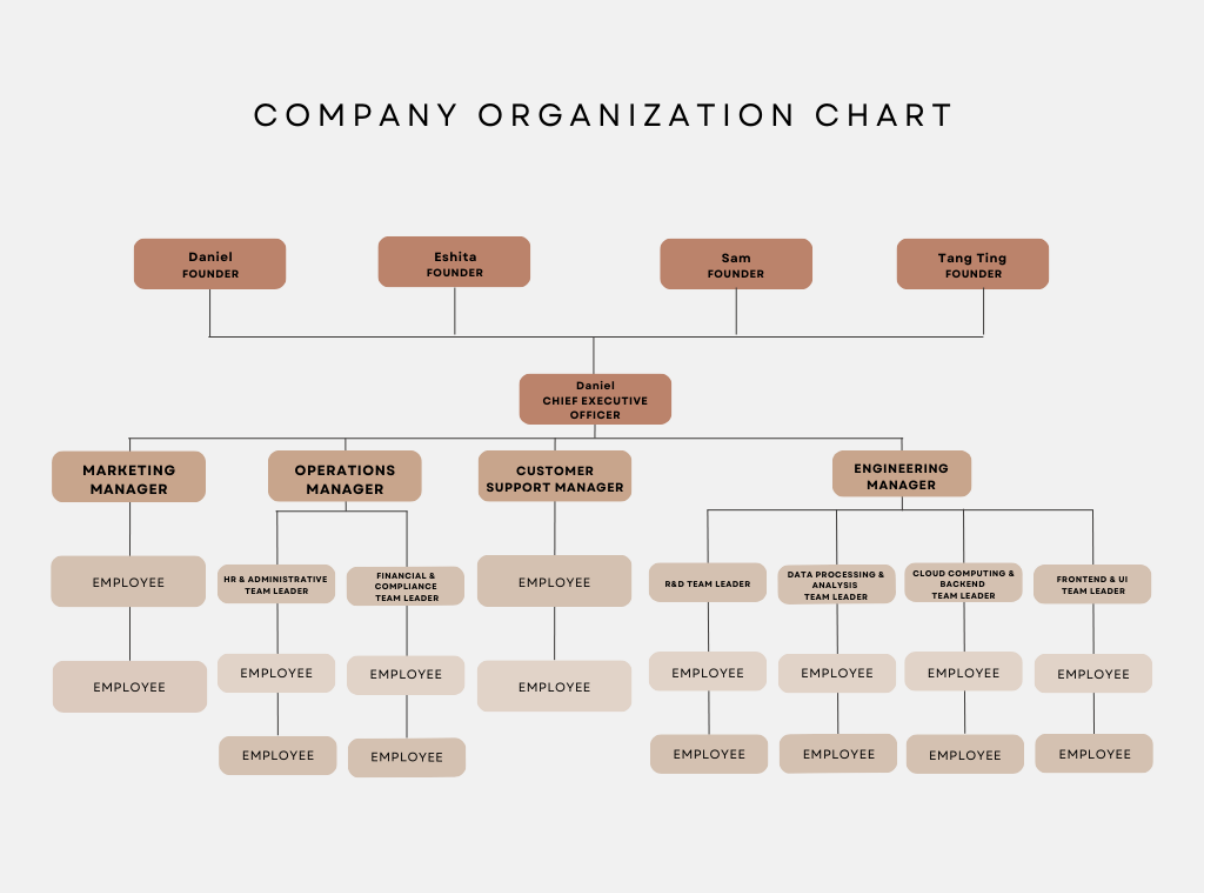


Figure 22: Company organization chart

In the dynamic landscape of today's business world, well-structured and effective management and organization are the cornerstones of success. This section of the business plan provides a comprehensive overview of the key individuals guiding our company towards its goals as well as the organizational structure that will facilitate seamless operations.

5.1 Founders and CEO

The founders of this company, Daniel, Eshita, Sam, and Tang Ting are a group of people from different backgrounds who come together with the same commitment to environmental sustainability by addressing the modern challenges of air pollution using artificial intelligence. Under the common agreement, these co-founders agree to appoint Daniel as the Chief Executive Officer of X company. This decision is based on Daniel's strong background in data analytics and vast experience in the artificial intelligence industry. He has also successfully launched and managed several startups in the past, showcasing his ability to identify market opportunities and drive business growth.

5.2 Sales & Marketing Department

The sales and marketing department will be instrumental in developing and executing marketing strategies in promoting our AQI data solutions and reaching our potential clients and investors effectively. This department will be responsible for conducting market research to identify target markets and customer segments, organizing marketing campaigns, and managing website content to increase product awareness of the AQI data solutions. On top of that, the team will also cultivate strategic partnerships with environmental organizations, government agencies, research institutions, and other relevant entities to increase brand awareness and credibility.

5.3 Operational Department

The operational department of the company is crucial to ensure the company's optimal performance. This department will be separated into two teams for an efficient reporting process: the Human Resources and Administrative team and the Finance and Compliance team.

- HR and administrative

In particular, the HR and admin team will be managing all aspects of human resources and administration tasks within the company. These include talent acquisition, performance management, and general administrative support such as arranging cross-department meetings.

- Finance and Compliance

On the other hand, the finance and compliance team will be handling the company's financial health and industry-specific regulations adherence. To illustrate, the team will be ensuring financial operations of the company remain stable and all business activities operate within the boundaries of relevant laws and regulations, such as data privacy and environmental policies.

5.4 Customer Support and Service Department

From the perspective of the customer support and service department, the team possesses a wealth of experience and expertise in customer support and service management, ensuring that all customers receive the assistance and support they need when using our services. As the first point of contact for our clients, the department is responsible for offering training and resources to help clients to be able to use the application programming interface and prediction platform. They also play an important role in resolving customer complaints and providing technical assistance to clients facing issues with our services. In addition to these responsibilities, the department actively engages in feedback collection, gathering valuable insights from customers for continuous improvement.

5.5 Product & Engineering Department

The product and engineering department is known as the core section of our company. It is structured by encompassing the combined efforts of the Data Acquisition and Analysis team, Frontend and UI team, Cloud Infrastructure and Backend team, alongside a dedicated R&D team.

- Data acquisition and analysis team

This team is responsible for collecting and managing the input data from our physical sensors and broadband companies. It also involves processing and analyzing the gathered information through data preprocessing, machine learning, and predictive analysis.

- Cloud computing and back-end team

This team will be overseeing the development of the application programming interface as well as managing the cloud infrastructure, databases, and back-end systems.

- Front-end and UI team

This team specializes in developing user-friendly interfaces, real-time map views, and data visualizations that provide a comprehensive experience for clients to access AQI predictions. Simultaneously, for continuous improvement and enhancement of business, the R&D team will focus on advancing, researching, developing, and experimenting with innovative approaches and technologies.

5.6 Company cultures and ethics

To further enrich the overall organizational excellence, the company encourages collaboration and integration among departments. This approach aims to bring a cohesive working environment for better communications between departments, comprehensive information sharing, and engagement to work on the organization’s strategic goals. For

instance, the marketing department will collaborate closely with the engineering department to create technical content on websites. These contents will demonstrate how users can leverage data according to their specific needs or highlight new features and enhancements of the UI dashboard. Besides, valuable feedback and insights collected from customers can be shared by the customer support department with both the marketing and engineering teams to enhance marketing material and continuous product improvements. The engineering team will also provide training and technical support to the customer support team in resolving any troubleshooting issues and customer complaints. Nonetheless, all key departments will cooperate with the operational department for budgeting processes, workforce planning as well as industry regulations and company policy adherence.

5.7 Productivity evaluation using KPIs

This section outlines the Key Performance Indicators (KPIs) that track and evaluate our company's productivity. All KPIs will be reviewed and refreshed quarterly, or every three months to ensure our company continues to move forward with new goals, objectives, and key results.

5.7.1 Sales & Marketing Department

Objective	Generate leads and sales for the company through effective online and offline marketing campaigns.
Key result 1	Increase the number of inbound and outbound leads generated per month by 10%.
Key result 2	Increase the conversion rate from leads to customers to 5%.
Key result 3	Achieve 100,000 monthly web traffic in 12 months.

5.7.2 Operational Department

Objective	To attract, retain, and develop top talent to support the company's growth.
Key result 1	Increase company headcount to 20 employees in 24 months.
Key result 2	Reduce the employee turnover rate to 5% or less.
Key result 3	Achieve an employee engagement and satisfaction score of at least 80%.

5.7.3 Customer Support and Service Department

Objective	Provide excellent customer service that results in high customer satisfaction and retention.
Key result 1	Achieve a customer satisfaction score of at least 90%.
Key result 2	Maintain 99% Service Level Agreement (99%) for all API clients.
Key result 3	Reduce the Customer Churn Rate (CCR) to 5% or less.

5.7.4 Product and Engineering Department

Objective	Build and maintain a reliable and scalable data pipeline and machine learning models to predict air quality outcomes.
Key result 1	Maintain and achieve an accuracy of at least 90% for air quality predictions.
Key result 2	Scale and support 100,000 API requests per second.
Key result 3	Achieve 99.9% uptime for the data pipeline and API.

5.8 Company Management Strategy

This section outlines the company's strategy to manage and maintain the growth of each department while improving the company's decision-making to fairly allocate resources and capital for each department.

Aspects	**Short-term plan (Next 5 years)**	**Long-term plan (Next 10 years)**
General	Focus on building and expanding the engineering department for building products and conducting research and development, while minimizing the headcount of other departments to maintain the company's resources and capital expenses.	Focus on building and scaling the remaining department once the product has the confidence to attract more customers.
Sales & Marketing	Utilize organic marketing to collect leads for API subscriptions with minimum advertising and marketing costs, such as building a strong digital presence using Facebook, Instagram, TikTok, LinkedIn, and Google.	Begin investing money into paid advertising with various distribution channels, such as Google ads, YouTube ads, PR, and media partnerships.
Operational	Focus on building a lean team of 5 to 20 people by hiring talented, experienced team members around the globe.	Increase the company's headcount to 60 people, with the majority of team members working in the engineering department to

		build better products via research and development.
Customer support & service	Improve customer satisfaction ratings by carrying out thorough customer feedback sessions and liaising with other departments to ensure all customer requirements are achieved.	Build a customer-centric culture by creating a self-service knowledge base, developing a customer loyalty program, and investing in customer support training and development.
Product & Engineering	Construct a Server Reliability Engineer (SRE) team of up to 5 people to oversee the entire data pipeline. Improve our API quality, with close to zero downtime and high data accuracy.	Increase our SRE headcount to 15 people, which sub-departments managing different data channels. Increase budget for research and development to increase product development efficiency and experiment with more sophisticated data systems and product lines.

6.0 Financial Plan

6.1 12 months revenue & expenses projection

- Revenue projection

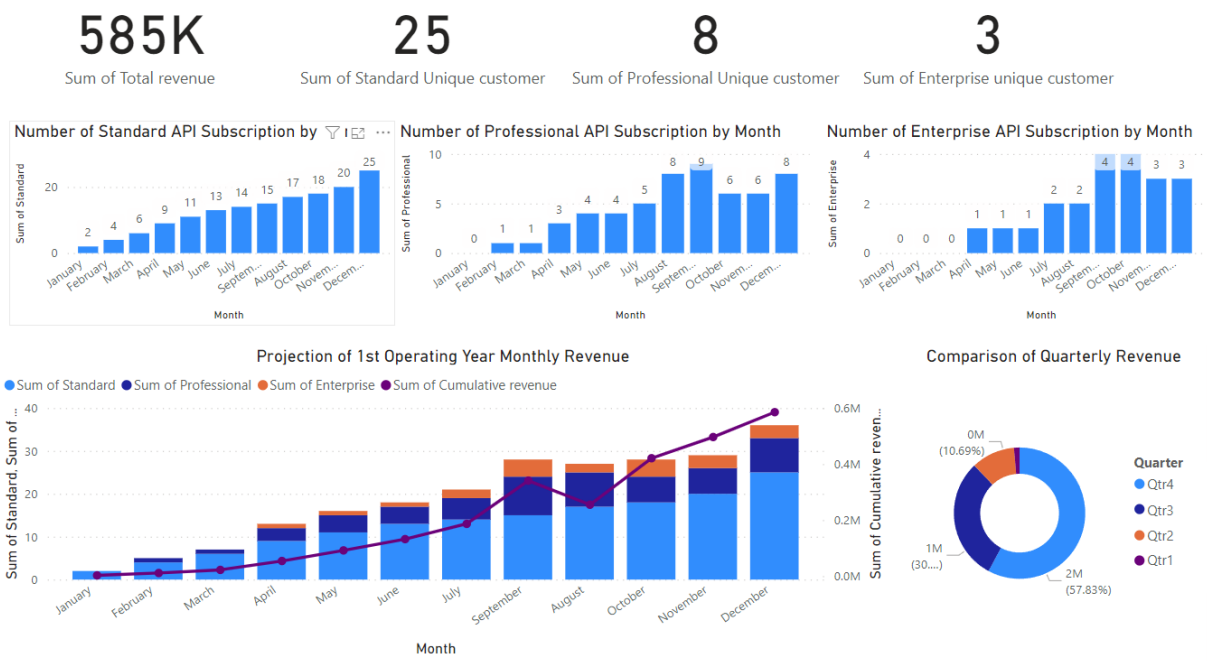


Figure 23: 12-months revenue projection on PowerBi

Main revenue category	Description
Standard	Customers who subscribe to the standard API plan
Professional	Customers who subscribe to the professional API plan
Enterprise	Customers who subscribe to the enterprise API plan

The above revenue projection is calculated based on the capability of our data expansion. In the first operating year, our plan is to set up air quality sensors only around the Federal Territory, our data API would only be available to clients around the same targeted area, such as hospitals, real estate companies, construction companies, and other industries.

In the first operating year, our company aims to earn RM585k in revenue, with a total of 36 API customers. There are 3 main types of customers, which are those who subscribe to our standard plan, professional plan, and enterprise-level plan.

Our company projected a healthy growth of numbers in terms of the standard plan. As a worst-case scenario, both professional and enterprise-level plans might face a certain months of plateau and even experience a higher churn rate.

Across all quarters in the first operating year, the revenue would grow steadily in each quarter. The first quarter is estimated to earn a total of RM22,000, the second quarter is projected to earn around RM110,000, the third quarter is projected to earn around RM209,000, and the fourth quarter is projected to earn around RM244,000. The large increase between the first and the second quarter is due to the increase in customers subscribing to our professional and enterprise-level plans. The fourth quarter is projected to hold the biggest revenue share across the first operating year, contributing 58% of the total revenue, followed by the third quarter at 30%, the second quarter at 11%, and the first quarter at 1%.

- Expenses projection

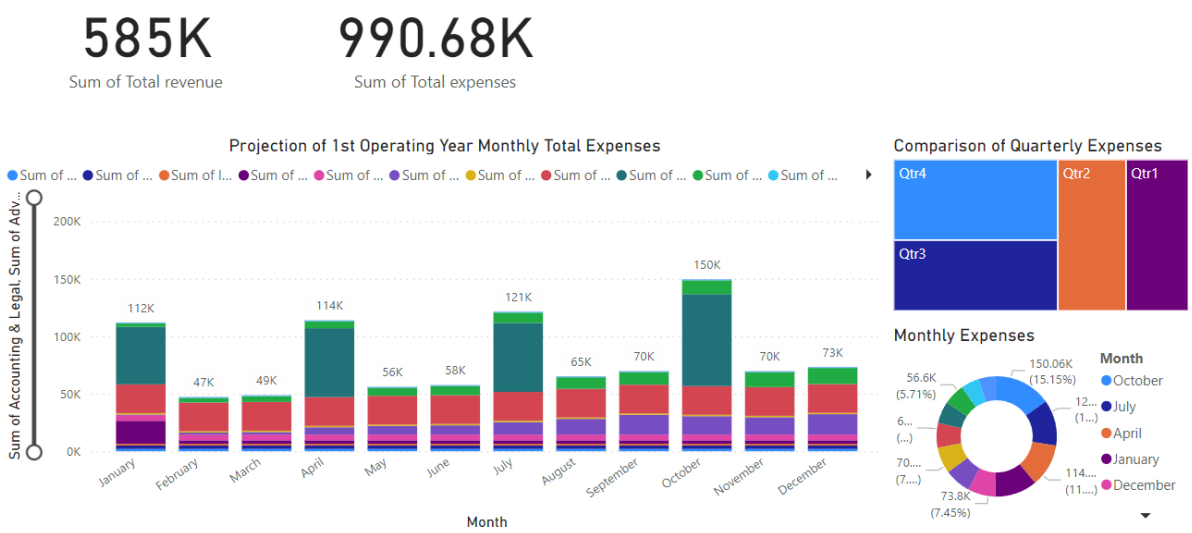


Figure 24: 12-month expenses projection on PowerBi

Main expenses category	**Description**
Air quality sensors	The actual sensors to be installed around Malaysia to capture air quality data
Technology subscriptions	Cloud services such as Amazon Web Service (AWS) support cloud computing for data pre-processing, data cleaning, data processing, data visualization, and data storage
Research and development	A dedicated budget to maintain product innovation and product experimentation
Salary	Income for all employees working for this company
Outsourced services	Any services that lead to freelancers outside of our company

Office Supplies	Company assets such as laptops, monitors, tables, chairs, and others
Advertising	Budget for paid advertising and marketing for both offline and online distribution channels
Travel and transport	Claimable fee for business-related travelling
Accounting and legal	Monthly accounting and legal fees to ensure our company operates on a legal basis
Maintenance	Any sort of physical or virtual maintenance fee
Rental	Monthly rental for our company's office
Utilities	Utility bills such as water, electricity, Wi-Fi, and phone
Insurance	To protect businesses from a variety of risks

The above expenses projection is calculated based on our capability to expand our operation. The bigger the expansion of our operation, the bigger the expense for our company.

In each starting month of a new quarter (January, April, July, October), a huge amount of expenses would be spent on installing air quality sensors to accommodate our expansion. The biggest spending month is projected to be in October, which is targeted to spend

around RM80,000 to install new sensors in bigger states in Malaysia, which could be either Johor or Pahang.

Aside from the quarterly surge in purchasing sensors, the average amount of monthly expenses would gradually increase as the company foresees healthy growth. The increase in monthly expenses is mainly contributed by the increase in salary to hire new employees and budget for research and development. To ensure our company maintains a healthy financial while staying innovative in technology, a total of 20% of gross profit would be allocated to the research and development (R&D) department for product improvement and various experimentations. As our monthly revenue grows, the budget for R&D will increase as well.

Another major expense would be technology subscriptions, which mainly refer to the operation of our cloud computing that contains our company’s main assets, air quality data.

The remaining expenses would be accounted for by categories such as rental, office supplies, utilities, transportation, legal, accounting fees, and others, which may fluctuate with minimum impact on the overall financial statement.

6.2 10-year financial projection and valuation

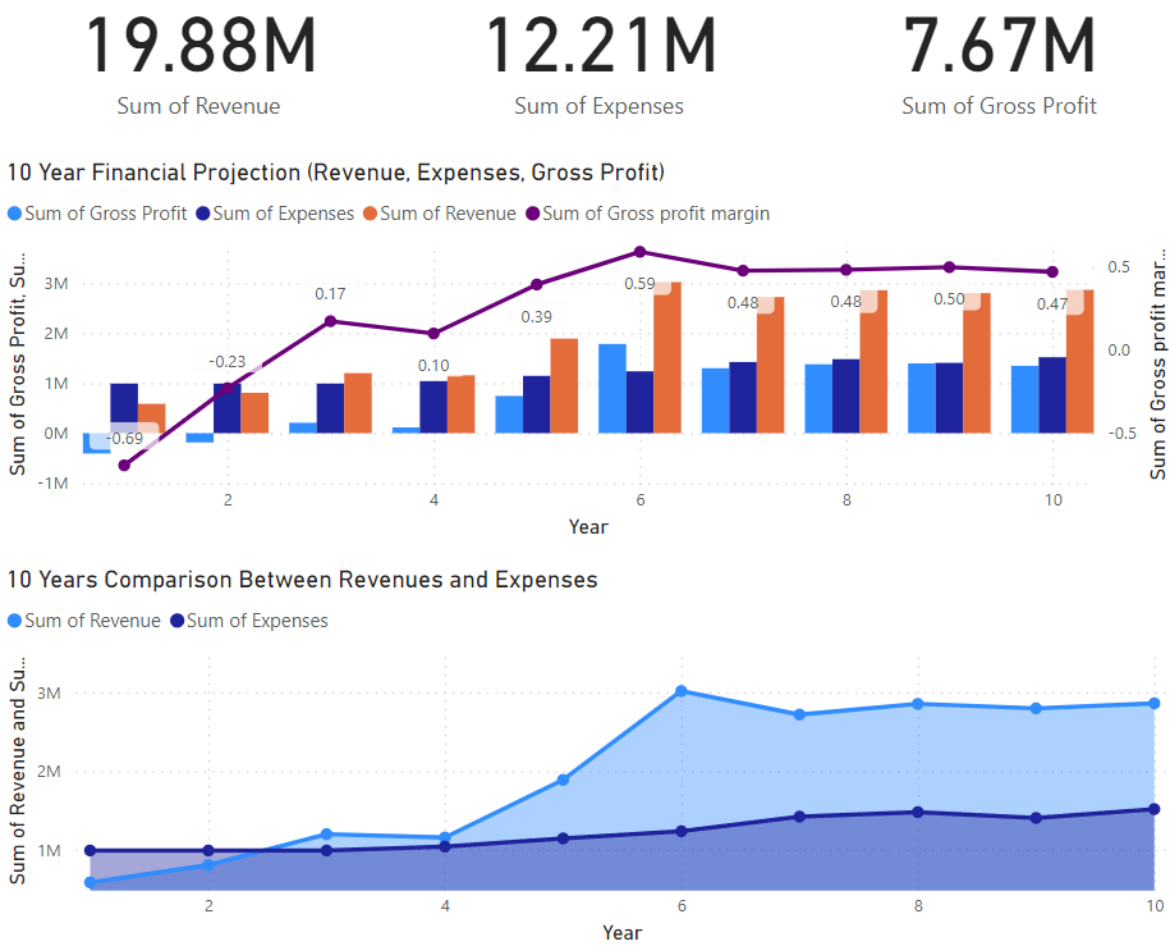


Figure 25: 10-year financial projection on PowerBi

The above dashboard presents our company's 10-year financial projection. The numbers for each year are compounded based on our 12-month financial projection while taking into account our continuous business expansion plan.

The first two years of our company's operation would result in a loss. In terms of gross profit margin, it is projected that Year 1 would result in a -69% loss while Year 2 would have an improvement but still withhold a -23% loss.

However, our finances would break even and start gaining profit in Year 3, with a 17% gross profit margin. The remaining future years would see a positive number for our company's profit margin, with a healthy range of around 30% to 60%.

Although our annual expenses would continue to rise due to the expansion of our business, our annual revenue would increase tremendously at a healthy level. The larger the area coverage of our air quality index, the greater the number of our potential API customers.

It is projected that our company will hit the profit maximization point in Year 6, which is when we have successfully covered the entire South East Asia Region. With that said three possible scenarios might occur after Year 6 based on different business decision-making.

- The Return to The Zero Point of The Firm Model

Figure 26: The Return to The Zero Point of The Firm Model

This section outlines the three possible scenarios of a company's financial growth once it achieves profit maximization (Ruiz Estrada, 2023). The above graph is simulated based on the research entitled "The Return to The Zero Point of The Firm Model" proposed by Ruiz Estrada in 2023.

6.2.1 Scenario 1: Full surviving sustainability

This possible scenario happens when the company is unable to sustain all customers after covering the entire Southeast Asia region, resulting in a high churn rate for API subscriptions and potential partnerships.

As a result, our company's revenue is decreasing annually, while the expenses continue to rise due to allocating more budget towards research and development (R&D) to either improve current data products or innovate new product lines to increase market size. All effort is focused on preventing the company from facing full bankruptcy as the revenue hits zero at least for the next 5 years.

6.2.2 Scenario 2: Long constant firm profit sustainability

This possible scenario happens when the company decides to stop expanding our air quality coverage outside of the South East Asia region.

Meanwhile, the company decided to put more focus on building better customer relationships with clients around Southeast Asia only. By putting more emphasis on retaining current customers instead of constantly expanding to new arenas, our company can maintain a healthy, consistent profit and cost for each upcoming year. This business strategy would help the company to retain profit maximization in the long run, at least for the next 10 years after reaching the maximum point in Year 6.

6.2.3 Scenario 3: Exponential growth in revenue

This possible scenario happens when the company decides to double down and expand to more continents other than the Southeast Asia region, striving for global domination in the industry.

This business strategy is risky but could result in an exponential growth in revenue in the short run, at least for the next 3 years. By expanding our business towards the international market, we could foresee a huge potential merger and acquisition scenario happening in one of the years. This scenario is most suitable as an exit strategy for this company, potentially selling to a major technology or data company such as Google, Amazon, and Facebook.

6.3 Startup capital

The amount of startup capital needed is RM5 million. The number is calculated based on the 10-year financial projection, and the available cash runway for our company to survive before running out of cash.

In general, the startup capital would be allocated mostly for air sensor installation, technology subscriptions, and salaries to hire product developers and engineers. Based on the 10-year financial projection, the RM5 million capital would allow our company to operate for up to 3 years until our break-even point. In the worst-case scenario, if the company fails to provide any sort of revenue in the first few years, the entire fund could allow the business to sustain up to 4.5 years, with an average of RM1 million expense per year.

7.0 Conclusion

We believe that our business has the potential to make a significant impact on the world. By providing people with access to real-time and predicted air quality data, we can help individuals to reduce their exposure to air pollution and improve their health. On the other hand, we believe that our valuable data and information would be of great value for companies in various industries to better improve our lives and well-being. We are excited to partner with investors and customers to make our vision a reality.

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