PlanetWatch®

Your planet needs you

White Paper

This version is under review

(an updated one will be published early 2023)

Version 1.1

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Executive Summary

PlanetWatch leverages advanced technologies and the engagement of local communities to raise the standards of environmental monitoring. By encouraging citizens to operate sensors and earn token rewards for data streams we are able to deploy dense, real-time sensor networks and deliver hyperlocal, street-level data quickly and cost effectively. Moreover we enable "Smart City as a Service" solutions and implement a circular, "green data" economy where citizens make their city smart and reap immediate benefits from their commitment. In addition, as a fraction of the total rewards budget is used to buy carbon credits, PlanetWatch is both helping protect public health through its data and financially supporting projects fighting climate change.

Our initial focus is on air pollution, which causes over 7 million premature deaths per year (source: WHO). Furthermore, recent scientific studies have shown a significant correlation between long-term exposure to air pollution and an increase in the Covid-19 mortality rate. Other studies indicate a significant risk of infection via aerosol, especially in indoor, crowded and inadequately ventilated spaces. Special attention to indoor air quality is needed for venues hosting very vulnerable populations such as hospitals and nursing homes.

PlanetWatch solves the following problems:

- **In most cities**, there are not enough outdoor air quality sensors to deliver hyperlocal data, which are necessary to timely detect, analyze and mitigate local pollution hotspots. PlanetWatch can deploy the large number of sensors needed to deliver hyperlocal data quickly and cost effectively.

- **Indoor air quality** PlanetWatch fills a gap in the market by selecting cutting-edge technologies and building affordable yet advanced turnkey air purification and monitoring solutions. For institutional customers, we can deliver real-time estimates of infection risks via aerosol as well as checking compliance with the latest air quality standards.

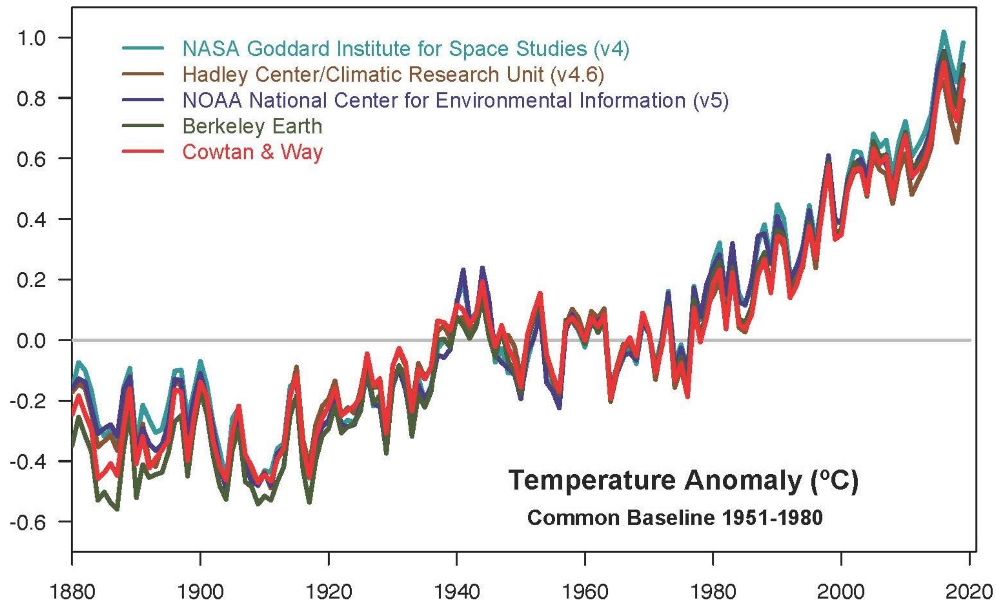
PlanetWatch is growing very fast. As of today, we have already posted over 40 million transactions on the Algorand blockchain out of a network of about 330 sensors. We expect to be able to connect thousands of sensors before the end of 2021.

1 The Big Picture

Evidence for climate change is in front of us. Scientific consensus on the influence of human activities on this phenomenon is very wide.

"Earth's changing climate is a critical issue and poses the risk of significant environmental, social and economic disruptions around the globe. While natural sources of climate variability are significant, multiple lines of evidence indicate that human influences have had an increasingly dominant effect on global climate warming observed since the mid-twentieth century".

(American Physical Society)



Source: https://climate.nasa.gov/scientific-consensus/

1 The Big Picture

Despite the urgency of the matter and formal commitments from many governments to reduce greenhouse gas emissions according to the Kyoto protocol, it is fair to say that acknowledging and taking action to mitigate health hazards from environmental challenges was not at the top of political agendas and public discussions in any country, until very recently.

Since 2018, teenage environmental activist Greta Thunberg has been successful in drawing global attention towards the urgency of climate change mitigation. After Thunberg addressed the 2018 United Nations Climate Change Conference, student strikes took place every week somewhere in the world. In addition, the onset of the COVID-19 pandemic in late 2019 has contributed to create a global sense of urgency and awareness for the role that each person has to play in order to protect public health and the environment. Most people now understand that our individual behaviours are instrumental to limit the spread of viral infections and to monitor and protect the environment we live in.

1.1 Why Air Quality Matters

Source: World Bank and WHO

7 Million	$225 Billion	$5,110 Billion
Premature deaths	Lost work hours	Assistance costs (equivalent to Japan's GDP)

Poor air quality is a major global health hazard. Air pollution kills an estimated seven million people worldwide every year. World Health Organization data shows that 9 out of 10 people breathe air that exceeds WHO guidelines, with low- and middle-income countries suffering from the highest exposures.

- **Outdoor air pollution** accounts for an estimated 4.2 million deaths per year due to strokes, heart diseases, lung cancer, acute and chronic respiratory diseases.
- **Indoor air pollution** is one of the leading causes of disease and premature death in the developing world. Even mild indoor air pollution is detrimental to health and reduces workers productivity.

"Air quality is closely linked to the earth's climate and ecosystems globally. Many of the drivers of air pollution (i.e. combustion of fossil fuels) are also sources of greenhouse gas emissions. Policies to reduce air pollution, therefore, offer a "win-win" strategy for both climate and health, lowering the burden of disease attributable to air pollution, as well as contributing to the near- and long-term mitigation of climate change".

(World Health Organization)

Air quality and Covid-19

The onset of the COVID-19 pandemic has drawn additional attention to air quality. Recent scientific studies have shown a significant correlation between long-term exposure to air pollution and an increase in the COVID-19 mortality rate.

Other studies have indicated a significant risk of infection via aerosol, i.e. a suspension of fine solid particles or liquid droplets in the air. Aerosol transmission is higher in indoor, crowded and inadequately ventilated spaces, where infected individuals) spend long periods of time with others, such as restaurants, choir practices, fitness classes, nightclubs, offices and/or places of worship. Special attention is needed for venues hosting very vulnerable people such as hospitals and nursing homes.

1.2 Air Quality Monitoring is Broken

Outdoors

In most cities worldwide, air quality sensors are not numerous enough to deliver hyperlocal, street-level air quality data. Compared to conventional air pollution management, which commonly relies on a few sparsely located monitors and modeling, hyperlocal data allows for a more holistic picture of air quality at a high spatial resolution and frequency delivering a better understanding of the true exposure and health impacts of air pollution. In particular, hyperlocal data are necessary in order to timely detect, analyze and mitigate dangerous local pollution hotspots, which can occur especially in inner cities. Air quality should be closely monitored especially in areas such as parks, where vulnerable populations (children, elderly citizens,..) spend a significant fraction of their time, but this is rarely the case.

Indoors

According to the EPA, we spend about 90% of our time indoors. Yet, there is no widespread culture of indoor air quality (IAQ) monitoring. In fact, health risks related to poor air quality are potentially greater indoors than outdoors because of prolonged exposure and concentrations of pollutants which can reach much higher levels than outdoors. Human senses alone cannot detect IAQ-related risks. Moreover, IAQ fluctuates over time based on activities performed and human occupation rates. Continuous monitoring is the only way to promote proper and constant IAQ. Monitoring can be the base for actionable strategies and trigger steps to ensure or restore healthy conditions at home, in the workplace and wherever people spend time. Good air quality is necessary for healthy buildings.

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2.1 A Network of Sensors and People

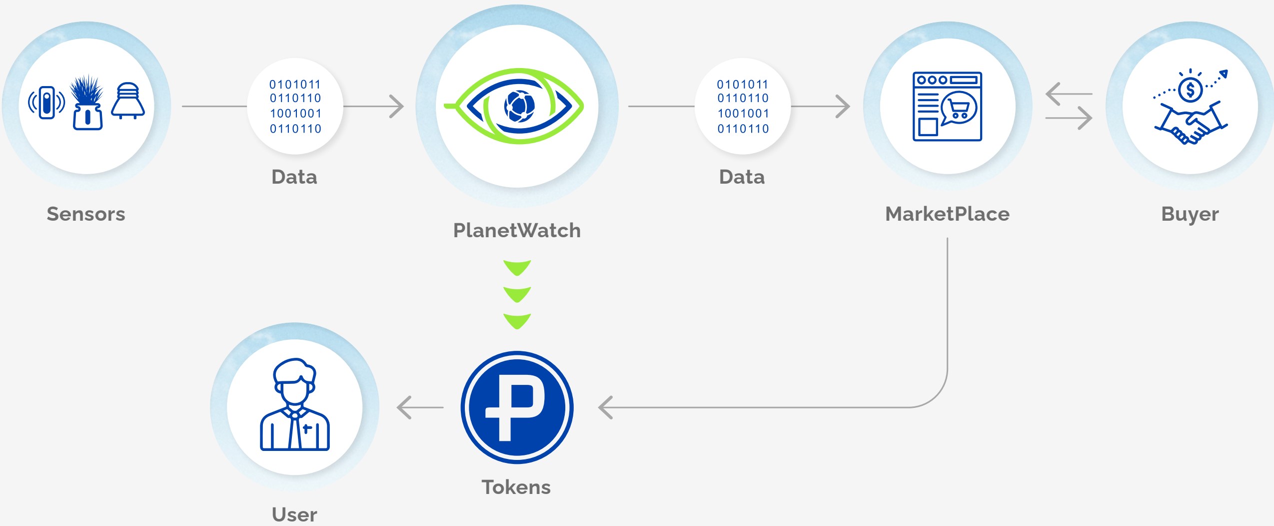
PlanetWatch's ambition is to overcome the limitations of current air quality monitoring networks and deliver high-resolution, real-time data while striking an optimal balance between data quality, network deployment time and costs.

In order to achieve this, we have developed a strategy based on:

- Adopting sensors which are at the same time highly reliable, affordable, easy to install and operate,
- Engaging local residents and providing incentives for them to help us deploy and manage sensors in a fast and cost-effective way.

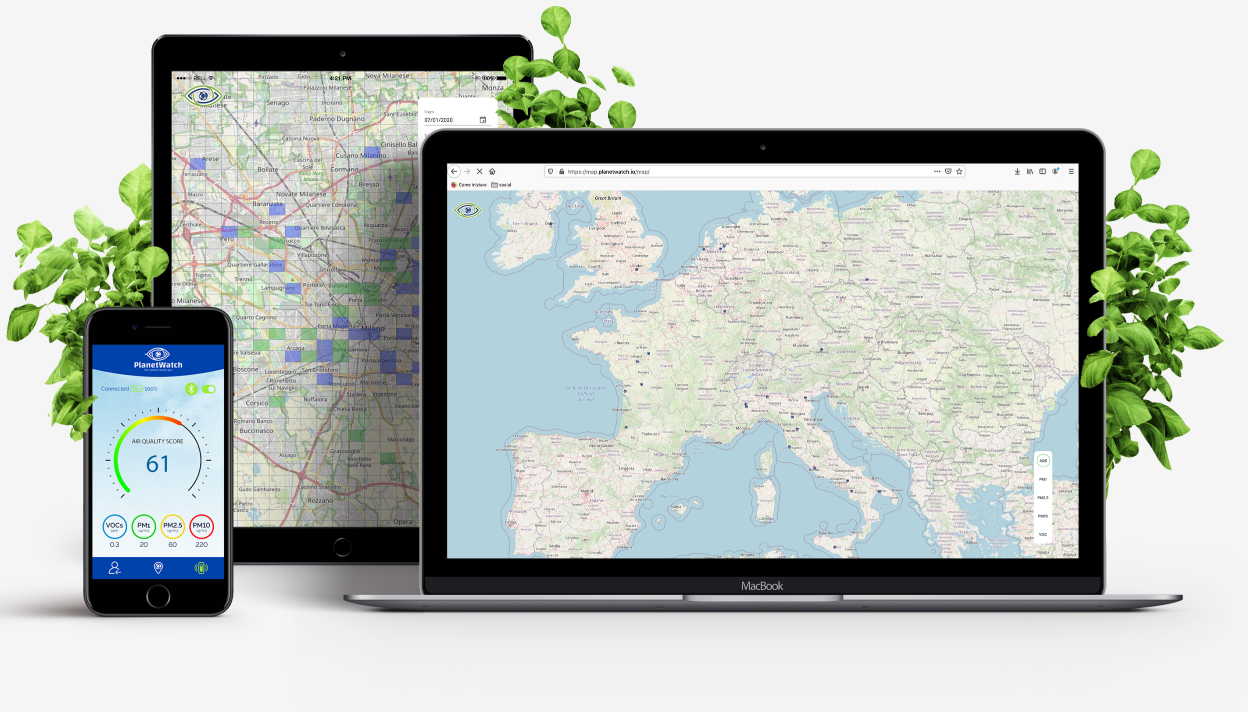
In each city of interest we proceed as follows:

1. **Community Building**
   We partner with local government and community leaders to raise awareness for air quality matters and to select PlanetWatch Ambassadors among reputable people who are keen to recruit other people supporting our deployment effort.
2. **Network Setup**
   Sensors are deployed and connected to the PlanetWatch network. Systems are thoroughly tested.
3. **Value from Data**



Outdoor sensor data are validated, analyzed and written on the Algorand blockchain. Sensor owners receive Planet token rewards, which can be redeemed for air purifiers and other useful products. Data is then shared across a range of channels, including mobile and web Apps for consumers, specialized dashboards for corporate and governmental users, as well as data feeds for online media outlets.

2 PlanetWatch



Outdoor and indoor sensors are both eligible for Planet token rewards. Data is used either in the form of aggregated, fully anonymized datasets, or in other ways subject to the sensor owner's approval. Under all circumstances, data will be shared in full compliance with privacy laws, in particular the European GDPR legislation.

Whenever data are monetized, revenues are shared with sensor owners in the form of Planet token rewards (see our token model for details).

2.2 Air Quality Sentiment Analysis

People themselves are sensors in our network. Poor air quality affects our health and can quickly trigger a feeling of discomfort. Some people are particularly sensitive, such as allergic people, asthma sufferers, etc., but anybody can detect an unpleasant or unusual smell, possibly faster than an electronic detector. This is why we will ask PlanetWatchers to provide feedback via our mobile App whenever they notice that their allergy symptoms get worse or simply perceive unusual outdoor air conditions. Data from human sensors will be used to build an Air Quality Sentiment Analysis, which will complement the hyperlocal information provided by electronic sensors.

2.3 Smart, Green, Carbon-neutral Cities

The notion of smart city is based on the idea that assets, resources and services in an urban context can be managed more efficiently by collecting real-time data from a wide range of devices and using them to monitor environmental parameters and optimize traffic and transportation systems, power plants, utilities, water supply networks, waste, etc.
Efficient city management requires cost-effectiveness, energy efficiency and ultimately reducing the carbon footprint of city processes. So, making a city "smart" implies making it "green".
Our "Smart City as a Service" solutions leverage a circular token-based economy where citizens make their city smart and earn rewards from their commitment. Following partnerships with local businesses and governmental entities, rewards could be redeemed against free tickets for public transport and other environmentally-friendly services. Finally, PlanetWatch will allocate a fraction of the total rewards budget to buy carbon credits from local projects, wherever applicable, further reducing the city's carbon footprint.

2.4 Governance

We will establish a decentralized governance model empowering all owners of sensors connected to PlanetWatch with voting rights in respect of decisions on token-related matters. Voting rights will be attached to sensor ownership via the sensor reputation system discussed in the token model section, i.e. owning a sensor with a reputation score of 1,000 will grant 1,000 votes.

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3.1 Air Pollution Causes and Dynamics

Air pollution is caused by natural and man-made sources. Natural sources contribute substantially to local air pollution in arid regions, more prone to forest fires and sandstorms. They include gases released by the body processes of living beings (CO_2 from humans, methane from animals, oxygen from plants during photosynthesis), smoke from the combustion of various flammable objects, toxic gases emitted for example by volcanic eruptions. However, human activities far exceed natural sources and major contributors of outdoor pollution include power generation, vehicle emissions, agriculture / waste incineration, industry and building heating systems.

The concentration of pollutants in the air is determined by various factors, such as the quantity of contaminants emitted, the number of polluting sources, the distance from the emission points, the morphological situation of the areas affected by the pollution and the local meteorological conditions. Although most air pollution emissions come from local or regional sources, in certain atmospheric conditions air pollution can travel long distances across national borders on timescales of 4-6 days, thus affecting people far from its original source. For example, wind-borne dust from the desert regions of Africa, Mongolia, Central Asia, and China can carry large amounts of particulate matter, fungal spores, and bacteria that affect health and air quality in remote areas. For this reason, global collaboration is important to manage and mitigate atmospheric pollution.

On a local scale, the factors that most affect the transport and atmospheric diffusion of pollutants are the intensity of the wind and atmospheric precipitation, which help to "wash" the air from the contaminants present. In addition, the intensity of sunlight and high temperatures, under certain conditions, can lead to photochemical smog, a particular kind of air pollution that occurs on days characterized by stable weather conditions and strong sunshine. The ultraviolet light of the sun induces photochemical reactions on nitrogen oxides (NOx) and volatile organic compounds (VOC), emitted into the atmosphere by many natural or anthropogenic processes, leading to the formation of ozone (O3), aldehydes and numerous other toxic substances for human beings, for animals and also for plants.

Generally the concentrations of air contaminants are lower when it is windy and the atmosphere is unstable in the lower layers. On the contrary, the concentrations of pollutants are high on a foggy days or in conditions of thermal inversions. Thermal inversions usually form in the winter months, on clear nights immediately after sunset, due to the rapid cooling of the ground (which in turn causes a rapid cooling of the air with which it is in contact). The hottest air rises and acts as a lid, trapping cold air near the ground, as well as pollution. As a result, the layer of air closest to the ground becomes more and more polluted.

On a hyperlocal scale, air pollution can be strongly influenced by the structure of the urban landscape (urban canyons, etc.). An urban canyon is a place where the street is flanked by buildings on both sides creating a canyon-like environment. In these locations, vehicle tailpipe emissions are the major source of many air pollutants such as ultrafine particles, fine particles, carbon dioxide, NOx. When the mean wind direction is perpendicular to the street, the vortex flow formed inside the canyon acts to confine air flow, reduce dispersion of pollutants and increase pollution concentrations. Such pollution peaks can only be detected and analyzed if a dense mesh of air quality sensors is available in the area, delivering hyperlocal data.

3.2 Indoor Air Quality

Indoor air quality has been identified by the US Environmental Protection Agency as one of the five environmental risks to public health, as exposure to toxic agents indoors is up to 10 times greater than outdoors. This is due to the combined effect of pollutants related to the inflow of external air (PM10, PM2.5, NOx, SOx) and those typical of closed environments (dust, humidity and mold, harmful emissions from building materials, of furnishings, coatings and wall paintings), as well as pollutants generated by air conditioning systems and those produced by daily activities.

Exposure to indoor air pollutants can lead to a wide range of adverse health outcomes in both children and adults, from respiratory illnesses to cancer to eye problems. The World Health Organization sets recommended limits for health-harmful concentrations of key air pollutants both outdoors and inside buildings and homes, based on global synthesis of scientific evidence.

In work environments, maintaining good indoor air quality is crucial (even in non-pandemic times, as it prevents flu outbreaks among colleagues and stimulates productivity. Clearly, proper indoor air quality is not sufficient to ensure a zero-risk microbiological scenario. Nonetheless, air quality monitoring supports the implementation of risk mitigation protocols, which can be as simple as frequently opening windows, preventing the accumulation of biological aerosols derived from people breathing.

Although it is not possible to detect directly, continuously and in real time the viral load in the air, it is possible to monitor a range of parameters that influence exposure to viruses, such as temperature, humidity, particulate matter, CO_2, density of occupancy of the rooms and ventilation. Widespread real-time air quality monitoring could make it possible to assess the potential exposure of people occupying public spaces to SARS-COV2 and other infections.

In addition to air quality monitoring, PlanetWatch has developed a full indoor infection risk mitigation strategy which leverages synergically devices monitoring air quality and physical parameters (temperature, humidity), thermal scanners, people counters and advanced sanitation technologies such as PCO (PhotoCatalytic Oxidation), which was developed and used by NASA for the sanitation of environments for aerospace missions. This technology uses UV light and a catalyst to generate natural oxidants, such as hydrogen peroxide, from the humidity present in the environment. Hydrogen peroxide, generated at concentrations that are completely harmless to humans and objects in the environment, eliminates viruses, bacteria, fungi and any microorganism that can harm health.

3.3 Core Technology Stack

Our turnkey solutions to collect, analyze and share air quality data, monitor key parameters and reward data originators, are based on the following advanced and environmentally-friendly technologies:

- The Algorand blockchain. A high-performance, energy-efficient, scalable and secure blockchain developed by Algorand, Inc., led by MIT professor and Turing Award recipient Silvio Micali. We use the blockchain as both an immutable data repository and as a tracking and rewarding system for all data streams.

- A wide range of IoT-ready environmental sensors which are characterized by low energy consumption and plug & play operations.

- An extensive software suite for big data acquisition, analysis and distribution, including advanced AI algorithms.

- Proprietary web and mobile interfaces and Apps, including user-friendly and informative visualization tools.

Sensors and Networks

In order to cover all the Air Quality Monitoring use cases identified by PlanetWatch, we need different types of sensors which we classify as follows:

Type 1: Premium outdoor devices,
Type 2: Consumer-grade outdoor devices,
Type 3: Indoor devices,
Type 4: Wearable and special devices.

Following a thorough market analysis and review of scientific literature, we have developed a proprietary methodology to:

- **Test sensor performance**, sometimes by comparing to higher-specs, reference systems,
- **Deploy outdoor sensors** by maximizing the network cost to performance ratio.

For each sensor type we have selected one or more devices to bootstrap our network. As most sensors will be operated by consumers, we are focusing on plug & play devices capable of keeping calibration over time.

We will be assessing and onboarding additional sensors on a regular basis, to keep a leading edge on technologies and costs.

Outdoor Data Collection and Validation Strategy

In order to obtain reliable hyperlocal outdoor air quality data in a cost-effective way, our strategy is to build a dense network based on two types of sensors:

Type 1

A high-performance yet affordable air quality sensor capable of measuring particulate matter (PM2.5 and PM10) as well as key gases such as NO_2, O_3 and CO.

Type 2

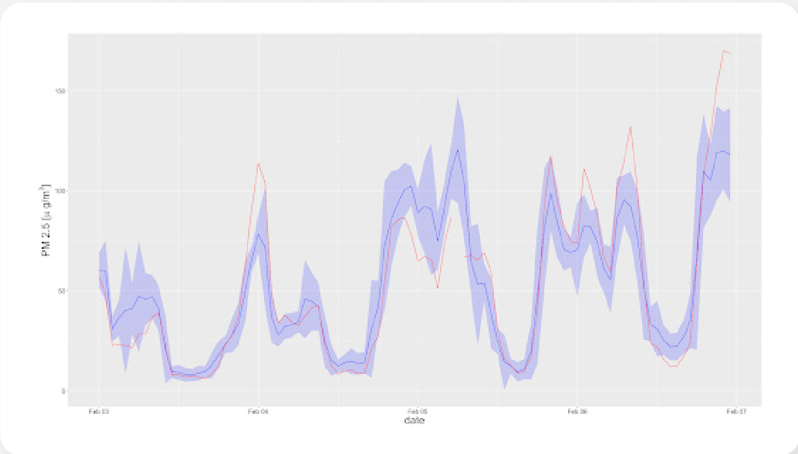
A consumer-grade sensor capable of measuring particulate matter (PM2.5).

We believe we can optimize value for money vs data quality by deploying Type 1 and Type 2 devices based on a 1:5 ratio. In particular,

- We overlay upon the Earth a grid of rectangular pixels. Pixel size is 0.72 km^2 (0.278 sq. mi.).
- We deploy one Type 1 and five Type 2 sensors in each pixel.

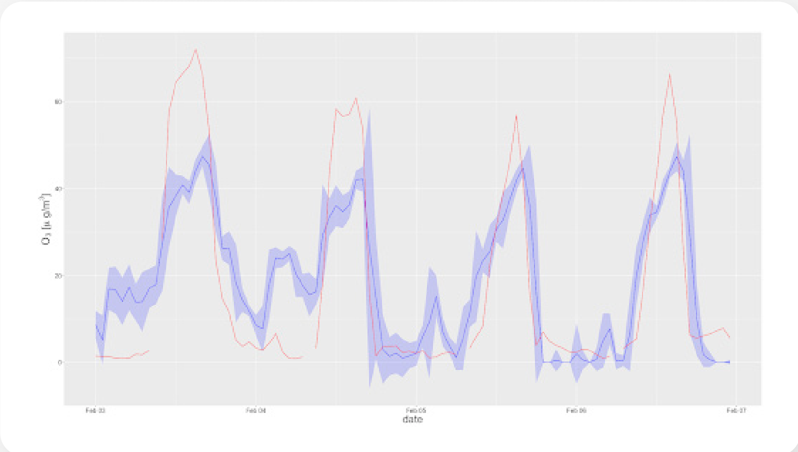
In order to test the quality of the resulting data sets, where data from Type 1 and Type 2 sensors are aggregated, we have proceeded as follows:

- We benchmark and calibrate Type 1 sensors against governmental reference stations, checking the reliability and consistency of the measurements over time. This activity was performed in Italy, by installing our Type 1 sensors very close to governmental ones. In the graph below you can see sample comparison data for hourly averages of PM2.5 and O3, indicating a very good match between the two datasets.

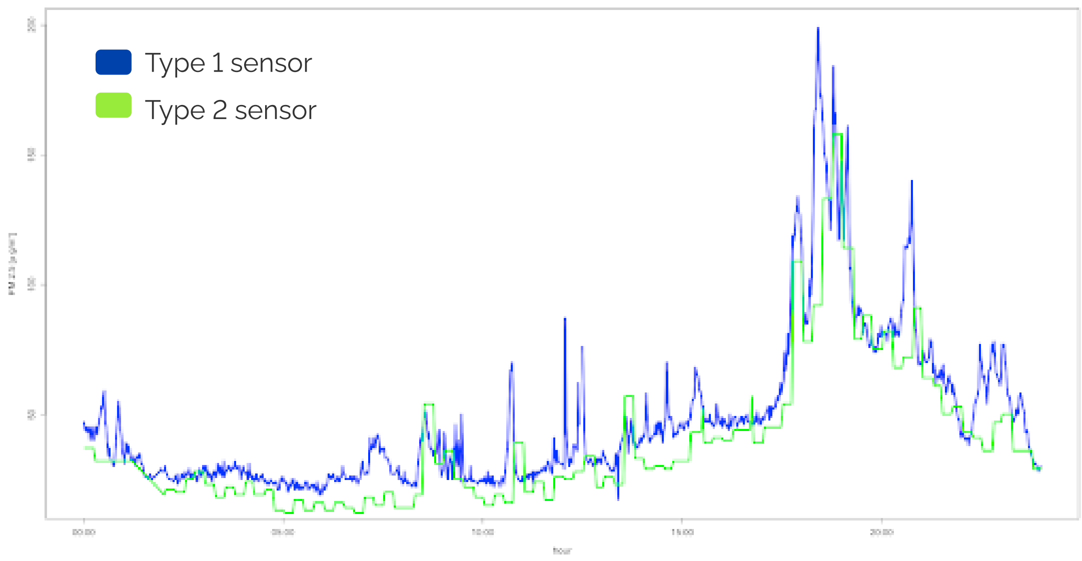


Governmental sensor

Type 1 sensor



- Having validated the performance of Type 1 devices against governmental systems, they become the reference system within our network for the validation of PM2.5 readings from Type 2 sensors. In the graph below you see Type 1 vs Type 2 PM2.5 data, yielding evidence for very strong correlation between the two devices:



The behaviour of the devices has been verified in real-life conditions, observing the effects of day/night shifts, traffic patterns and meteorological events. For the Type 2 device, different positions and installation modes have been tested, to evaluate the robustness of readings when the system is placed on shelves, tables, fences or directly on the ground. Finally, multiple rounds of tests have been performed, to check the response of the devices to specific triggers, e.g. combustion of different fuels.

All these tests have validated the robustness of our network deployment approach based on a mix of Type 1 and Type 2 sensors. By recruiting local residents and engaging them in network deployment activities, we are able to deliver hyperlocal data quickly and cost effectively in any city. Such data provide valuable information to study the local dynamics of atmospheric pollution and analyze correlations in space and time between the measured values and potentially relevant phenomena such as vehicular traffic, heating and industrial activities.

Type 1 Devices

The Type 1 device currently adopted by Planetwatch is named Airqino. It monitors in real time (every second, with moving average every 120 seconds) CO, NO_2, O_3, PM2.5, and PM10.

Airqino was developed by an Italian research institute. Its performance has been independently tested and has an extensive, verifiable track record of successful installations and operations in the last 7 years (see e.g. this paper) in several cities including very polluted areas. The device was also tested in extreme environments (North Pole) over the period 2017-2021 where it is still running properly. As confirmed by a study from the European Commission's Joint Research Center, this is one of the best and most robust outdoor air quality sensors in the sub-5,000 € price range.

Airqino is at the same time a reliable scientific instrument and a plug & play device which can be easily installed and operated by anybody, thanks to its built-in SIM card which ensures seamless connectivity.

Type 2 Devices

The Type 2 device currently adopted by PlanetWatch is named Arianna. It is a smart flowerpot which can be placed on windowsill, balcony or in a garden in a spot exposed to as much sunlight as possible and within the range of a WiFi network. Arianna includes sensors for climatic parameters and particulate matter (PM 2.5) and is powered via a photovoltaic panel.

PlanetWatch plans to introduce additional Type 2 sensors to offer PlanetWatchers choice and to cater for different installation scenarios.

Type 3 Devices

Indoor air quality monitoring is performed via devices that continuously measure VOC (Volatile Organic Compounds), PM2.5, CO2, temperature and relative humidity. PlanetWatch is currently using a device named Awair Omni, which provides very stable performance and complies with the RESET standard for air quality monitoring. RESET defines a set of requirements for continuous monitoring of an interior space or building, including monitor deployment, monitor specifications, installation, data reporting, data platform and calibration requirements. Compliance with RESET's technical requirements provides a scientific and repeatable method of measuring air quality by using accredited and comparable data to monitor air quality optimization indexes and the potential for exposure to microbiological contamination in the monitored environment.

Finally, compliance with the performance targets set by RESET opens the way to obtaining the RESET Air certification for healthy buildings.

PlanetWatch is planning to release its own RESET-compliant indoor air quality monitor.

Type 4 Devices

These are wearable devices which monitor directly the quality and safety of the air that people breathe. They are very useful in order to study how lifestyles affect people's exposure to pollution, in particular for people who are very sensitive to poor air quality (asthma sufferers, people with allergies, etc.). We are currently using the Atmotube PRO sensor as a Type 4 device. It detects PM1, PM2.5, and PM10 pollutants, like dust, pollen, soot, and mold, plus a wide range of Volatile Organic Compounds (VOCs). The device communicates via Bluetooth with the owner's smartphone. A mobile App then enables data visualization and streaming to PlanetWatch via the phone's internet connection.

The Algorand Blockchain

We leverage the highly secure, scalable and energy-efficient Algorand blockchain to store air quality data and to track and reward all data streams. Before Algorand, it was believed that blockchains were unable to achieve simultaneously high levels of decentralization, security, and scalability. This belief was formulated via the so-called Blockchain Trilemma.

Algorand's pure proof-of-stake protocol solves the trilemma and sets a new standard for blockchains:

1. It easily handles over 1000 transactions per second,
2. Blocks are finalized in under 5 seconds, delivering an optimal experience to end users,
3. Algorand never forks, which means all transactions are final. Once a block appears, the transactions it contains can immediately be relied upon.
4. Algorand is decentralized by design in both its node distribution and voting power. It has a diverse global network of nodes run by universities, non-profits, research institutions, cutting-edge organizations and investors.
5. With negligible transaction fees, Algorand reduces the cost structure of those building and transacting on the platform.

Last but not least, the Algorand team has been developer-focused since day one. In just a few months since launch, it already provided SDKs for Java, Javascript, Go and Python. It is an open-source platform with an accessible team of world-renowned experts ready to help build successful applications.

Algorand Standard Assets

Algorand Standard Assets (ASAs) provide a standardized, Layer 1 mechanism to represent any type of asset on the Algorand blockchain. These can include fungible, non-fungible, restricted fungible and restricted non-fungible assets. If one compares Algorand's ASAs to the implementation of token-related functionalities on other blockchains, it emerges that:

- **ASAs** are very fast and secure, as they are built directly into Algorand's Layer 1,
- **ASAs** are low cost to execute, due to Algorand's minuscule transaction fees.

Additional benefits include a simple asset issuance process and the universal interoperability of all assets issued on Algorand.

PlanetWatch leverages ASAs' technology by issuing both fungible and non-fungible tokens.

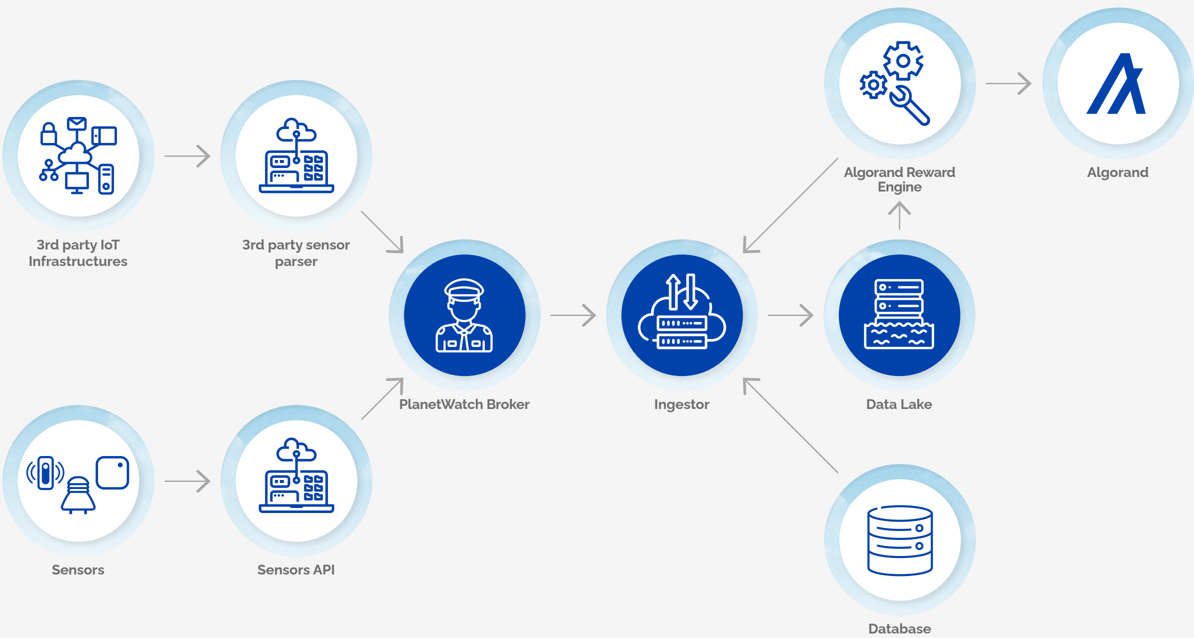
- **Planet is a fungible utility token** giving access to PlanetWatch products and services. Please refer to the Token Model section for details.

- **Each air quality sensor** connected to the PlanetWatch network is linked to a non-fungible token (NFT). Unlike fungible ones, Non-fungible tokens have UNIQUE attributes, so they can be used to represent a unique object in the digital on in the real world, such as a sensor with its own serial number. In PlanetWatch, NFTs act as ownership certificates for the sensors so that token streams linked to each sensor are sent to the wallet of the owner of the relevant NFT. In addition, PlanetWatch is looking forward to leveraging additional NFT use cases, such as digital collectibles.

Interacting with the Algorand Blockchain

Air quality data is encrypted, entered in the notes field of an Algorand transaction and sent in broadcast through the PlanetWatch Algorand node. Every 24 hours an algorithm checks the number of data streams sent, updates the sensor score (see Token Model) and communicates with the reward engine to send Planet token rewards to sensor owner accounts. As discussed in the Token Model, for Type 1 and Type 2 sensors, additional parameters are taken into consideration.

PlanetWatch is currently developing sensors capable of directly encrypting data and signing Algorand transactions before streaming. This process will add security to the data by delivering a "proof of origin".



Data Processing

PlanetWatch's ambition is to manage a network of thousands of heterogeneous sensors, each of them streaming data every few minutes, aggregating and processing data in near real time to deliver useful and timely information to a wide range of users via different interfaces. This is a very challenging technological goal.

Data Acquisition

The first challenge is about efficient data acquisition. To tackle this, we leverage the CERN Control and Monitoring Platform (C2MON). This is a heterogeneous data acquisition framework with configuration, persistence, historical browsing, control and alarm functionalities. It has been developed for CERN's demanding infrastructure monitoring needs and is based on more than 10 years of experience with the Technical Infrastructure Monitoring (TIM) systems at CERN. It comes with a simple and intuitive data subscription API with integrated history browsing capabilities that can be used to form the basis for industrial dashboards and other graphical monitoring applications. Powerful data filtering and configuration mechanisms help fine tune data flow and prevent data burst situations. It also offers built-in support for Elasticsearch.

Thanks to our CERN Spin-Off status, we have a fast track to obtain expert C2MON support directly from CERN experts whenever needed.

Data Analysis

We want to analyze air quality data generated by different types of sensors in the context of outdoor, indoor and mobile/wearable use cases.

With outdoor data, we focus on developing algorithms capable of detecting patterns while analyzing typical days on an hourly basis and weeks on a daily basis, for each pollutant. This approach helps find correlations between human or industrial activities, such as rush hours traffic, and pollution dynamics. Within the same approach, we aim at detecting anomalies and pollution peaks. When the pollutant concentration exceeds a fixed limit, the algorithm automatically starts a detailed analysis in order to understand the causes of the anomaly.

Device owners, by acting as “human sensors”, can add useful information to our analysis by reporting smells and other anomalies such as a visible presence of dust, for instance. Our algorithms will incorporate this information and combine it with sensor data in order to improve the identification and analysis of pollution events.

Our algorithms aim to develop long-term strategies for healthier lifestyles and building management with the data collected using indoor devices.

As for the outdoor case, we analyze pollution patterns for the typical day, both in domestic and professional environments, looking for activities and habits which negatively affect air quality. For instance cooking without adequate ventilation at home, smoking or not opening windows during cleaning activities are typical examples of very bad habits.

In public spaces and offices, we analyze correlations between air quality parameters and other environmental data, e.g. attendance levels, in order to assess the risk of infections spreading via human aerosol.
Finally, the analysis of data from wearable devices is extremely challenging and interesting from the point of view of precisely correlating personal exposure to air pollution with events and lifestyles. In order to perform such analysis, a starting point is to devise algorithms capable of detecting if the device is placed indoors or outdoors, as well as specific events of relevance to the user's health such as smoking a cigarette or entering a smoky environment. The ultimate goal is to deliver pertinent, actionable recommendations to users when their behaviour is exposing them to poor air quality, e.g. "open your window ", etc.

In order to detect indoor/outdoor transitions, one could think of using sudden temperature variations, but it is easy to show that such a simple criterion is not reliable enough. It is necessary to deploy a more sophisticated approach, based on combining multiple quantities (e.g. temperature, humidity, the level of volatile organic compounds) in order to obtain a classifier which can determine if the user is indoors or outdoors.

A MultiVariate Analysis (MVA) allows to exploit all the non linear correlations between variables to separate different populations or classes for a given dataset, commonly defined as signal and background (in our case, the signal could be "the user is inside" and the background "the user is outside"). The input of a MVA consists of a training sample and a set of discriminant variables. The training sample is a set of data where signal and background are already separated: this sample is used by the MVA, during the so-called training phase, to learn to discriminate between the two populations. Once the training phase is ended, the MVA divides the variable space, defining a decision boundary, in a signal and a background region, in order to maximize the separation between these two classes. Starting from the variables defining each event of the data sample, the classification process defines a classifier in a narrow range (usually it is defined between 0 and 1):
If the classifier approaches the lower level in the definition range, it means that the event associated to that classifier corresponds to a background event.
If the classifier approaches the upper value, the event is defined as signal.

Classification algorithms provide also a cut value for the classifier which allows to maximize the signal events with respect to the background.
These tools enable the detection of additional correlations between variables, if the dataset is large enough. The growth of the PlanetWatch network will be instrumental to develop and refine them.

User Interfaces

We are releasing a wide range of user tools and interfaces in order to deliver useful information to all of our partners, which include governmental bodies, academic institutions, corporations, blockchain experts as well as people with no interest in technicalities.

Dashboard

Our main user dashboard enables sensor owners to view live as well as historical data from their sensors in order to analyze trends over time.

In particular, it is possible to check:

- Sensor type,
- Last data written on the Algorand blockchain,
- Number of data streams sent,
- Number of pixels visited,
- The balance on the Algorand account of the sensor owner and the third-party infrastructure provider, if any.

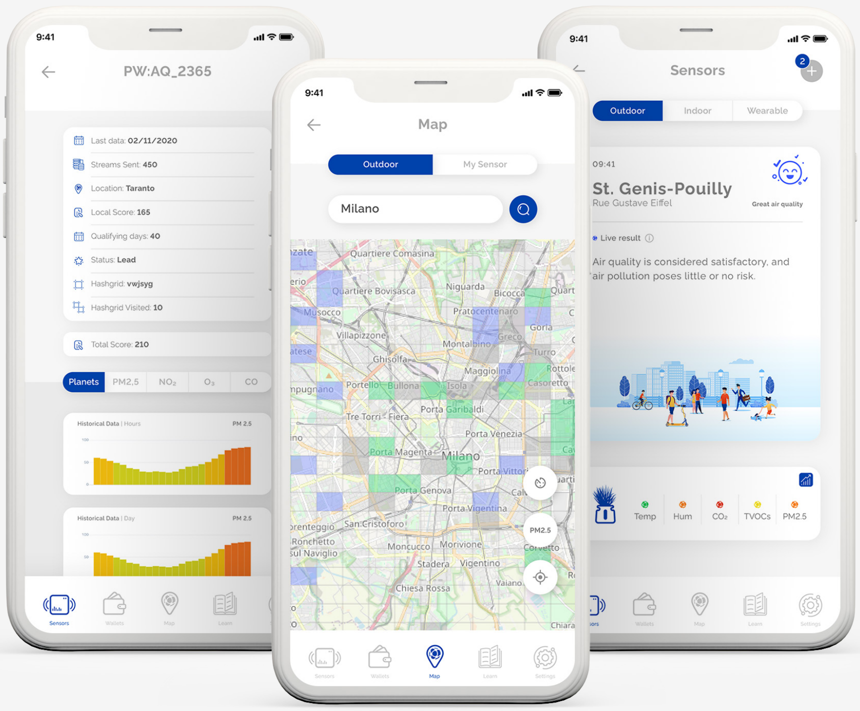
Finally, it is possible to switch between different sensors and check online/offline status.

Mobile App

The PlanetWatch App was developed in native language both in Android and iOS versions in order to offer the best user experience and speed. Special attention was paid to deliver a simple, ergonomic and intuitive design for maximum ease of use.

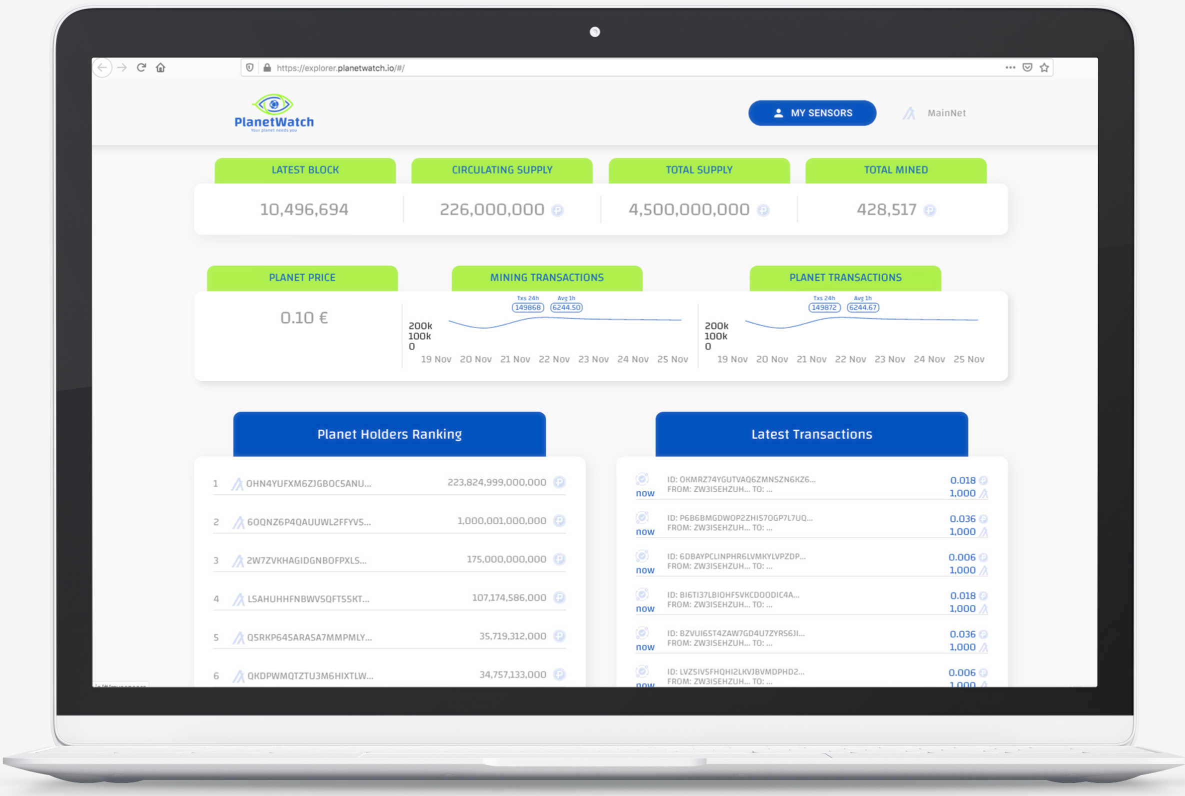
Through the mobile App it is possible to:

- Create, import and manage one or more Algorand Accounts,
- Check the outdoor air quality index in the current location with comments and suggestions,
- Add, manage and query own sensors,
- Check regional air quality via the global map,
- Receive Planetwatch news and updates.



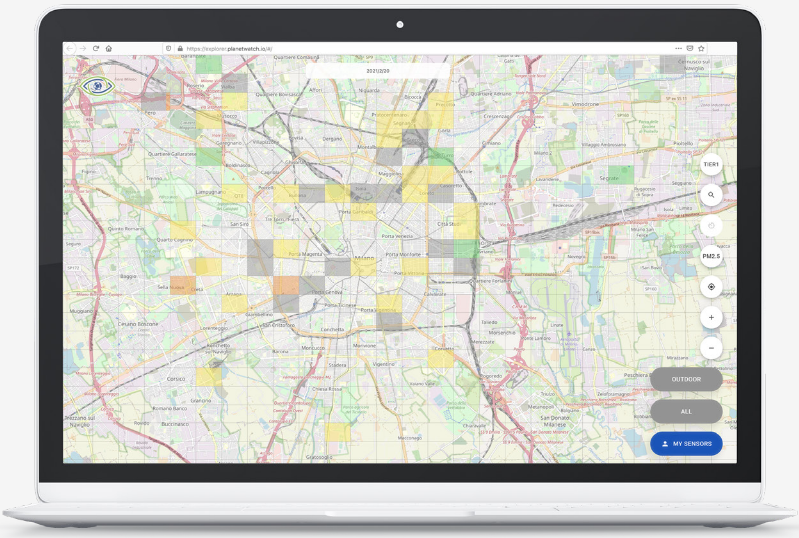
PlanetWatch Explorer

The Explorer lets users browse PlanetWatch-related transactions on the Algorand blockchain. It also lists the most active sensors in the Planetwatch network together with additional historical data, statistics and information.

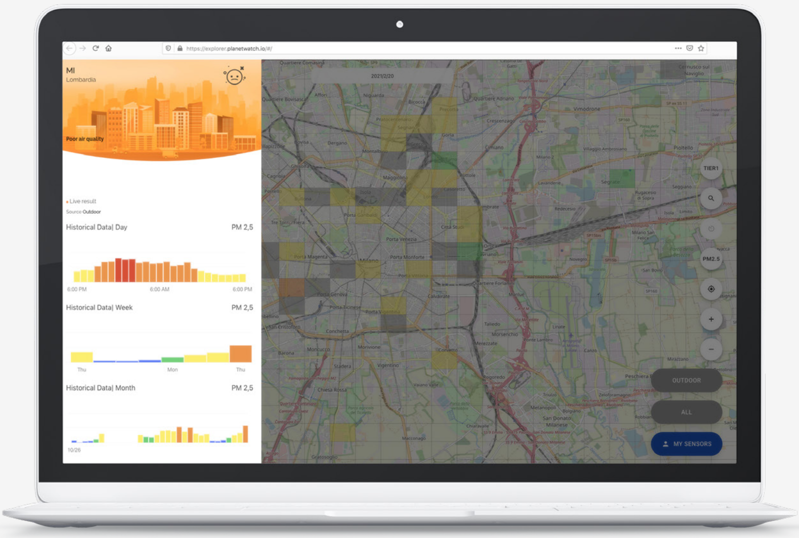


Map

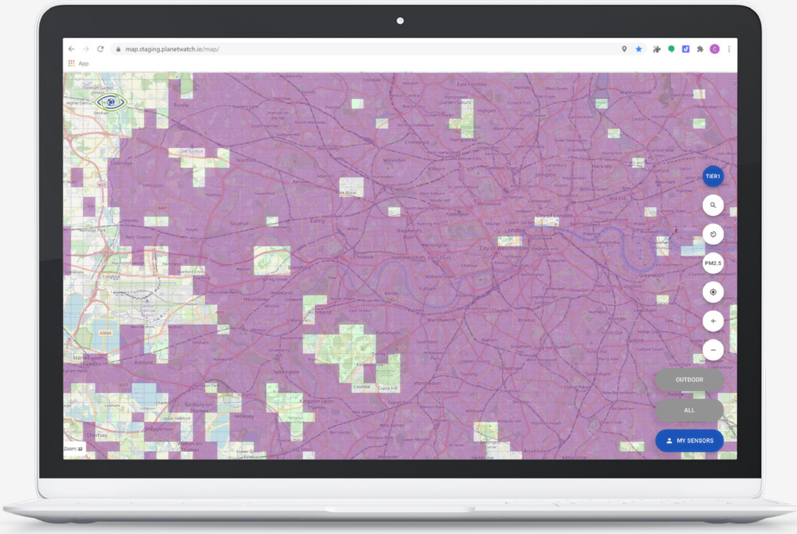
The PlanetWatch map provides open access to data from the outdoor PlanetWatch sensor network. By zooming in on specific locations, coloured pixels appear in areas with live air quality information from PlanetWatch sensors.



By clicking on a pixel (1.2 x 0.6 kms), it is possible to view live and historical data for the previous 24 hours, week or month.



Additional map features include the possibility to click on the Tier 1 button to check if the location corresponding to the address falls inside a Tier 1, densely populated (purple) pixel, according to the definitions in our token model.

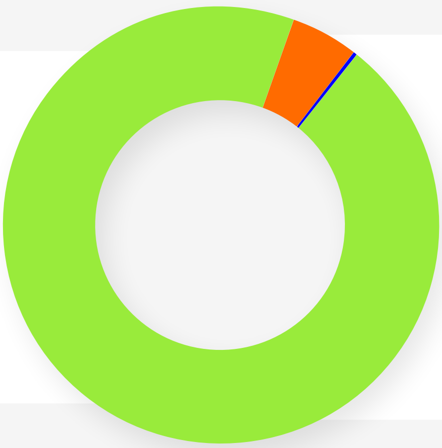


Access to the private section of the map is for those who own a sensor connected to the PlanetWatch network. Following authentication, one can zoom further in, up to a pixel size of 152.9 x 152.4 m. Visualization parameters can be toggled to show data from different sensor types.

4 Token Model 44

4.1 Generalities

PlanetWatch has issued a utility token on the Algorand blockchain in the form of an Algorand Standard Asset (ASA). The name of the token is PLANET. The maximum token supply is 4,500,000,000. This figure was chosen as it corresponds to the estimated age in years of the Earth. All tokens have been minted at the start of the project. A number of tokens corresponding to 5% of the maximum token supply was immediately allocated to PlanetWatch. The remainder of the tokens are being released over time and allocated to reward data streams. During the test phase of the project, 2 million Planets were allocated to reward data streams. As soon as this allocation will be exhausted, the project will be launched officially. Then the present token model shall apply and the total amount of tokens allocated to data rewards shall be 4,273,000,000. For technical reasons, a transition period will occur between the end of the test phase and the official launch. During the transition period, which will last at most 24 hours, no rewards will be allocated. The transition will occur in April 2021.



5% Initial PlanetWatch allocation **225,000,000**

0,04% Data rewards during test phase **2,000,000**

94,96% Data rewards following launch **4,273,000,000**

Maximum Token Supply
4,500,000,000

Following the launch, the token release schedule is set at 534,125,000 Planets/year. This rate will be halved every four years. The release schedule enforces the hard cap of 4.5 Billion Planets (see schedule below).

Token Release Schedule

Year	Tokens/year	Total tokens	Year	Tokens/year	Total tokens
1	534,125,000	534,125,000	31	4,172,852	4,252,135,742
2	534,125,000	1,068,250,000	32	4,172,852	4,256,308,594
3	534,125,000	1,602,375,000	33	2,086,426	4,258,395,020
4	534,125,000	2,136,500,000	34	2,086,426	4,260,481,445
5	267,062,500	2,403,562,500	35	2,086,426	4,262,567,871
6	267,062,500	2,670,625,000	36	2,086,426	4,264,654,297
7	267,062,500	2,937,687,500	37	1,043,213	4,265,697,510
8	267,062,500	3,204,750,000	38	1,043,213	4,266,740,723
9	133,531,250	3,338,281,250	39	1,043,213	4,267,783,936
10	133,531,250	3,471,812,500	40	1,043,213	4,268,827,148
11	133,531,250	3,605,343,750	41	521,606	4,269,348,755
12	133,531,250	3,738,875,000	42	521,606	4,269,870,361
13	66,765,625	3,805,640,625	43	521,606	4,270,391,968
14	66,765,625	3,872,406,250	44	521,606	4,270,913,574
15	66,765,625	3,939,171,875	45	260,803	4,271,174,377
16	66,765,625	4,005,937,500	46	260,803	4,271,435,181
17	33,382,813	4,039,320,313	47	260,803	4,271,695,984
18	33,382,813	4,072,703,125	48	260,803	4,271,956,787
19	33,382,813	4,106,085,938	49	130,402	4,272,087,189
20	33,382,813	4,139,468,750	50	130,402	4,272,217,590
21	16,691,406	4,156,160,156	51	130,402	4,272,347,992
22	16,691,406	4,172,851,563	52	130,402	4,272,478,394
23	16,691,406	4,189,542,969	53	65,201	4,272,543,594
24	16,691,406	4,206,234,375	54	65,201	4,272,608,795
25	8,345,703	4,214,580,078	55	65,201	4,272,673,996
26	8,345,703	4,222,925,781	56	65,201	4,272,739,197
27	8,345,703	4,231,271,484	57	32,600	4,272,771,797
28	8,345,703	4,239,617,188	58	32,600	4,272,804,398
29	4,172,852	4,243,790,039	59	32,600	4,272,836,998
30	4,172,852	4,247,962,89	60	32,600	4,272,869,598

Earth Credits

Planet tokens can be redeemed against products and services (e.g. air purifiers) by first converting them into Earth Credits. These are non-transferable credits with a fixed redemption value of 0.10 €. Earth Credits can either be obtained in exchange for Planets, or purchased directly on the PlanetWatch website. They are priced as follows:

- **0.10** € if paid in euros
- **0.09** € if obtained by redeeming Planets at the prevailing Planet/EUR market rate.

4.2 Data Reward Policy

General Principles

PlanetWatch is building a network of sensors and people who are keen to participate in a global effort to deliver more effective environmental monitoring. Out of this effort, the key deliverable is an extensive body of hyperlocal, near real-time air quality data. The dataset is built out of data streams sent by sensors connected to PlanetWatch. Planet rewards are then issued in return for valid data streams, based on the intrinsic value of each stream.

The value of a stream depends on data content and reliability.

For outdoor sensors, it also depends on the stream origination location and the availability of streams from comparable sensors nearby.

In order to assess the value of data streams according to the above criteria, we introduce a set of classification rules.

Sensor types

In order to cover all the Air Quality Monitoring use cases identified by PlanetWatch, we need different types of sensors. PlanetWatch-approved sensors are divided as follows:

- **Type 1**: Premium outdoor devices
- **Type 2**: Consumer-grade outdoor devices
- **Type 3**: Indoor devices
- **Type 4**: Wearable and special devices

For each sensor type, we set a default streaming frequency, which determines the maximum number of streams per day which can be rewarded:

Daily streams per sensor	Type 1	Type 2	Type 3	Type 4
Streaming time interval (minutes)	15	15	5	2
Daily streams	96	96	288	720

The number of actual data streams sent to our platform may be higher or lower than the default value. If higher, the default value acts as a cap on the number of streams which can be rewarded.

The data reward pool is split into sub-pools for each sensor type as shown in the table below. We also show, based on a 534,125,000 Planets total reward pool in year 1, the projected Planet annual and daily reward budget breakdown:

	Type 1	Type 2	Type 3	Type 4
Reward breakdown per sensor type	40%	20%	20%	20%
Year 1 reward budget	213,650,000	106,825,000	106,825,000	106,825,000
Daily reward budget	585,342	292,671	292,671	292,671

Pixels

We overlay upon the Earth a grid of rectangular pixels. Pixel size is 0.72 km2 (0.278 sq. mi.). Pixels are classified according to a 2-tier system:

- **Tier 1**: Areas with high population density
- **Tier 2**: Rest of the world

The classification is based on worldwide population density data made available by the European Commission under its Global Human Settlement Layer Tier 1 pixels are those where the population density is estimated at 2,000 inhabitants per square kilometer or more (dataset here).

The reward pool for outdoor sensors (Type 1 and 2) is further split across pixel tiers (70% for Tier 1 and 30% for Tier 2). We show below the projected Planet daily reward budget breakdown per Tier in year 1.

<table>
<tr><th></th><th>Type 1</th><th>Type 2</th><th>Type 3</th><th>Type 4</th></tr>
<tr><td>Daily reward budget Tier 1</td><td>409,740</td><td>204,870</td><td rowspan="2">292,671</td><td rowspan="2">292,671</td></tr>
<tr><td>Daily reward budget Tier 2</td><td>175,603</td><td>87,801</td></tr>
</table>

The pixel structure is instrumental to implementing a reward policy driven by our outdoor monitoring goal: equip as many pixels as possible worldwide with one Type 1 sensor and five Type 2 sensors per pixel. This mix of sensors strikes an optimal balance between data density, quality and deployment costs.

In order to incentivize sensor deployment in compliance of the above guidelines and to reward steady sensor performance, we establish some additional definitions and rules.

PlanetWatch
Your planet needs you

Sensor Reputation System

Each sensor is awarded a 100-point setup bonus the first time it is connected to the PlanetWatch network. The performance of each sensor in the network is assessed daily and a score is assigned as follows:

- If the sensor has delivered more than 50% of the expected daily data streams (e.g. more than 48 streams for Type 1 sensors), it is deemed *qualifying* and it earns one point,
- If the sensor has failed to deliver more than 50% of the expected daily data streams, it is *not qualifying* and loses one point.

For Type 1 and Type 2 sensors, additional rules apply.

- In each pixel, the Type 1 sensor which gets installed first and streams data for at least 30 qualifying days from that pixel is entitled to a 100-point Pioneer bonus. Likewise, the first five Type 2 sensors installed in each pixel earn the Pioneer bonus. These bonuses can only be earned once in a sensor's lifetime, even if the sensor changes location.
- For a given sensor, a Local Reputation Score applies in each pixel. If a sensor is moved to a new location in another pixel, its Local Reputation Score in this new location starts at 0, regardless of its score in the previous pixel(s). Over time, it will earn reputation points in the new pixel (if it qualifies) and lose points in the old one(s).

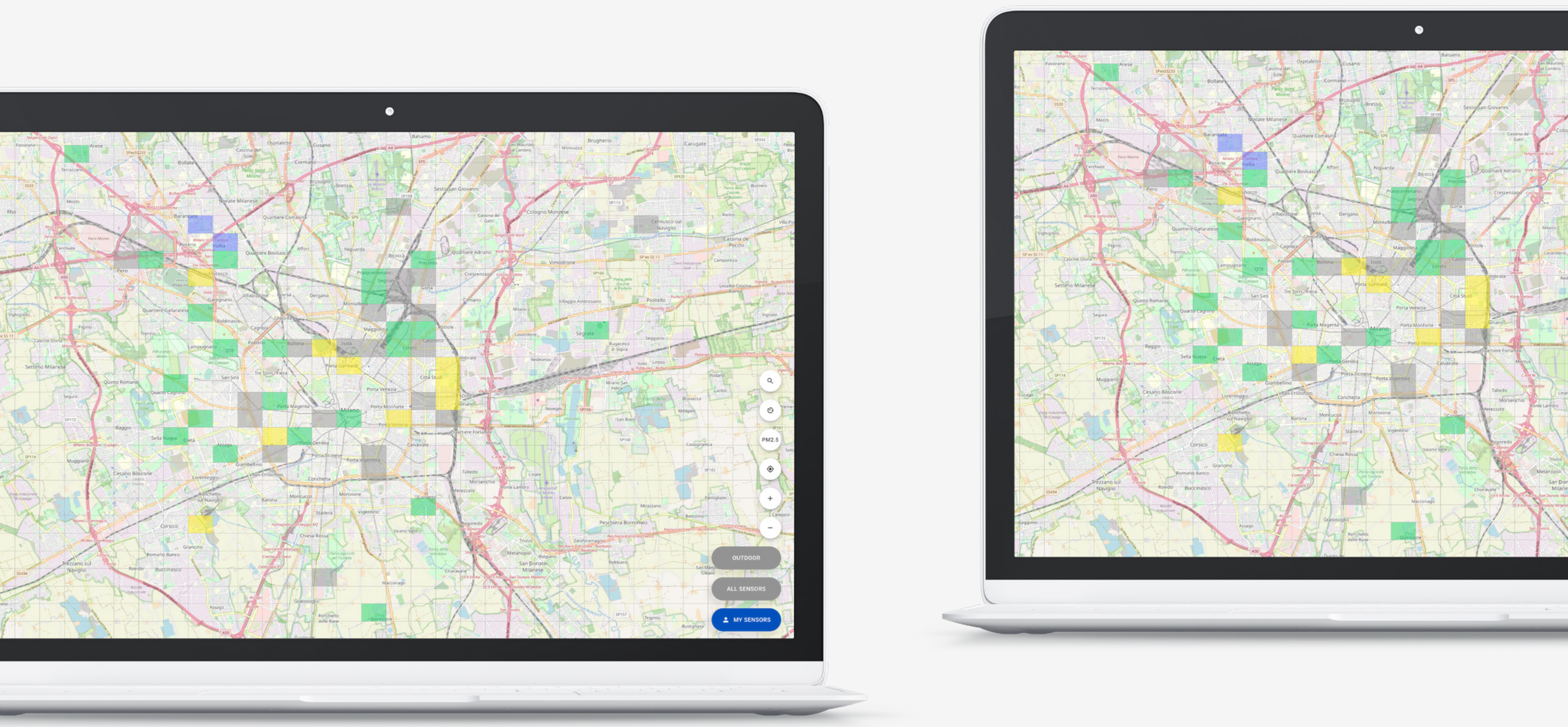
The Global Reputation Score of a sensor, summed across all relevant pixels, is only relevant in the context of governance, since voting rights are linked to a sensor's aggregate reputation score across all pixels.

Lead vs Backup Sensors (Type 1 and Type 2 only)

In each pixel, the Type 1 sensor with the highest Local Reputation Score enjoys the status of lead Type 1 sensor. Likewise, the five Type 2 sensors with the highest Local Reputation Score are the lead Type 2 sensors. Other Type 1 and Type 2 sensors in that pixel (if any) are regarded as backup sensors.

Lead sensors enjoy higher rewards, as in each pixel and for each sensor type, rewards are split as follows: 90% to the lead sensor(s) and 10% to the backup sensor(s). Clearly if there are no backup sensors, 100% of the reward pool goes to the lead ones. In each pixel, sensor scores are updated daily so lead status is reassessed every day.

If two or more sensors of the same type have the same Local Reputation Score in a given pixel, priority to get lead status is attributed to the sensor which first streamed data in that pixel.



Reward Rates

We have set a maximal reward rate per stream. For Type 1 and Type 2 sensors, the rate depends on sensor location via the pixel tier system and also depends on whether or not the sensor has lead status and backup sensors are present. (see table below).

Max Reward per Stream		Type 1	Type 2	Type 3	Type 4
Tier 1 pixel	Lead Sensor	1.7360	0.2000	0.2010	0.0400
	Backup Sensor	0.1736	0.0200		
Tier 2 pixel	Lead Sensor	0.8680	0.1340		
	Backup Sensor	0.0868	0.0134		

All rewards earned by sensors are split as follows:

- **Sensor owner 80%**

  PlanetWatch 20%.

- PlanetWatch provides a tool allowing the sensor owner to split rewards with a third party (e.g. a friend hosting the sensor).

Keeping into account all the rules and definitions set forth above, we can provide estimates for the maximum daily rewards per sensor based on sensor type and pixel tier (whenever applicable):

Max Daily Reward		Type 1	Type 2	Type 3	Type 4
Tier 1 pixel	Lead Sensor	166.65600	19.20000	57.88800	28.80000
	Backup Sensor	16.66560	1.92000		
Tier 2 pixel	Lead Sensor	83.32800	12.86400		
	Backup Sensor	8.33280	1.28640		
Max Owner (80%) Daily Earnings		**Type 1**	**Type 2**	**Type 3**	**Type 4**
Tier 1 pixel	Lead Sensor	133.32480	15.36000	46.31040	23.04000
	Backup Sensor	13.33248	1.53600		
Tier 2 pixel	Lead Sensor	66.66240	10.29120		
	Backup Sensor	6.66624	1.02912		

Reward Pool Dynamics

As mentioned above, the maximum daily reward per sensor is capped. On the other hand, the number of tokens allocated to the daily data reward pool is 1/365 of the annual token release schedule, split according to sensor types and pixel tiers when applicable.
As a consequence, at some point in time the number of sensors in the network will get large enough to "saturate" the daily rewards budget.

For each sensor type and pixel tier, the saturation point can be defined as the maximum number of (lead) sensors that are able to receive the maximum daily reward allocation without going over the protocol's reward pool budget. When the number of (lead) sensors exceeds the saturation point, daily rewards per sensor start decreasing. The figures in the table below are based on 534,125,000 Planets in the annual reward pool.

<table>
<tr><th>Saturation points</th><th>Type 1</th><th>Type 2</th><th>Type 3</th><th>Type 4</th></tr>
<tr><td>Tier 1 pixel</td><td>2,459</td><td>10,670</td><td rowspan="2">5,055</td><td rowspan="2">10,162</td></tr>
<tr><td>Tier 2 pixel</td><td>2,107</td><td>6,825</td></tr>
</table>

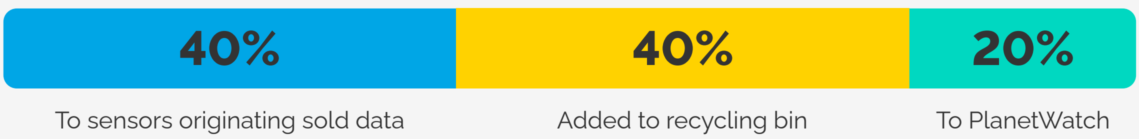
Conversely, as long as the number of sensors is below the saturation point, since rewards per sensor are capped, a fraction of tokens from the daily budget will not be used. Unused tokens will fill a "recycling bin" budget. In the early stages of the project, we expect that a large fraction of the rewards budget will end up in the recycling bin.

Additional contributions to the Reward Pool

Over time, the combined effect of a strong increase in the number of sensors and the halving events occurring every four years would make it difficult to reward data streams with a meaningful number of tokens. To mitigate this, two additional contributions to the reward pool are envisaged:

1. When a saturation point is attained, tokens in the recycling bin are added to the reward pool's scheduled daily token issuance, up to the extent that is needed to restore maximum daily rewards for each sensor (if a sufficient number of tokens is available in the recycling bin).
2. Whenever Earth Credits are used to get access to air quality data, revenues are converted back into Planets and allocated as follows:

Revenues From Data Access Sales



These additional "emissions" help fill the recycling bin while enforcing a strict maximum Planet supply.

5.1 Core Team

Claudio Parrinello Ph.D.
CEO & Founder

Claudio is PlanetWatch's CEO. He obtained his Ph.D. in Theoretical Physics from Scuola Normale Superiore in Pisa. He leads the company and develops its strategy while following directly high-profile partnerships and investor relations. A former research physicist, international consultant and manager @CERN, Geneva, Claudio is an Italian national who has lived and worked in the USA, the UK, France and Switzerland. In 2012 he cofounded a French startup in sensors and robotics. He has been active in the blockchain ecosystem since 2016.

Ivan D'Ettorre
CTO & Founder

Ivan is PlanetWatch's CTO. He is responsible for maintaining the strategic focus of the project and turning a concept into reality with the best available technologies. He holds a Master's Degree in Telecommunications Engineering from the Turin Polytechnic. He held several managerial positions in multinational companies with special assignments related to their international expansion in Brazil and he has worked as a consultant at ERICSSON, HUAWEI, LG, WIND / TRE. He founded several startups in the technology, gaming and communications domains. In 2016 he got interested in blockchain technologies, focusing on technology and innovation aspects. He also achieved outstanding results as a Ju-Jitsu athlete.

Davide Caiulo Ph.D.
Data Scientist

Davide obtained his PhD in particle physics at the Université Claude Bernard Lyon 1 in 2017. He spent 7 years in academic research, working on different subjects: Higgs boson search, neutrino physics and new physics searches. He focused his activity on data simulation and analysis, electronics R&D and software development for data acquisition and analysis. At PlanetWatch Davide occupies the position of data scientist, and is in charge of R&D of devices for environmental measurements, data analysis, and developments of algorithms using AI.

Dario Di Lelio
Mea Business Develop.

Dario is exploring business opportunities for PlanetWatch in the EMEA region. He is a business development manager and management consultant with over 15 years of experience in Technology and Digital Transformation projects. Dario has led and implemented projects in Europe, Middle East and Africa (EMEA) for corporations such as Oracle and Booz Allen Hamilton. He has a master's degree in software engineering from the University of Rome "La Sapienza, with areas of expertise including cloud-based solutions, cyber security, blockchain, AI and machine learning.

Roberto Falzone
Mobile Developer

Roberto holds a Master's Degree in Networks and Services Innovation in the ICT sector from the Turin Polytechnic. He has held various positions as a technical developer and team leader, creating dozens of mobile apps for clients such as Mediaset, Sky Italia, Finelco, Eataly and other multinational or national companies. In 2017 he entered the blockchain world, focusing initially on Ethereum smart contracts and then switching to EOS. In PlanetWatch Roberto is responsible for the APIs communicating with the web and mobile front end. He is also the lead person for the design, creation and integration of mobile Android & iOS Apps.

Ernesto Fucci
Project Manager

Ernesto is PlanetWatch Italy's Project Manager. He is responsible for creating new business opportunities and developing new partnerships with local communities. He holds a BA in International Relations and a Master in Diplomatic Studies. Ernesto is an Italian citizen who has lived and worked extensively in Germany, France, Switzerland and Australia. After a short career in diplomacy, he's been working as a freelancer in various branches, with his main focus on tourism and collaborating with internationally renowned companies around the world.

Maria Giovanna Fucci
Administration

Maria Giovanna is the head of the administrative and accounting department of Planetwatch. She graduated in Law in 2008 with a thesis in Criminal Procedure Law. She worked in insurance companies and notary offices, before dealing with the administration of some technological startups. Her great passions? Art history, travel and Italian and French pastry.

Marina Markezic
Business Developer

Marina has worked in the blockchain industry since 2017 as a professional legal and business advisor, starting out in one of the first European blockchain accelerators as a lead adviser. She is currently mentoring and advising startups, specializing in blockchain governance and token regulation. Selected as one of the 100 top women in Fintech by LATTICE80 in collaboration with Miss Kaya, she is eager to contribute to the changes innovative business models will bring to the society. Her understanding and involvement in the alternative finance prior to the crypto era, especially the crowdfunding process, helps her to address strategic business question in the legal uncertainty following the crypto space. Marina is an experienced startup mentor.

Gabriella Motta Ph.D.
Sensor and Indoor
Air Quality Specialist

Gabriella is a Sensor and Air Quality Specialist, with experience in air quality and environmental sustainability. Certified RESET professional, she oversees the design of indoor air quality monitoring solutions and participates in the design of PlanetWatch secure air quality monitoring devices. She holds a Master Degree in Telecommunication Engineering, obtained at the Politecnico of Turin in 1996 and the PhD in Electronic Engineering, Photonics specialization, at the Politecnico of Turin in 2000. She has professional experience both as an employee and as a freelance.

Rosario Nocera
Art Director

Art director and Graphic Designer Rosario manages PlanetWatch's branding and design. In 2012 he won the first "International Reggae Poster" contest, which gave him the opportunity to exhibit around the world, including at the OAS (Organization of American States) in Washington DC. in 2016 his poster became the symbolic image of the 23rd edition of the Sunspash Rototom. In 2012 he also exhibited two posters on the theme "To be human" at the Dansk Plakatmuseum in Aarhus, Denmark. In 2013 Moleskine published Rosario's poster against the mafia in the book "Good 50x70 Anthology, 5 years of social communication told through 930 posters". In 2015 and 2016 Desktopography chose two of his works as downloadable wallpaper.

5 **Team**

Valerio Pescatore
Web & CEO Specialist

Valerio is a web marketing and communication expert, He founded his first digital agency in 2010. He obtained various certifications, specializing in SEO and Google Ads. In PlanetWatch Valerio is in charge of SEO and website design and maintenance

Leonardo Placanica
Web & Blockchain Develop.

Leonardo is studying Computer Science at the University of Milan while working as a freelance full stack developer. He started his career at 17 with a stage for a local IT company focusing on web and mobile development. In PlanetWatch Leonardo is responsible for some web products with focus on front end and back end projects.

Dario Salerno
IT Engineer

Dario is a IT Network and Infrastructures specialist, with an electronic engineering background. He spent his career deploying ISPs Networks and services, Cloud infrastructures, hardware/software product development as technology consultant in Europe, Brazil, Angola, Latin America and USA. He also has experience in Wireless Community Networks contributing to the Ninux.org project, implementing decentralized network services and designing infrastructure architectures. In PlanetWatch is responsible for the Cloud Infrastructure, Database and data acquisition platform. He is also in charge of the PlanetWatch sensor hardware development.

5.2 Advisors

Federico Demicheli
Algorand Mentor

Federico is an early employee at Algorand, where he focuses on business development. He works with innovative startups, enterprises and governments applying technology to remove friction from existing processes and creating new economic models. He has a background in investment banking, with an expertise in structured finance and securitization.

Pietro Grassano
Business Advisor

Pietro is Business Solutions Director Europe at Algorand, where he takes care of business initiatives leveraging the possibilities of blockchain technology.

Pietro has more than 20 years of experience in the asset management sector. At J.P. Morgan Asset Management from 2002 until 2019, he has been Country Head for France since 2014; beforehand he had been Head of Sales for Italy and responsible for business in Greece. He was previously a consultant in the financial pole of Andersen Consulting. Pietro started his career in Brussels, in a commodities trading company. He is a proud supporter of the Torino Calcio football team.

Antonio Marincolo
Legal Advisor

Antonio is PlanetWatch's legal advisor. He has a degree in Law from the University of Perugia, with a thesis on Cross-border Mergers in the credit sector and also holds a Master as "Business Lawyer" from the Business School of Il Sole 24 Ore. He is also an Adjunct Professor of "Administrative Law" at the School of Specialization for Legal Professions - University of Perugia. He has authored papers in administrative and tax law. He has been working in Law Firms specializing in Corporate, Administrative and Tax Law.

Paolo Spagnolo Ph.D.
Scientific Advisor
& Founder

Paolo is our Scientific Advisor. He is a Particle Physicist at INFN, member of the Scientific Advisory and Financial Board of the accelerators division. After his PhD, he worked at the Imperial College of London and at CERN in Geneva for the Large Hadron Collider Experiment called CMS. He is one of the physicists involved in the Higgs Boson discovery. He also had experience in strategic business consulting with Bain & Co in Milano. Paolo is now involved in experiment searching for Dark Matter though he initiated an R&D on microwaves single photon sensors, based on superconducting ultra-cold nano-wires, in collaboration with the NEST Labs in Pisa.

PlanetWatch®

Your planet needs you

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