



GAIOTA

IoT data for the world

Project Documentation

August 2018

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INTRODUCTION

According to research, over 30 billion devices will be connected to the Internet to provide massive amount of IoT data, accounting for 10 percent of all the data registered globally in 2020. In recent years, IoT is becoming a crucial enabler for global development solutions and currently addressing Sustainable Development Goals (SDGs). However, the subject of “where or how can I find specific sensor data in a certain area” still has room

for improvements. Inspired by World Challenge Finland 2018, July Babies team is working on galoTa platform to answer such question.

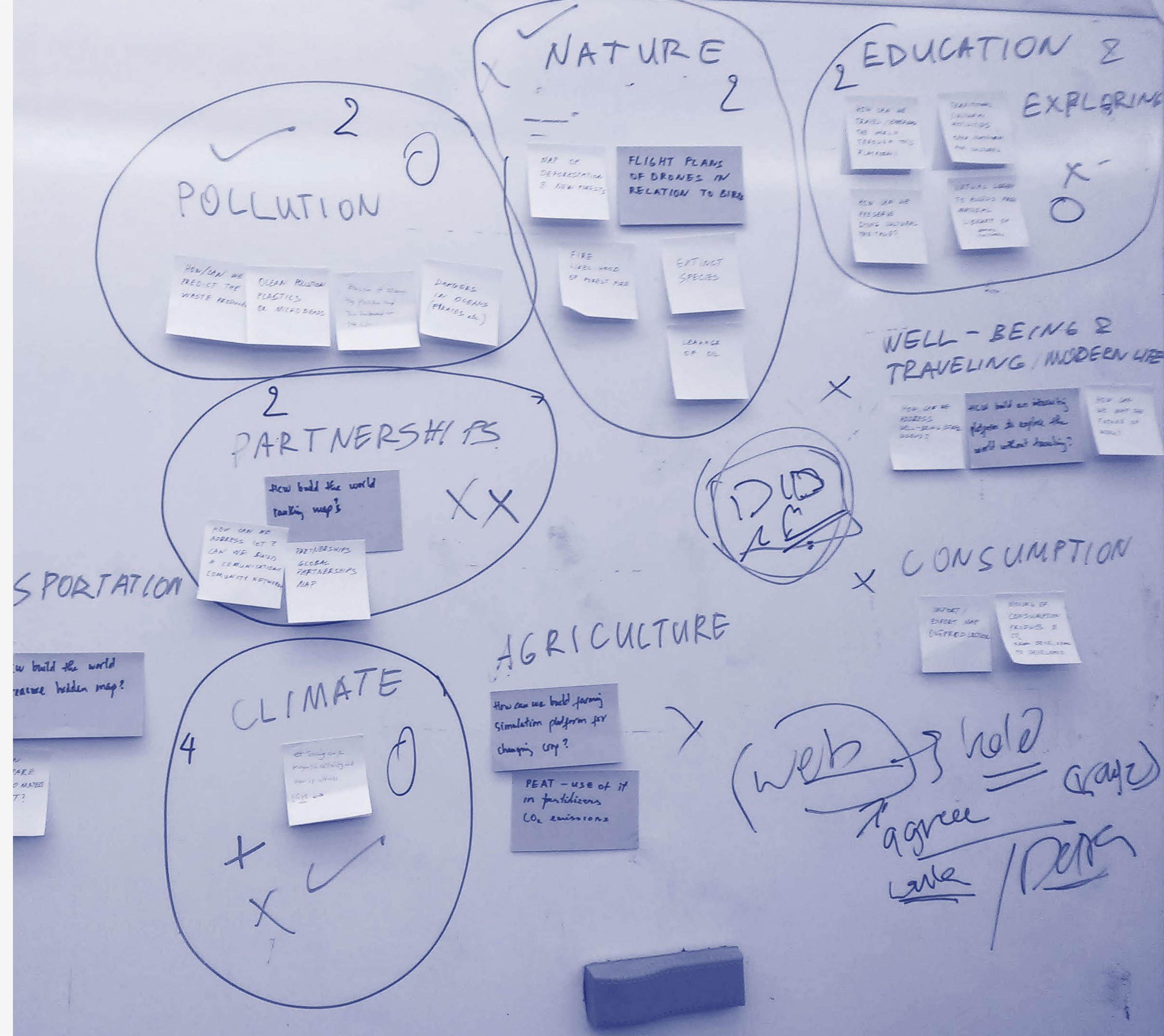
GaloTa - the word takes its inspiration from Gaia, a mythical name for Earth Mother, into which we add the acronym IoT, which stands for Internet-of-Things, as it is the subject of our interest. Put it simply, we aim to incorporate the WorldWind platform

into our search engine which allows users search for open IoT data. Our story started from July 2018 when we all gathered at “Chill and Grill” event hosted by Ultrahack in Otaniemi. Since then we have fallen in love with the multidisciplinary team setting that applied design method approach to handle the challenge within a month.

PROJECT APPROACH & METHODOLOGY

We came together as a multidisciplinary team with open minded attitude to start working on the challenge from scratch. Therefore we decided to apply Design Thinking approach and Design process to frame our work within one month from ideation to delivery. There are four main stages that we've gone through to build galoTa: discover, define, develop and deliver.

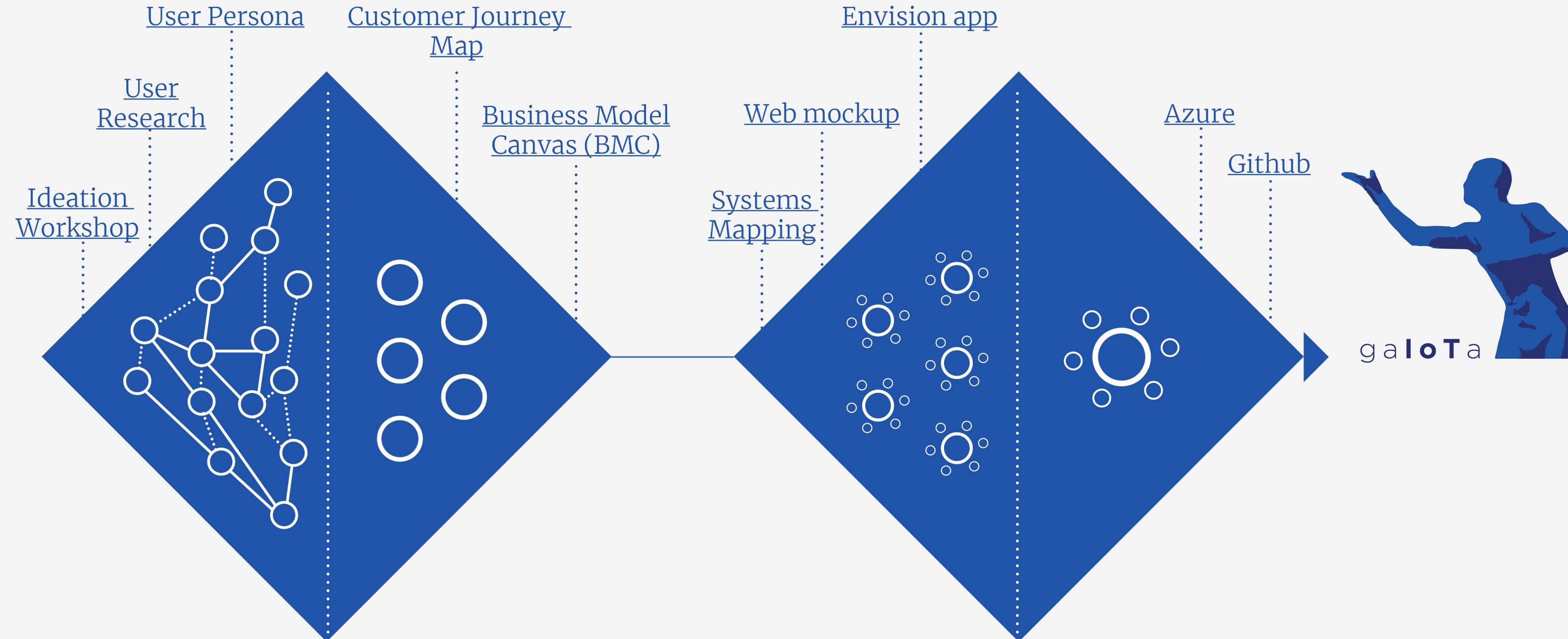
Many different tools have been applied throughout the process that our project approach figure illustrates as following.



Project Approach

design process

Tools



Stage

Description

DISCOVER

Ideation workshop has been conducted to identify our team's topics of interest. User research and user persona's have been developed based on results to gain insights on the user needs.

DEFINE

Discover phase results allowed to build a customer journey map. Different versions of BMC have been refined including future revenue model.

DEVELOP

Systems mapping was used to design the working process for Gaiota. Then, different versions of Website mockup were developed by the multidisciplinary team. We use Envision app to test the Website & App customer experience.

DELIVER

Final website and Gaiota application would be released on August 3rd. Source code would be published as the same time via Github.

Our workshops within a month

1

Ideation
workshop

2

Idea Selection
& Concept
Development

3

Prototyping

4

Prototyping

5

Testing

6

Refining

7

Final &
submission

GAIOTA PLATFORM DESCRIPTION

GaloTa Platform

galoTa is a transparent data web app which enables people to find available open IoT data. It enables researchers, businesses, and anyone who are interested in data science and IoT to make use of the massive useful available IoT data around the world for innovations to spin-off. It functions via optimized search engine for different open API data sources with highly interactive 3D/4D visualization supported by WorldWind virtual globe platform.

On GaloTa platform users are able

to find IoT devices located on certain geographical locations of interest, access their measurements data in real time in order to get the latest/updated data possible, and view historical reading of sensors attached to the devices.

Difference between Satellite & IoT data

- Open data are abundant, but many are not easy to find, in particularly IoT data.
- Satellite data is useful, but IoT devices are “closer to the ground” and

able to measure certain properties which satellites alone are not able/difficult to.

- Typical search engine can discover satellite data providers easily, but IoT data aren’t as easy with search engine
- Open satellite data are usually properly archived and can be obtained rather straightforwardly in bulk. In contrast, many IoT data can only be fetched with queries through their API. Bulk downloading is often not possible and extensive historical data is not made available

GAIOTA PLATFORM DESCRIPTION

Features of galoTa app

- Gather public/open data through online querying of a number of different IoT data providers and open IoT projects, including open IoT smart city projects (the list of IoT data sources is growing). The current IoT providers/projects are listed in the "Data Providers/sources" section.
- The app gathers different types of IoT devices, each equipped with different types of sensors (Air quality is one and most typical, but there are others!)

Users can select individual IoT devices and will be presented with a short summary of the IoT device.

• Users can get historical sensor readings generated by individual sensors attached to the selected IoT device. Sensor readings are presented either in 2D time series chart, or 3D and 4D time series visualizations where sensor readings are displayed on the World Wind according to the each reading timestamps and animated. 2D chart can be downloaded/printed

as image, while raw historical readings can be downloaded as (CSV) files for further data analysis.

- Customizable search and fetching of historical IoT sensor readings taken on certain time-frame, adjustable time-range between each measurements, and type of sensors to see.
- Users can filter discovered IoT devices based on their geographical locations.

- The app mainly relies on real time query to the IoT providers to ensure that the latest measurements can be obtained when the app is used.

GAIOTA USERS

GaloTa focuses its services on three main customer segments:

Researchers

Academia, data analysts, research lab managers or IT engineers who want to explore real time and historical data from available sensors around the world to gain more insights for new findings and innovation in their fields of expertise.

Businesses

Entrepreneurs, corporate Managers, SME owners & other types of business developers who want to improve, innovate or even create new initiatives for their businesses based on the insights gathering from IoT data could benefit from galoTa platform. In addition, Data driven businesses could also approach wider range of data available, access and connect with data providers for more business opportunities to come.

Explorers

Explorers are the users driven by curiosity. Their core motivation to use galoTa is gaining new experiences, learning about different places and cultures and implementing those learnings into something bigger. galoTa enables to do this in a more sustainable way than conventional travelling reducing the carbon footprint. Users like travellers, innovators, educators and general public can be identified as explorers.

GAIOTA FOR RESEARCHERS

Mr John - Postdoc Researcher at AB Environment Institute

Xtensio



"A quotation that captures this user's personality."

Age: 32

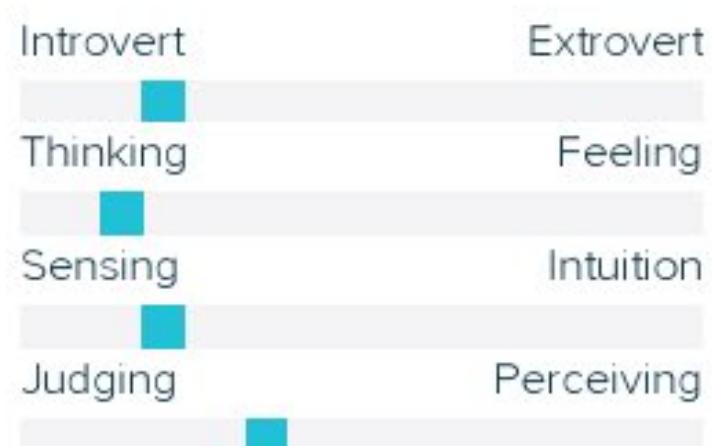
Work: Researcher

Family: Single

Location: Atlanta, USA

Character: NITP

Personality



Introvert

Detail-oriented

Focus

Independent

Goals

- Progress in his professional work
- Provide accurate & high quality research work
- Find out new insights or invent new things

Frustrations

- John finds it's hard to collect environment data from areas outside US.
- John wants to find the open data from similar regions as the one he is doing research for comparison but it's not easy

Bio

As a researcher, working on real life data and generating insights for development are the main roles for John at work. He keeps looking for data sets and tools that enable him to deliver better research results. Nowadays, there are many IoT open data that John can find from the internet. However, he has to approach different sources and gather the data manually from different sites for analysis. It takes a lot of time and he becomes even more frustrated with the massive IoT data available.

Motivation

Incentive

Fear

Growth

Power

Social

Brands & Influencers



Preferred Channels

Traditional Ads

Online & Social Media

Referral

Guerrilla Efforts & PR

GAIOTA FOR BUSINESSES

Mr. Lee - Kimberly Clark Business Development Manager

Xtensio



*Data-driven Business Manager
whose decision making based on
data analysis & critical thinking*

Age: 32

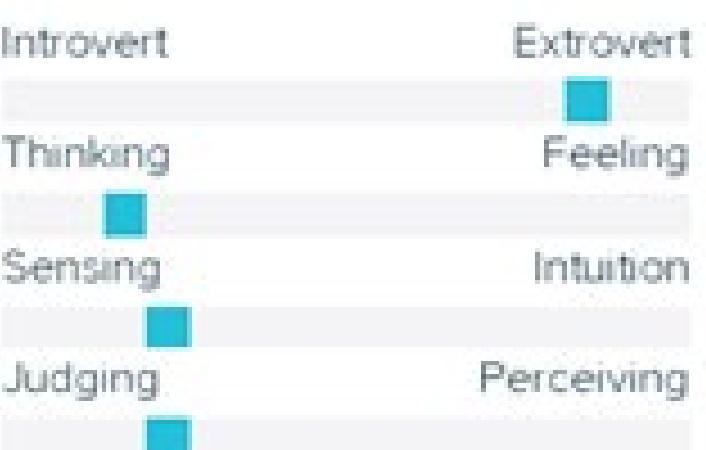
Work: Sales Manager

Family: Married, 1 kid

Location: Indonesia, Jakarta

Character: Open-minded

Personality



Opportunity alert
Innovative
Socialize
Critical thinking
Drinker

Goals

- Deliver business objective
- Develop personal skills
- Get promotion at work

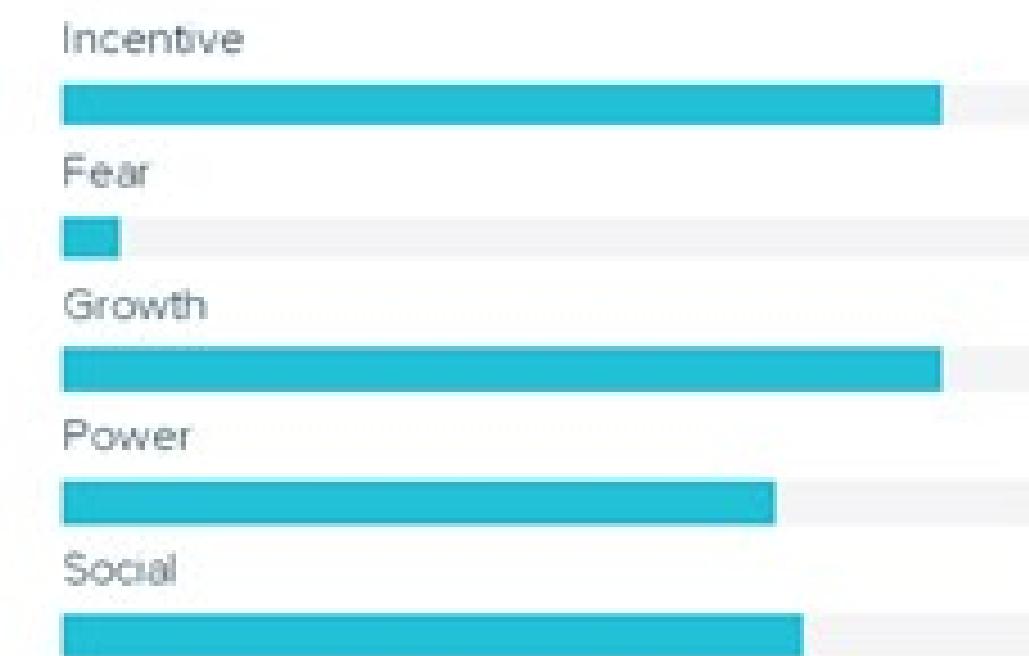
Frustrations

- High pressure in traditional business competition
- Threats from new innovative comers
- Lack of data or inaccurate data related to business segments

Bio

Lee has 10 years experience in FMCG industry. He worked for Coca-Cola before took over the Sales Manager position at Kimberly Clark, Indonesia. Opportunities recognition is always his main focus at work thus he can find more ways to improve the company business. He is open minded to new technology that enable businesses to optimize cost and maximize sales revenue. He had experience in leading change within the company when introducing GPS tracking technology, data analytics tools. Now he is very curious about IOT and wishes to know if it could help the company for business development.

Motivation



Brands & Influencers



Preferred Channels



GAIOTA FOR EXPLORERS

Xtensio

Gloria- travelling enthusiast



"Travelling brought me experiences and friends for life"

Age: 25

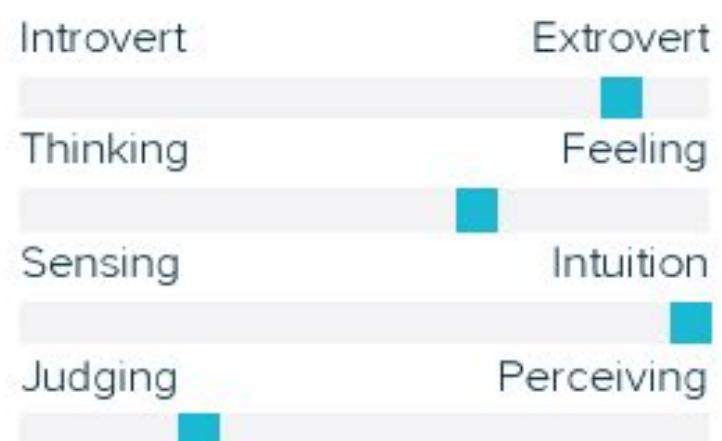
Work: Geography Student

Family: In partnership

Location: Berlin

Character: Social

Personality



Curious
Active
Open-minded
Practical

Goals

- Explore the world and learn other cultures
- Graduate and start teaching Geography
- Improve cooking skills

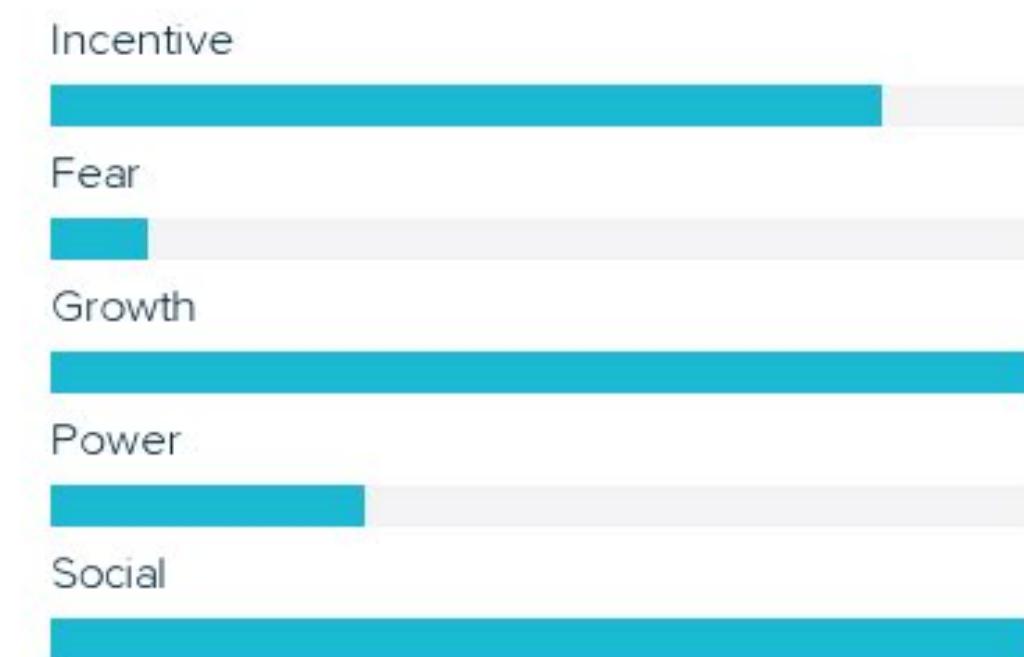
Frustrations

- Loves travelling, however is concerned about high carbon footprint she leaves with every trip
- Low budget limits the travelling opportunities
- Photos and videos does not provide entertaining and educational experience as travelling

Bio

Gloria is a travel enthusiast studying Geography. She wants to make most of her life and experience new places. She already has been to 14 different countries and wants to expand this list. However, she has increasing concerns on sustainability and the GHG emissions she is producing. Feeling responsibility on her actions she is looking for alternative ways to experience the world like travel apps, movies, photographs, literature... However, that becomes very challenging to gain a complete experience she is seeking for.

Motivation



Preferred Channels



THE GAIOTA APP ARCHITECTURE AND CORE COMPONENTS

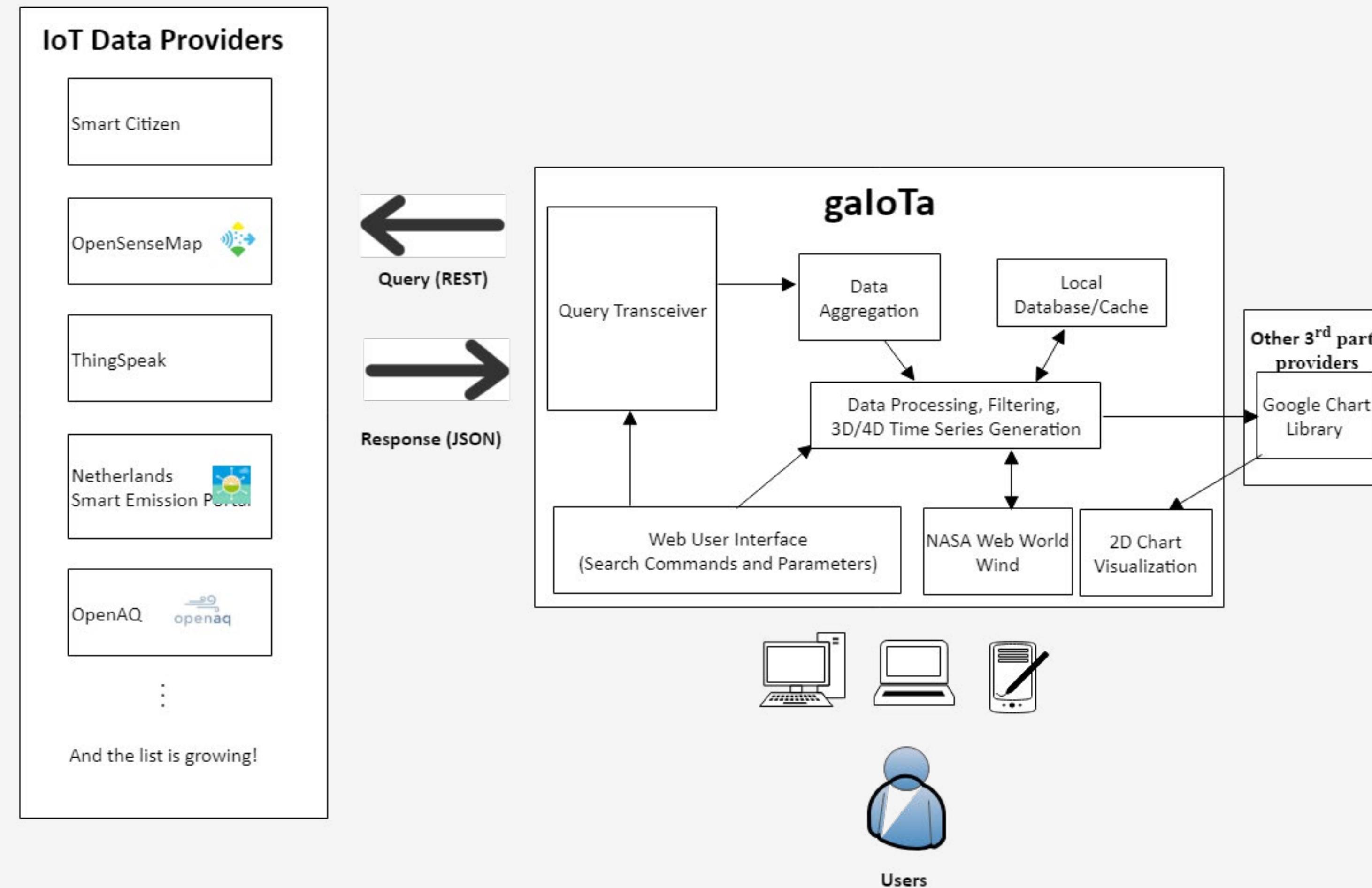


Figure 1. The Diagram of galoTa app

The app relies on real-time queries in getting the IoT data. Queries are made through REST protocol, as per the requirement of the providers' API, and the providers transmit the response back to the app, with the results in structured in JSON format. Upon the completion of the query processes (when the IoT data providers have sent their results), the app aggregates the query results and caches them internally. The "Data Processing, Filter, and 3D/4D Time Series Generation" is responsible for taking care of the core functionalities of the app, from

simple filtering, data processing, and generating the necessary visualization and time series (2D and 3D/4D). The app utilizes the Google Chart library to generate the 2D chart, which needs to be accessed and loaded remotely due to the terms and conditions of the use of Google Chart library. The app can technically be accessed with different computing devices including mobile/ smartphones, however the current version of the app is not currently optimized for mobile devices.

GETTING STARTED & USER MANUAL

App layout

- Go to the website to open the app.
- When the app page is initially opened, the app will have the following layout as seen in *Figure 2*.
- When app page is initially opened, the app automatically initiates real time query to a number of IoT providers.

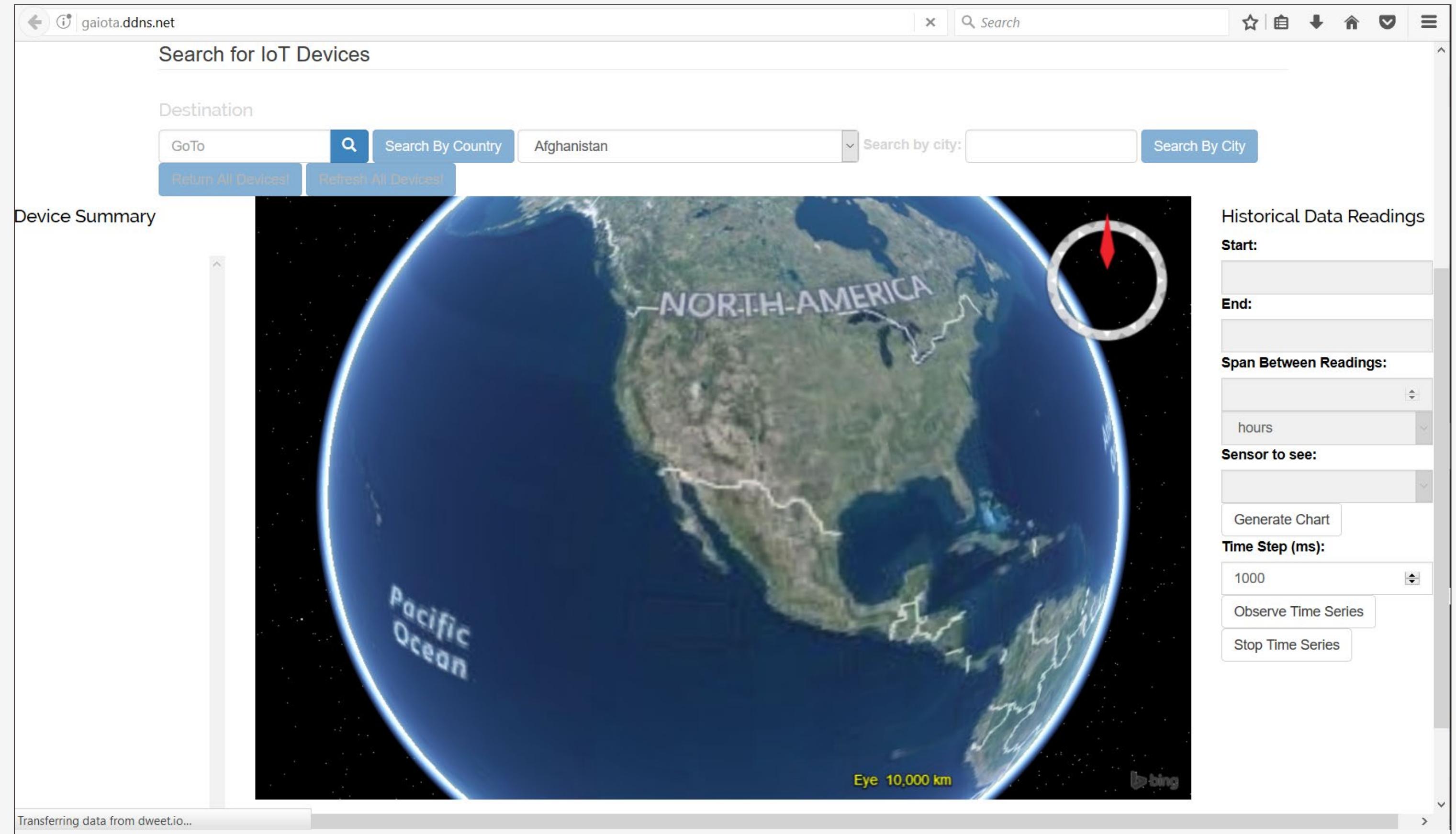


Figure 2. Overall layout of the GaloTa application

GETTING STARTED & USER MANUAL

Opening the platform

- The query will return a list of IoT devices which have made their data open for public. The response from the query also have annotated geolocation data of each IoT devices in the list. These geolocation data are necessary for their location pinpointing on the World Wind platform.
- Once the query process is completed, the discovered IoT devices are pinpointed on the World Wind globe. (See *Figure 3*).

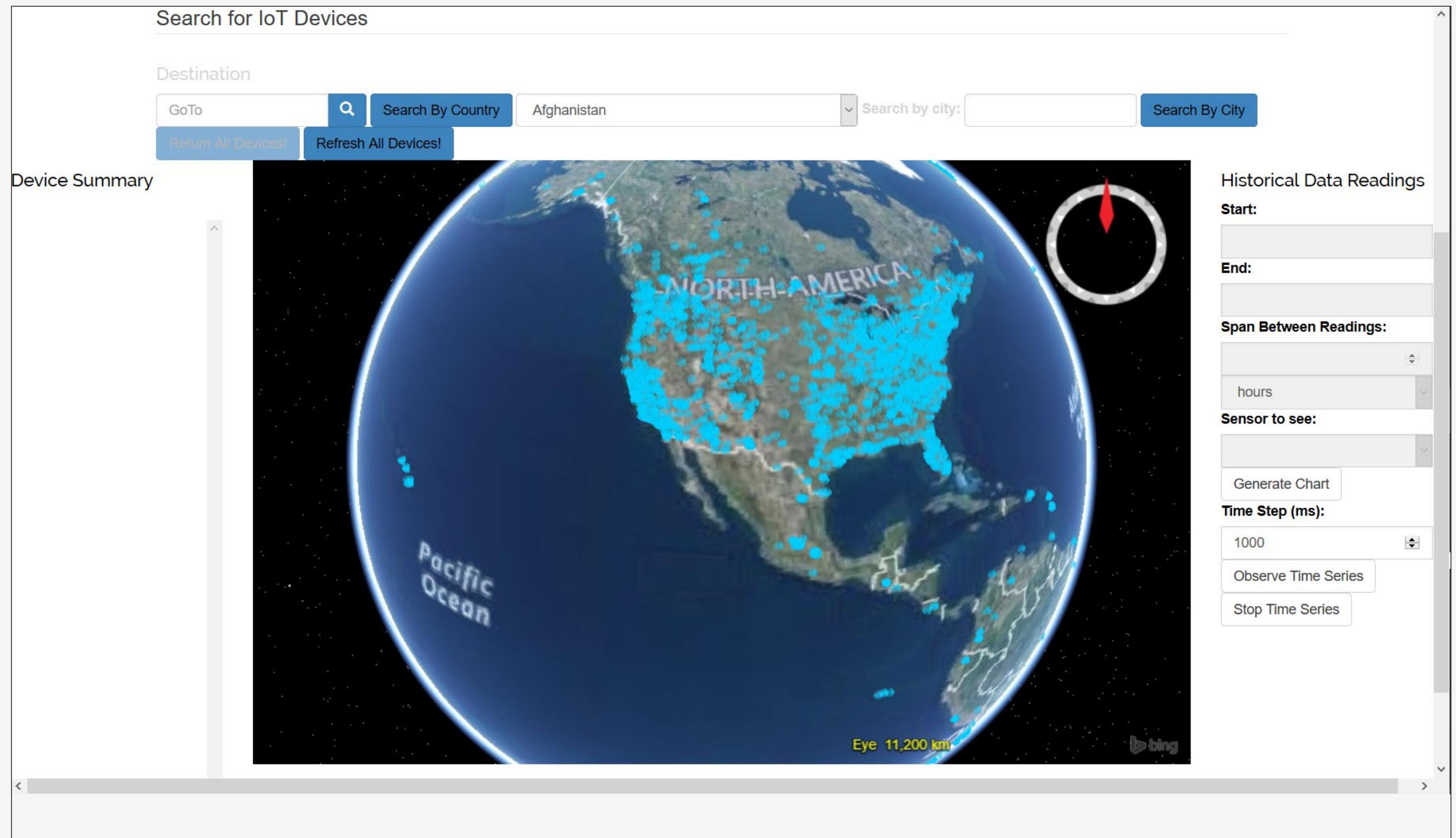


Figure 3. Discovered IoT devices shown on the World Wind globe

GETTING STARTED & USER MANUAL

App functions

- From here on, the users can decide how to proceed. For example, they may scroll the globe to see whether there are discovered IoT devices located in certain geographical regions. They can use the Destination search field and type in the location that they want to use and click the blue magnifying icon. The galoTa app will utilize built-in World Wind reverse geocoding function and then the globe will move to a particular geographical location according to the result of the reverse-geocoding function (see Figure 4).

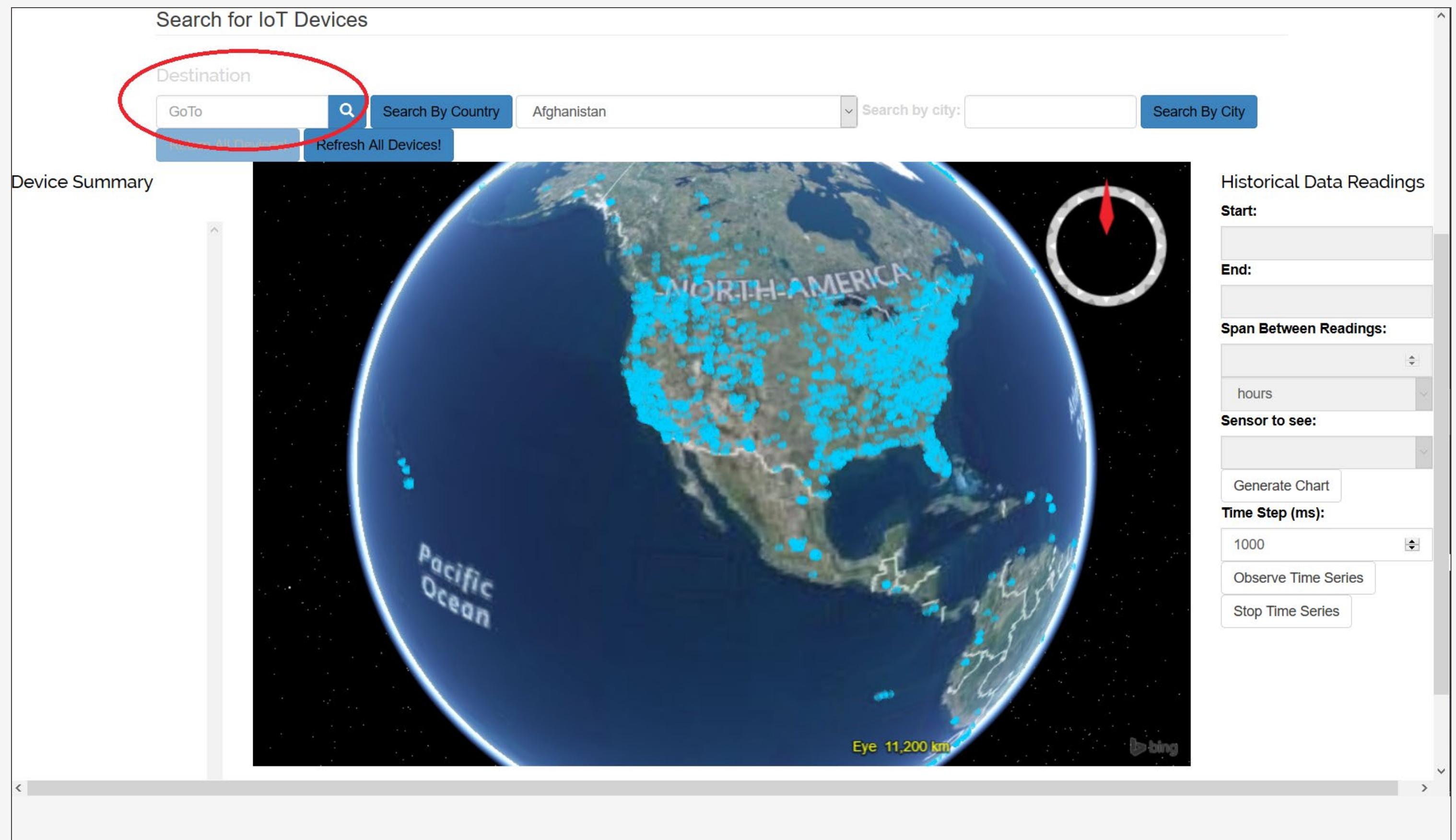


Figure 4. The Destination search field (in red circle)

GETTING STARTED & USER MANUAL

Filtering IoT devices & search by country

- Users can also filter IoT devices shown on the World Wind globe by their geographical locations. The search function of galoTa allows for filtering based on the country and city where the IoT devices are located. A dropdown menu with a list of countries is provided which users can select to see IoT devices that are located on the selected country. When the button “Select By Country” is clicked, a filtering function is applied and the globe will display IoT devices located on the selected country. Similar

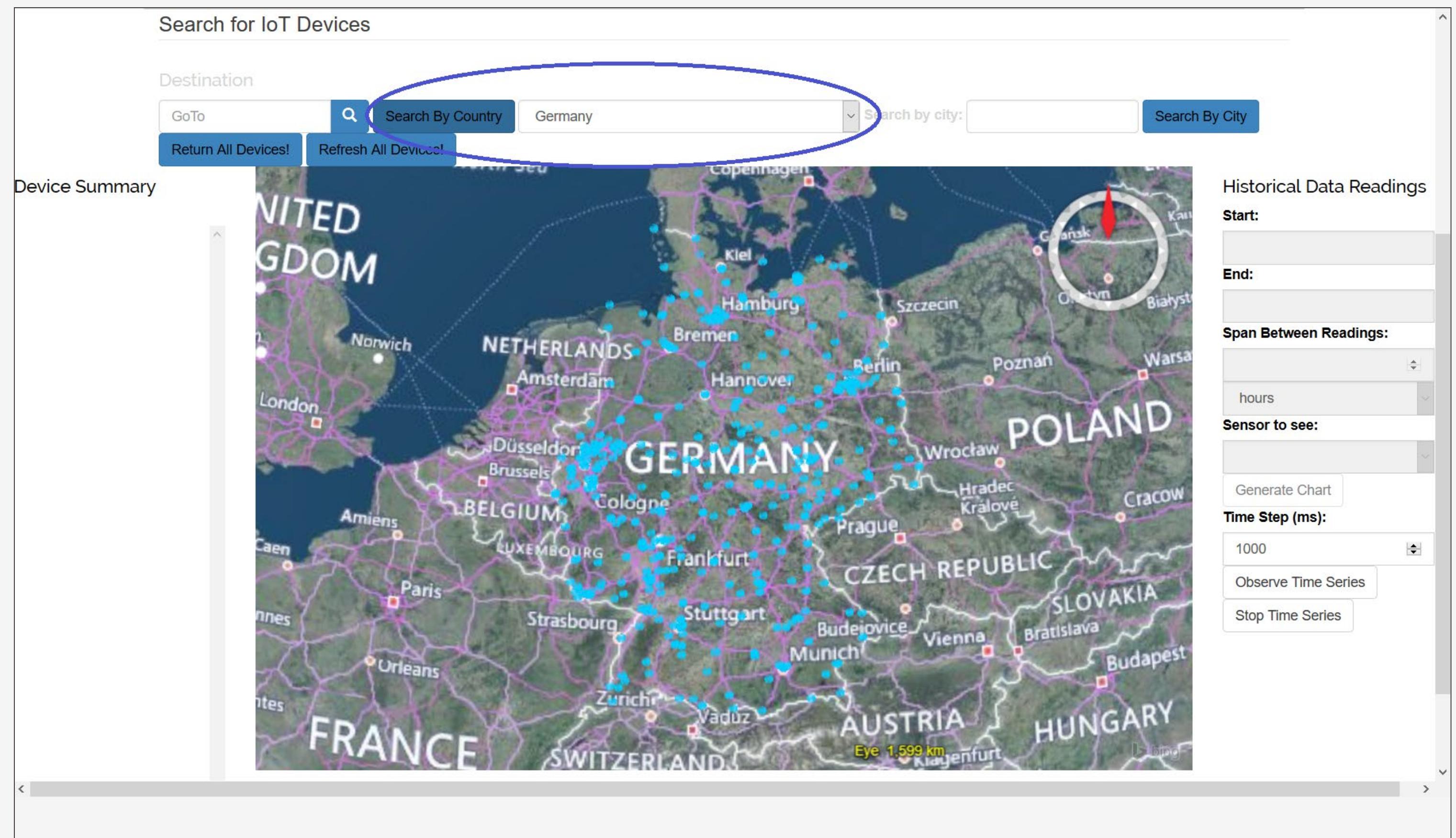


Figure 5. The Search by Country search function (in blue circle) and an example of a search result showing IoT devices located in Germany

method applies to searching by city, where the users can type the name of the city of interest. With a click of the button “Search By City”, the app will show IoT devices located within the city of interest. *Figure 5* shows where the inputs for the above functions are located, and also an example of the results of Search by Country function showing all IoT devices in Germany. *Figure 6* shows an example of the results of Search by City function, showing all IoT devices in the city of Hamburg, Germany.

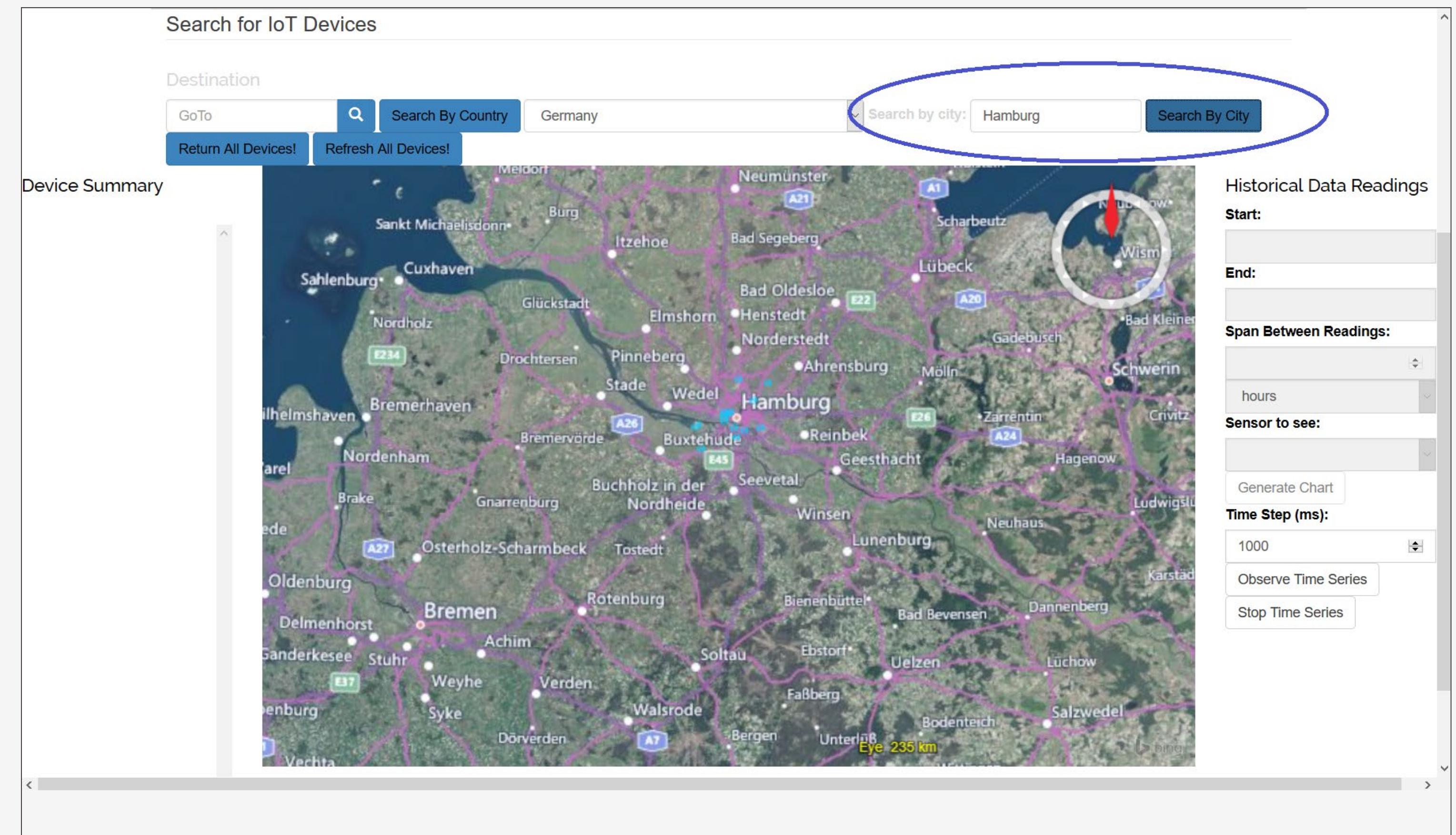


Figure 6. The Search by City search function (in blue circle) and an example of the result showing IoT devices located in the city of Hamburg, Germany

GETTING STARTED & USER MANUAL

Rediscover IoT devices

- In case the users wish to return all discovered IoT devices back on the globe after utilizing the Search By Country or Search By City functions, they can do so by clicking the "Return All Devices!" button. See *Figure 7*.
- Users who wish to see get updated list of IoT devices can trigger a search query function to rediscover IoT devices through the "Refresh All Devices!" button. See *Figure 7*.

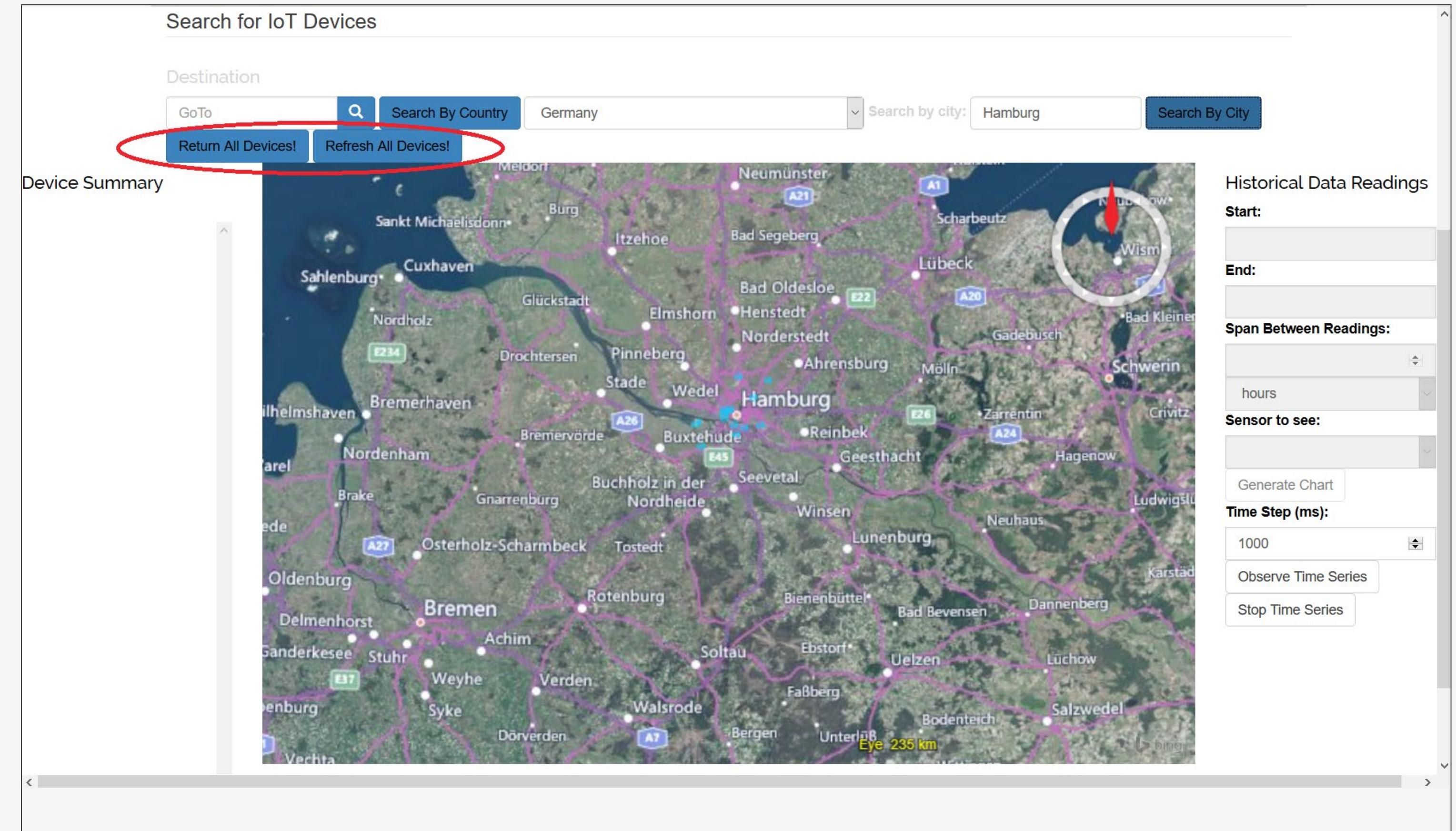


Figure 7. "Return All Devices" and "Refresh All Devices" button (in red circle)

GETTING STARTED & USER MANUAL

Device Summary

- With the discovered IoT devices located on the globe, the users can select a device to receive a summarized information regarding the selected IoT device, which will be displayed on the left side of the app below the “Device Summary” section. An example is shown in *Figure 8*, where a selected IoT device (encircled by a blue circle in the middle) is highlighted in green, and the summarized information regarding the device is presented below the “Device Summary” section on the left side of the app.

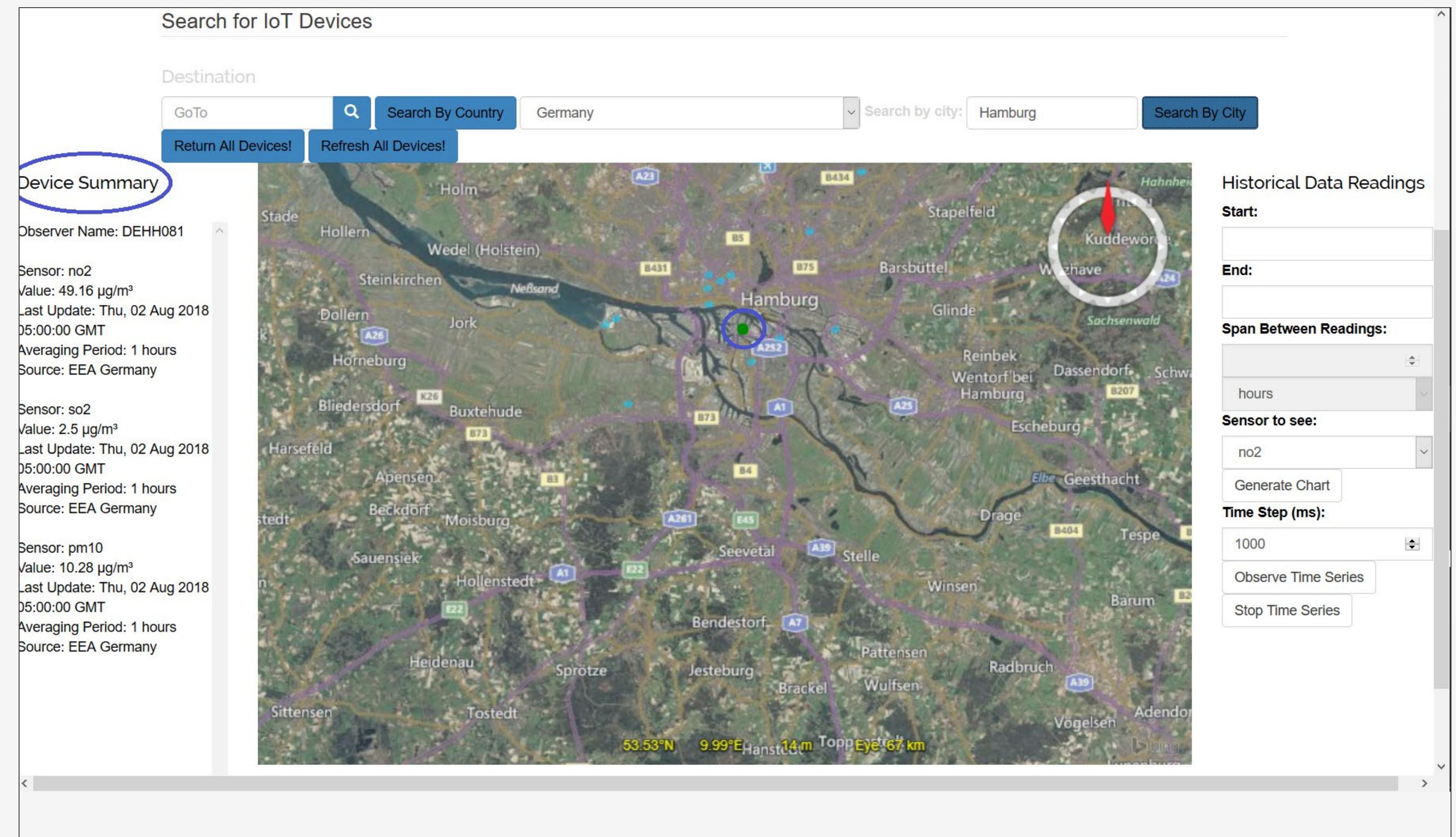


Figure 8. Selected IoT device and its' summary (see blue circles)

- The “Device Summary” information includes the name/label of the device, type of sensors attached to the device, the latest uploaded measurement/reading of the sensors, the timestamp of the latest measurement, and other information, for example in *Figure 8*, the source of the data and averaging period which signifies that the value uploaded by the IoT device is the average value of sensor readings over certain time frame, which in the example shown in Figure 8, the value is an average over one-hour measurements.

GETTING STARTED & USER MANUAL

“Historical Readings”

- If desired, the users can observe historical measurements/readings of the selected device. The “Historical Data Readings” section at the right side of the app allows users to access historical sensor data. The users can select the time frame of historical readings that they wish (which should be determined by taking into the account the time stamp of the latest uploaded sensor readings), time range between each readings (if applicable depending on the IoT provider of the selected IoT device),

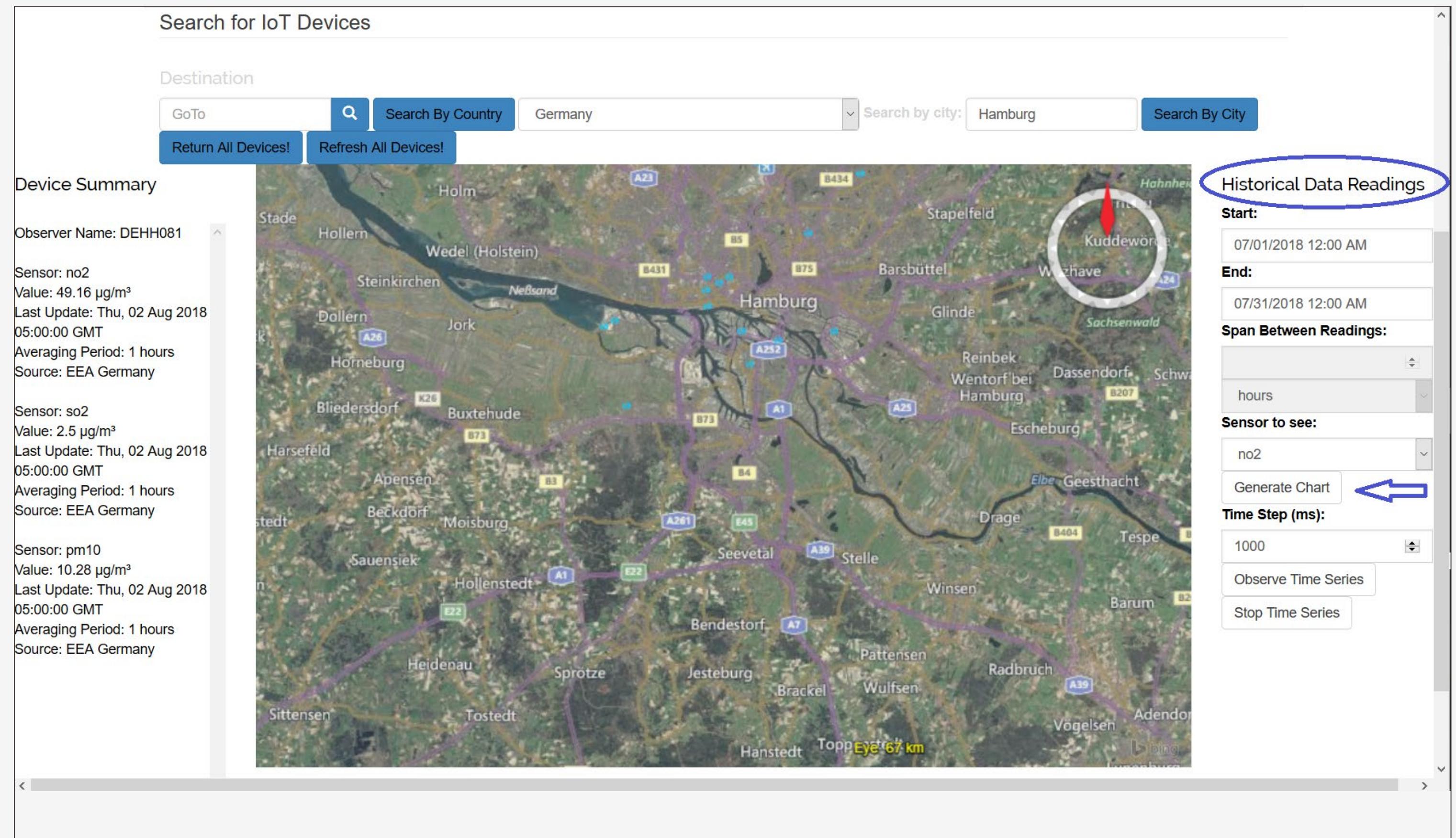


Figure 9. The “Historical Readings” section at the right side of the app (in blue circle) and the “Generate Chart” button (pointed by the blue arrow) (blue arrow)

and the type of sensors that the users are interested to see. The field Start and End determine the time-frame of the historical readings of interest, the “Span Between Readings” determines the time-range between each reading (when applicable), “Sensor to see” menu allows users to choose which sensor attached to the selected device that they are interested with. See *Figure 9*.

GETTING STARTED & USER MANUAL

“Generate Chart”

- Once the necessary parameters are provided, users may choose to observe historical measurements on a typical 2D chart. The “Generate Chart” button is provided which, when clicked, will open a new window browser and generate a

chart of the sensor readings based on the provided parameters (see Figure 9). Once the chart has been generated, the users may proceed by generating an image out of the generated chart (e.g., for printing purpose) by clicking

the “Generate Printable Chart” button (pointed by blue arrow in *Figure 10*), or instead generate a CSV file shall they wish to do their own further data analytics through the “Generate and Download CSV” button (*See Figure 10*).

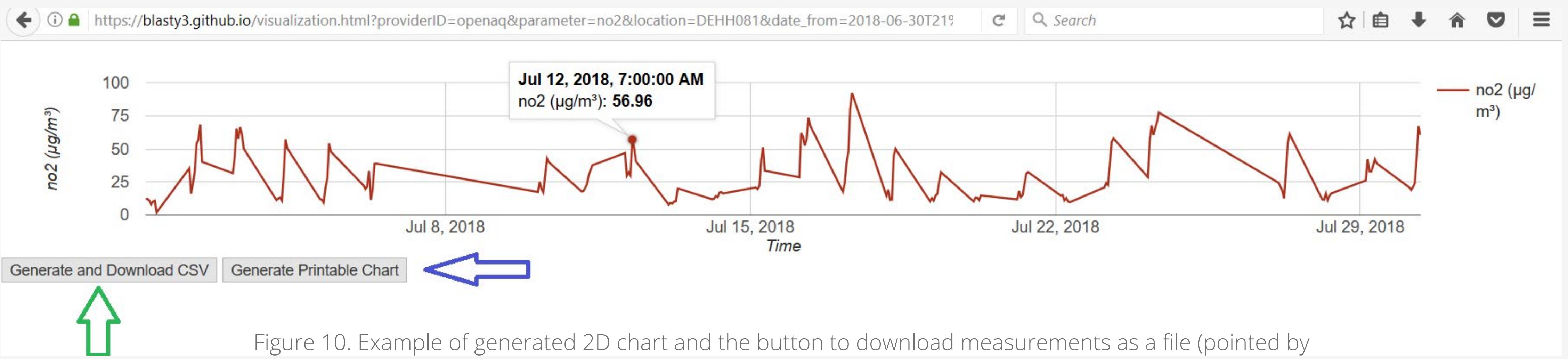


Figure 10. Example of generated 2D chart and the button to download measurements as a file (pointed by green arrow) and the button to convert the chart into printable image (pointed by blue arrow).

GETTING STARTED & USER MANUAL

Observe Time Series

- In addition, apart from the possibility of generating 2D chart, users can also generate a 3D/4D time series of the sensor readings and visualize them on the World Wind globe directly. This is made possible using the functions triggered by the click of the button "Observe Time Series" shown in *Figure 11*. The generation of the time series also use the same "Start" and "End" date-time field and "Sensor to see" field just like the 2D chart generation function, except that this function also requires an additional parameter of time step which will determine the

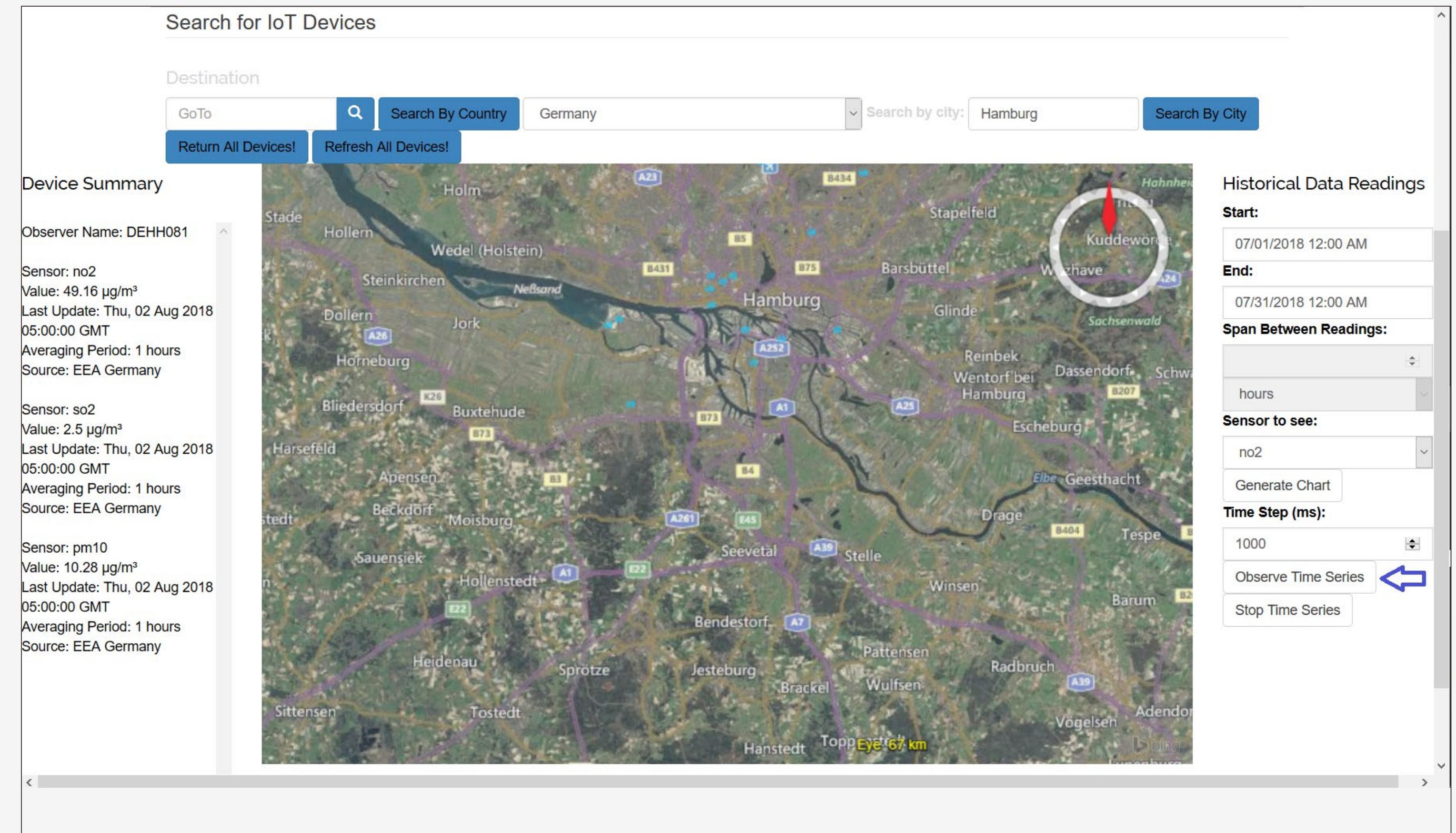


Figure 11. The "Observe Time Series" button to trigger 3D/4D visualization

GETTING STARTED & USER MANUAL

Observe Time Series

interval of changes between sensor readings during the “animation” (4D time series). This parameter is set by the “Time Step (ms)” field, which sets the interval in milliseconds (ms) unit.

GETTING STARTED & USER MANUAL

3D/ 4D Visualization

- Once the generation of 3D/4D time series is triggered by the user, the app will automatically zoom in closer to the location where the selected IoT device is on the WorldWind globe surface, and then presents a time series (animated) of the historical sensor readings based on the provided parameters. A snapshot of this 3D/4D visualization is shown in Figure 12. Once the users are satisfied, the visualization can be turned off through by pressing the "Stop Time Series" button pointed by the blue arrow in *Figure 12*.

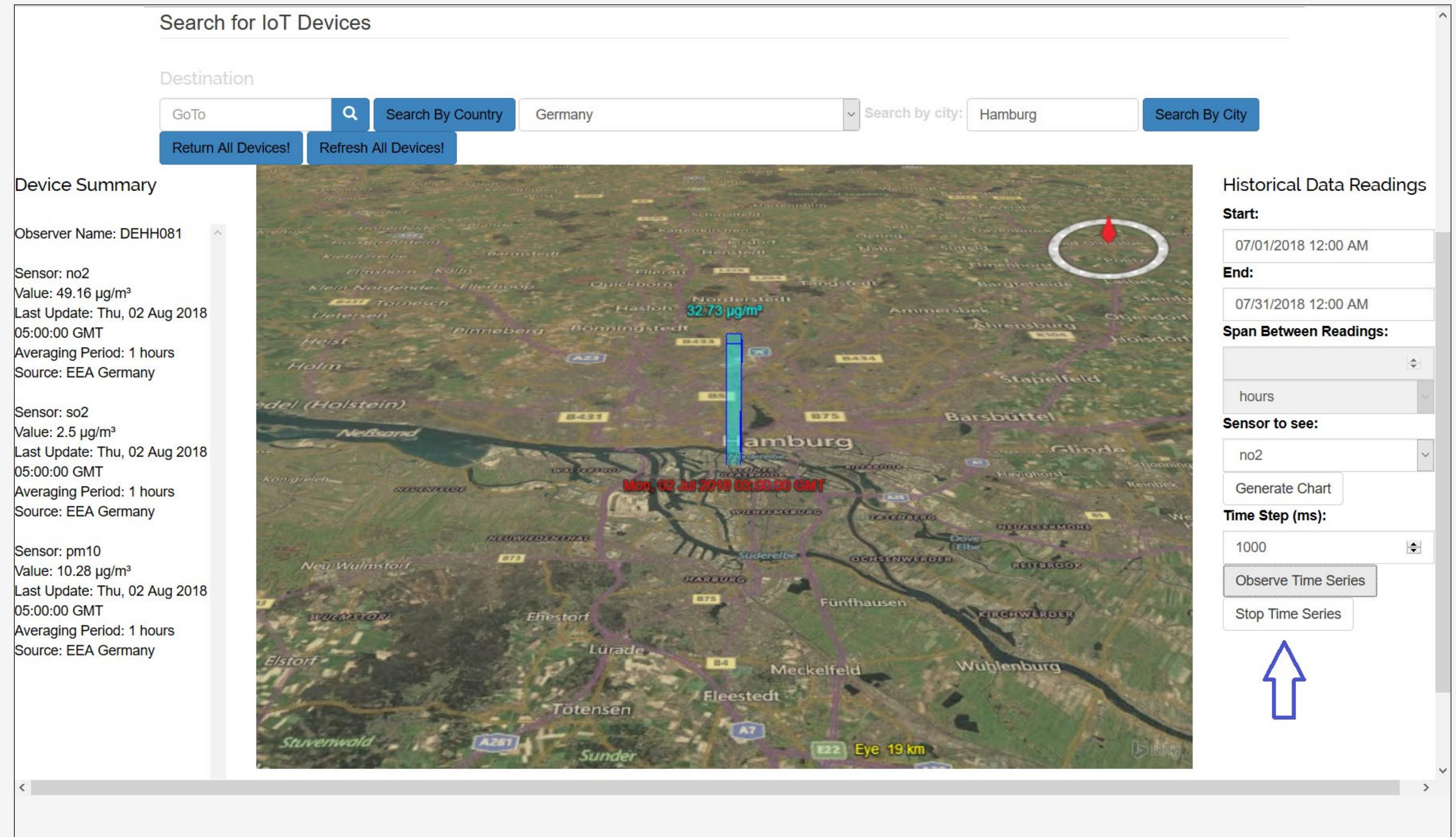


Figure 12. A snapshot of 3D/4D visualization of historical sensor readings.

DATA PROVIDERS/ SOURCES

The app obtains IoT data from a list of IoT data providers/IoT projects which host public, open IoT devices.

These providers include:

- Smart Citizen (<https://smartcitizen.me>)
 - OpenSenseMap (<https://opensensemap.org>)
 - ThingSpeak (<https://thingspeak.com>)
 - Dweet (<https://dweet.io>)
 - Netherlands Smart Emission Portal : <http://smartemission.ruhosting.nl/>
 - OpenAQ : <https://openaq.org>
 - Database from Geonames.org (under MIT license)
- and the list is growing!**

Other resources

The app makes use of Google Chart API to generate the 2D chart of sensor readings.

GAIOTA BUSINESS MODEL

Key Partners	Key Activities	Value Proposition	Customer Relationships	Customer Segments
1. Open source API for IoT data platform <ul style="list-style-type: none"> - Thingful - Thingspeak - Specific fields of IoT data sites 2. Public sectors <ul style="list-style-type: none"> - Public orgs - NGOs - Academy 	<ul style="list-style-type: none"> - Building algorithm for search engine - Connect with open source API IoT platforms - Data analytics - Web app interface - IoT community exposal 	<p>galoTa enables internet users to find and make use of massive available IoT data around the world via:</p> <ul style="list-style-type: none"> - Search for & access to IoT data from different open API sources - Request for IoT data alerts - Connect with data providers 	<ul style="list-style-type: none"> - galoTa Newsletter - Forum discussion & users engagement - Co-creation workshop & online discussion - Short tutoring video - IoT news 	1. Researchers <ul style="list-style-type: none"> - Data scientists - Engineers - Academia 2. Businesses <ul style="list-style-type: none"> - Data-driven business - Innovators - Corporates, SME, Start-ups
3. Media 4. Service providers related to IoT industry	Key Resources <ul style="list-style-type: none"> - Worldwind platform - Open source API IoT data - Domain & hosting - Team & supporters 		Channels <ul style="list-style-type: none"> - IoT communities in social media & forums - Start-up communities & events - Partnership channels 	3. Explorers <ul style="list-style-type: none"> - Students - Travelers - Whoever
Cost Structure <ul style="list-style-type: none"> - Labor costs - Infrastructures including domain, hosting & other online services - Community outreach activities 	Revenue Streams <ul style="list-style-type: none"> - Short term: Idea Competition prize - Sponsors - Fundraising - Long term - IoT Data trading - IoT scientists, IoT outsourcing match making - advertisement 			

SUSTAINABILITY



SUSTAINABILITY
TRANSITIONS
IN IOT

GaloTa team takes a conscious approach in designing for sustainability transitions. IoT is already here and the trends show that it will keep increasing by 2020, attaining a 19.92% Compound Annual Growth Rate (Forbes, 2017). Thus, there is growing concern in how to manage this field in sustainable ways.

The development of galoTa platform has been strongly referring to IoT: Guidelines for Sustainability published by the World Economic Forum.

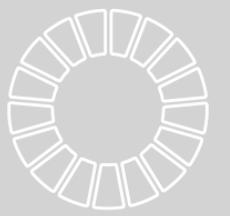


FROM ACCIDENTAL
TO PURPOSEFUL

Companies, such as IoT Analytics, predict that “IoT for sustainability” will become a new theme in 2018 and sustainability will be consciously embedded in IoT solutions rather than accidental. Studies, showing that IoT has development benefits that could be maximized without compromising commercial viability, support our values.

In long-term perspective, galoTa aims to educate what it means and how to design sustainable IoT projects in collaborative ways by sharing the knowledge and experience.

SUSTAINABILITY



SUSTAINABLE
DEVELOPMENT GOALS

The nature of IoT opens up new possibilities to aim for SDGs. At its core, IoT is about measuring and remotely controlling previously unconnected “things”. The technology reaches people and objects that previously could not be reached (World Economic Forum, 2018).

In a long-term, after having learned from users' experience on galoTa platform, SDGs will be used to evaluate potential impact and measure the results.



LEARN
WITH
GAIOTA

Various barriers, including the lack of understanding, make it challenging to implement sustainability in practice. Thus, galoTa aims to educate and build confidence to its users. For casual users, it may simply give the satisfaction of “feeling good by doing good”. For expert users, the aim is also to help them utilize the availability of IoT data so as to improve their decision making.

SUSTAINABILITY



SUSTAINABILITY
AWARENESS
CULTURE

Sustainability values are within galoTa's team culture. We aim to create a positive impact and we believe that the platform such as galoTa can open up new possibilities for making a change. Driven by this belief, we create and aim for our shared vision – IoT data for the world.



COLLABORATION
FOR A
SHARED VISION

GaloTa team believes in collaborations and that together we can overcome the limitations of fragmentation in IoT data. Currently, all our data providers are open source. In the future, we aim to involve more diverse partners to expand the IoT data network. If there is any interest for involvement, please get in touch with us!

OUTREACH

Our outreach efforts in this project are reflected by three main activities:

1

We contacted data providers to discuss on how we can approach their open API for data processing
For example: we got advice on how we could process with Thinkful open IoT data

2

We contacted IoT start-ups for learning and future collaboration
For example: Ruuvi start-up in Helsinki, from which we get reference for streamr.com

3

We started doing social media outreach by facebook and instagram activities where we can interact with the community of interest.

TEAM MEMBERS



Mcha Khamis
Software Developer

Passionate about latest technology trends. Background Mobile communication systems and signal processing currently pursuing Machine learning and Artificial Intelligence

Resaercher at Aalto University
master student in computer communication and information science

Web development, UI Design

Viktorija Piaulokaitė
Design & Sustainability Strategist

Passionate about bridging different disciplines to create new meanings.

Viktorija is pursuing Creative Sustainability master's degree at Aalto University. She holds B.Sc in Industrial Design Engineering/ [Open Innovator] and has previously worked in design firms in The Netherlands and Germany.

UX & UI design, sustainability expertise, visual production, community outreach

Heru Raha
Aerodynamicist, Numerical Methodist, Consummate Movement Practitioner

Former fluid mechanics lecturer at Aalto Univ., performer and/or instructor of dance theatre

Ph.D. in Aerospace Engineering from Wichita St. U., Kansas, experienced in MHD and propeller cavitation modelling.

Creative management, Video production, User research

Udayanto Dwi Atmojo
Technology Enthusiast & Innovator

Huge interest in state of the art, future technologies for the greater good and benefit for all.

Has PhD in Electrical/Electronic Engineering from The University of Auckland, New Zealand. Now Postdoc at Aalto University. Experience in software development and embedded systems.

Data analyst, App Development

Loi Tran
Business Shark

Former CBD Manager at Procter & Gamble & Co-founder of World Team Technology JSC. Loi cultivates a strong interest in Business and Innovation.

Master of Science in Entrepreneurship and Innovation Management. Aalto University (Finland) & Uppsala University (Sweden).

Project Planning, Business Model development, Community outreach.

GET IN TOUCH

If you are a Business who want to expand more in IoT Data field
a researcher looking for IoT Data.a hobbyist
willing to share data with the world. or simply a
customer who need to hear reviews before
buying IoT device **This is the place for you**

Finland

-  +(358) 46 53 20 497
-  support@gaiota.com
-  Otakari 5 building H
Espoo, Finland



GaIoTa
2018