galoTa

IoT data for the world

Project Documentation

August 2018

CONTENTS

g a **I o T** a

A 3D search engine for the Internet of Things (IoT) data

BACKGROUD

gaIoTa is a web-based application which can search for open source/public Internet of Things (IoT) devices. The app utilizes **NASA Web World Wind** 3D globe platform which enables the users 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 these devices.

This project has been developed in just around 1 month time FROM SCRATCH and with team members completely alien to the World Wind platform and to the web application development.

Core members: Loi Tran, Viktorija Piaulokaite, Udayanto Dwi Atmojo, Mcha Khamis, Heru Reksoprodjo

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.

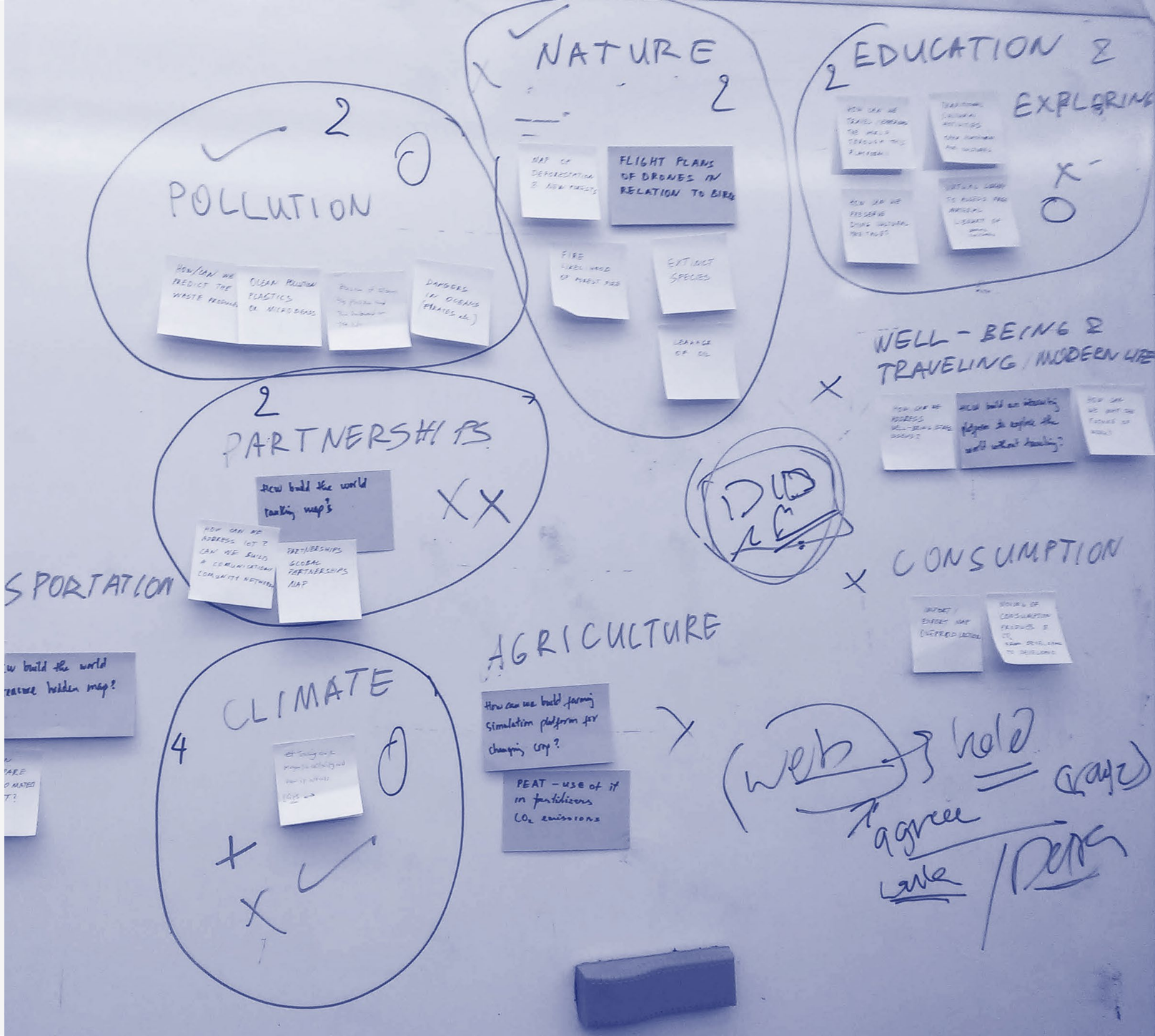
GaloTa - the word takes its inspiration from Gaia, a mythical name for Earth Mother, into which we add the acronym IoT, which stands for Internet-of-Things, as it is the subject of our interest. Put it simply, we aim to incorporate the WorldWind platform into our search engine which allows users search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

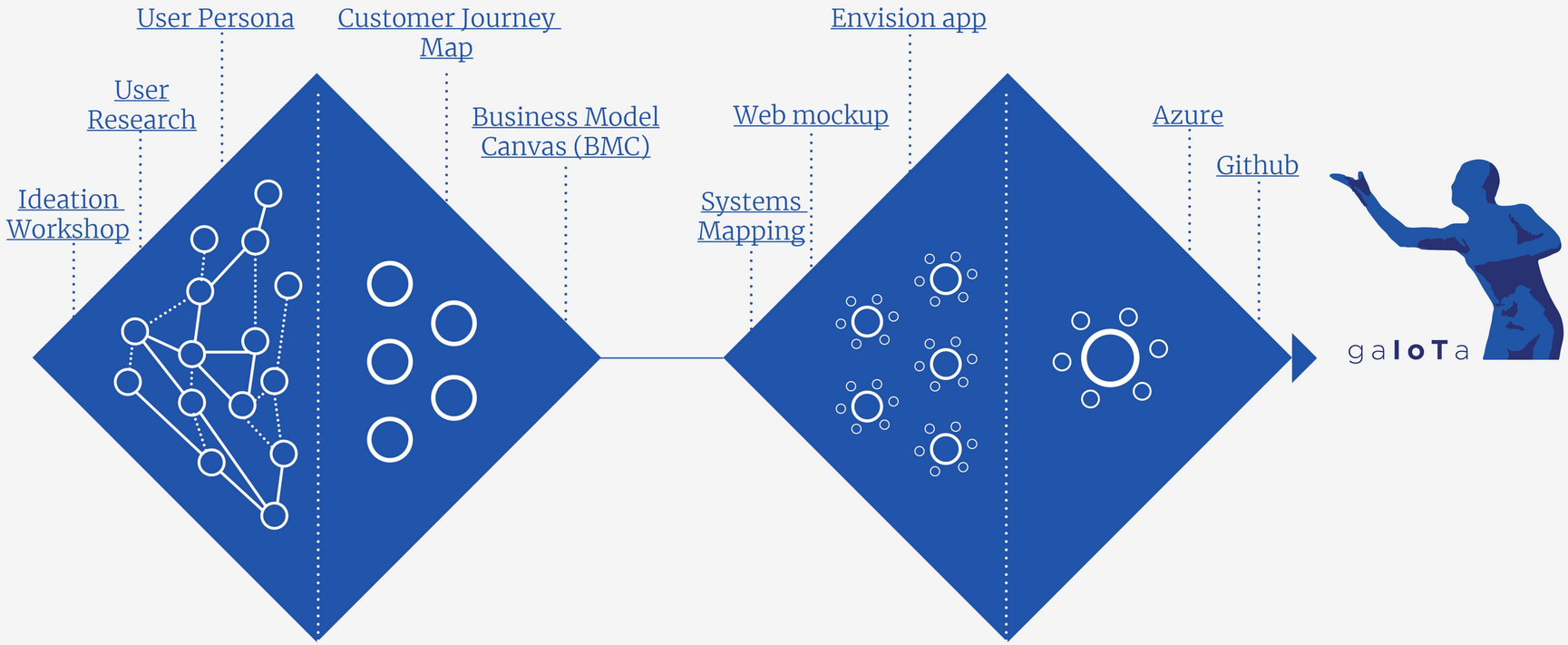
We came together as a multidisciplinary team with open minded attitude to start working on the challenge from scratch. Therefore we decided to apply Design Thinking approach and Design process to frame our work within one month from ideation to delivery. There are four main stages that we've gone through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

GaIoTa Platform

gaIoTa 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 GaIoTa 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 measurecertain 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.

USE CASES & AIMS OF GAIOTA

- As a teaching/education tool for educating the public and demonstrate what IoT is about

- Towards improved accessibility of IoT data, which has been dubbed as one important factor for sustainable development, especially in realizing the so-called “smart cities” and improved urban management

- Assists interested members of the public/community/citizen to engage and participate in improving smart services and governance through easier access to open IoT sensor data.

- Foster new innovations and IoT-based projects through improved accessibility of IoT data

GAIOTA PLATFORM DESCRIPTION

Features of gaIoTa app

• Gather public/open data through online querying of a number of open IoT data providers and open IoT projects, including open IoT smart city projects (the list of IoT data sources is growing)

• 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 geographical parameters and keyword-based parameter.

• 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

GaIoTa 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 gaIoTa 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.

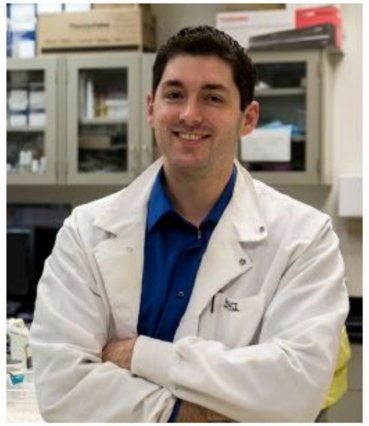
Explorers

Explorers are the users driven by curiosity. Their core motivation to use gaIoTa is gaining new experiences, learning about different places and cultures and implementing those learnings into something bigger.
gaIoTa 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	Extrovert
Thinking	Feeling
Sensing	Intuition
Judging	Perceiving

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 find it's hard to collect environment data from area outside US.
- John want 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 set 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 site 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

Introvert	Extrovert
Thinking	Feeling
Sensing	Intuition
Judging	Perceiving

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

Incentive
Fear
Growth
Power
Social

Brands & Influencers

Preferred Channels

Traditional Ads
Online & Social Media
Referral
Guerrilla Efforts & PR

GAIOTA FOR EXPLORERS

Gloria- travelling enthusiast

Xtensio

"Travelling brought me experiences and friends for life"

Age: 25
Work: Geography Student
Family: In partnership
Location: Berlin
Character: Social

Personality

Introvert	Extrovert
Thinking	Feeling
Sensing	Intuition
Judging	Perceiving

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 want 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

Incentive
Fear
Growth
Power
Social

Preferred Channels

Traditional Ads
Online & Social Media
Referral
Guerrilla Efforts & PR

THE GAIOTA APP
ARCHITECTURE AND CORE COMPONENTS

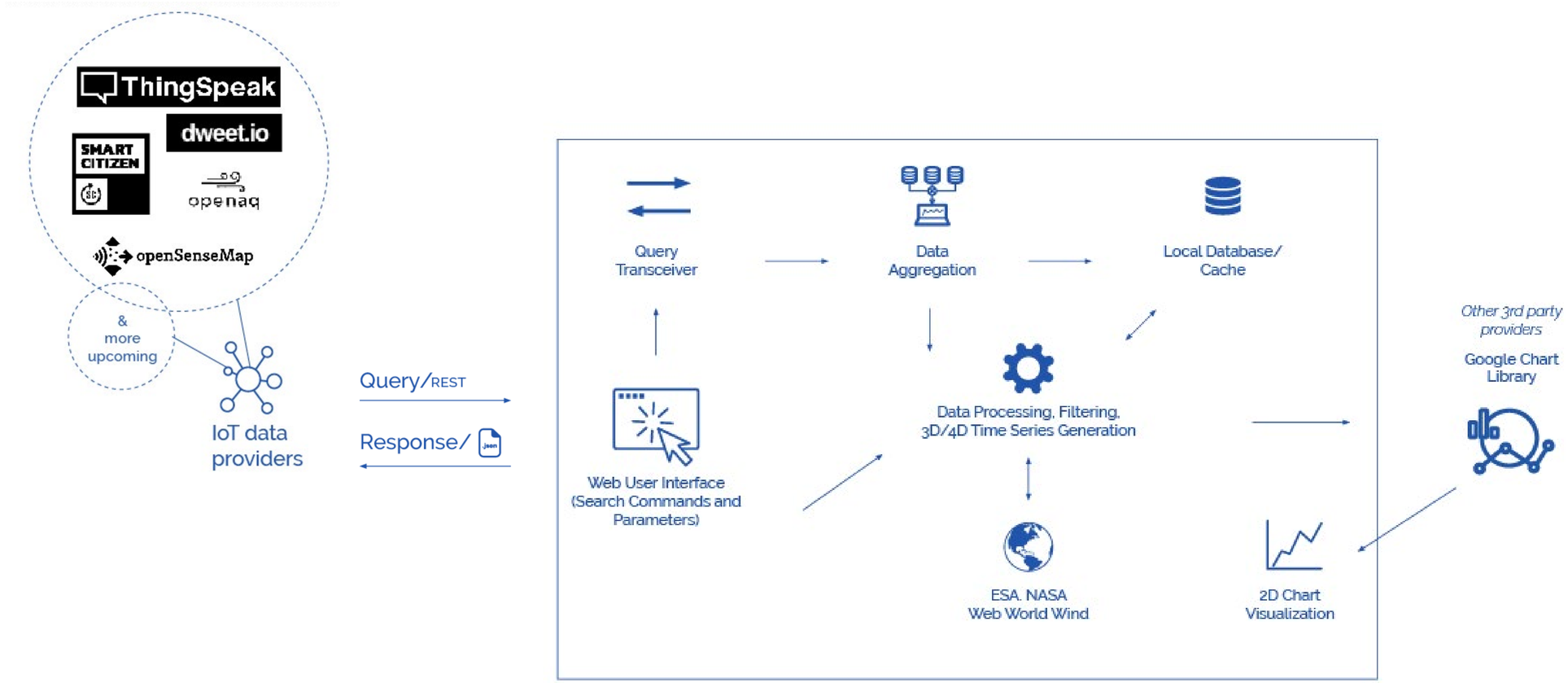


Figure 1. The Diagram of gaIoTa app

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.

“CHANGES LOG” –
LIST OF IMPROVEMENTS SINCE THE PRELIMINARY SUBMISSION

Front-end (visual modifications to enable better flow of app’s utilization by users.

The search panel, the parameters field for visualizing historical data, and the “device summary” panel can be shown or hidden at will by users or as necessary. To better demonstrate the difference in appearance of the app during the preliminary and the final event, Figure 1 shows the visual appearance of the app before (left) and after modifications (right).

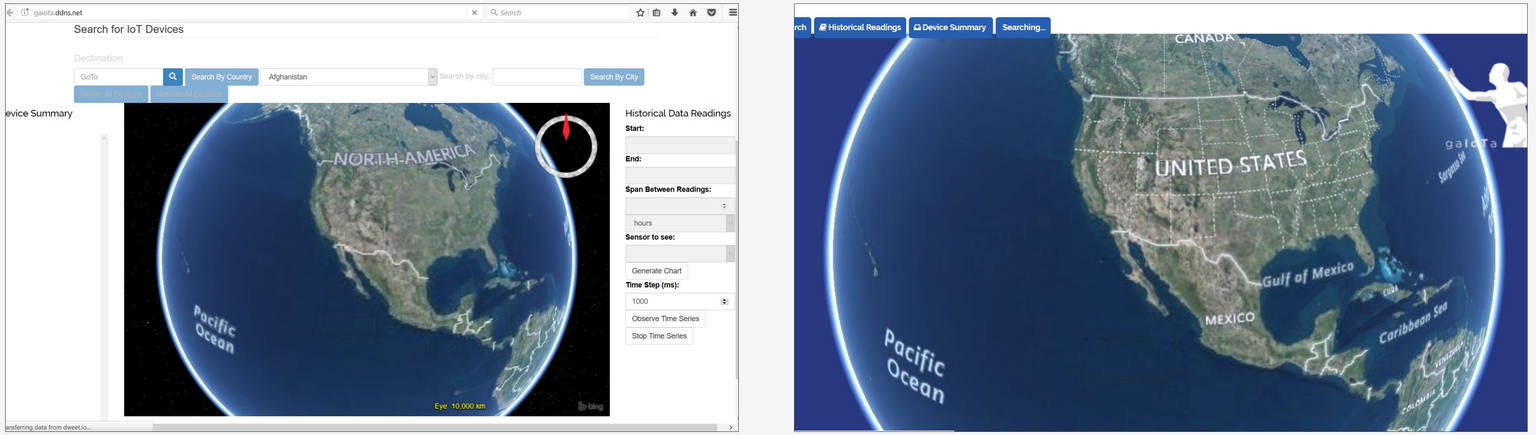


Figure 1. Initial front look of the app during the preliminary submission (left) and during the final event (right)

“CHANGES LOG” –
LIST OF IMPROVEMENTS SINCE THE PRELIMINARY SUBMISSION

Additional Search Capabilities

The app introduces two new/additional search functions. One search function is geographical-based search called “Search by Radius”, which allows users to filter discovered IoT devices (and data generated by the sensors attached to these “things”, consequently) based on their distance from the center point of the World Wind globe on screen. Users can specify the maximum distance from the center of the globe on screen in meter or kilometer unit. The second search function is keyword-based search function referred as “Search by keywords”, allowing users to filter discovered IoT devices based on keywords which are relevant to each of them. Also, it’s possible for users to make a “combined” search by keywords and radius altogether at the same time.

“CHANGES LOG” –
LIST OF IMPROVEMENTS SINCE THE PRELIMINARY SUBMISSION

Overall Performance Improvements

During the preliminary submission, the app faces issues with performance due to the huge number of “objects” (or placemarks) being drawn on the World Wind platform. This issue has been tackled through clustering these placemarks using the so-called Power Markers library[1], which allows a group of placemarks to be clustered together when the World Wind viewing range is at certain range, improving the app’s performance when a huge number of placemarks are involved. The team also had to make substantial modifications to the Power Markers library itself in order to properly visualize (or hide) placemarks dynamically when different types of visualizations are needed.

[1] S. Battaglia, ”Power Markers, NASA Web World Wind Plugin”,
Available: https://simonebt92.github.io/NASA-WWW-MarkerCluster/

“CHANGES LOG” –
LIST OF IMPROVEMENTS SINCE THE PRELIMINARY SUBMISSION

Additional IoT Data Providers

We added additional IoT data providers into our search, including the Barcelona Smart City data provided by the Ajuntament de Barcelona (Barcelona City Council), flood/river water level from the UK Environmental Agency, and environment condition and nuclear radiation from the Safecast citizen science project. All of which generate data through sensors attached to Internet-enabled “things” (IoT)

“CHANGES LOG” –
LIST OF IMPROVEMENTS SINCE THE PRELIMINARY SUBMISSION

Visualizing “Stationary” and “Mobile” IoT data

When one hears the word “IoT”, they will often associate IoT devices or “things” which remain at the same geographical location at all time (stationary). However, not all IoT devices are stationary. Some of them moves around and changes their locations in certain time frame or at certain point in time. gaIoTa app now enables two WorldWind IoT layers, “stationary” and “mobile IoT” to facilitate the visualization of data generated by both types of IoT.

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.

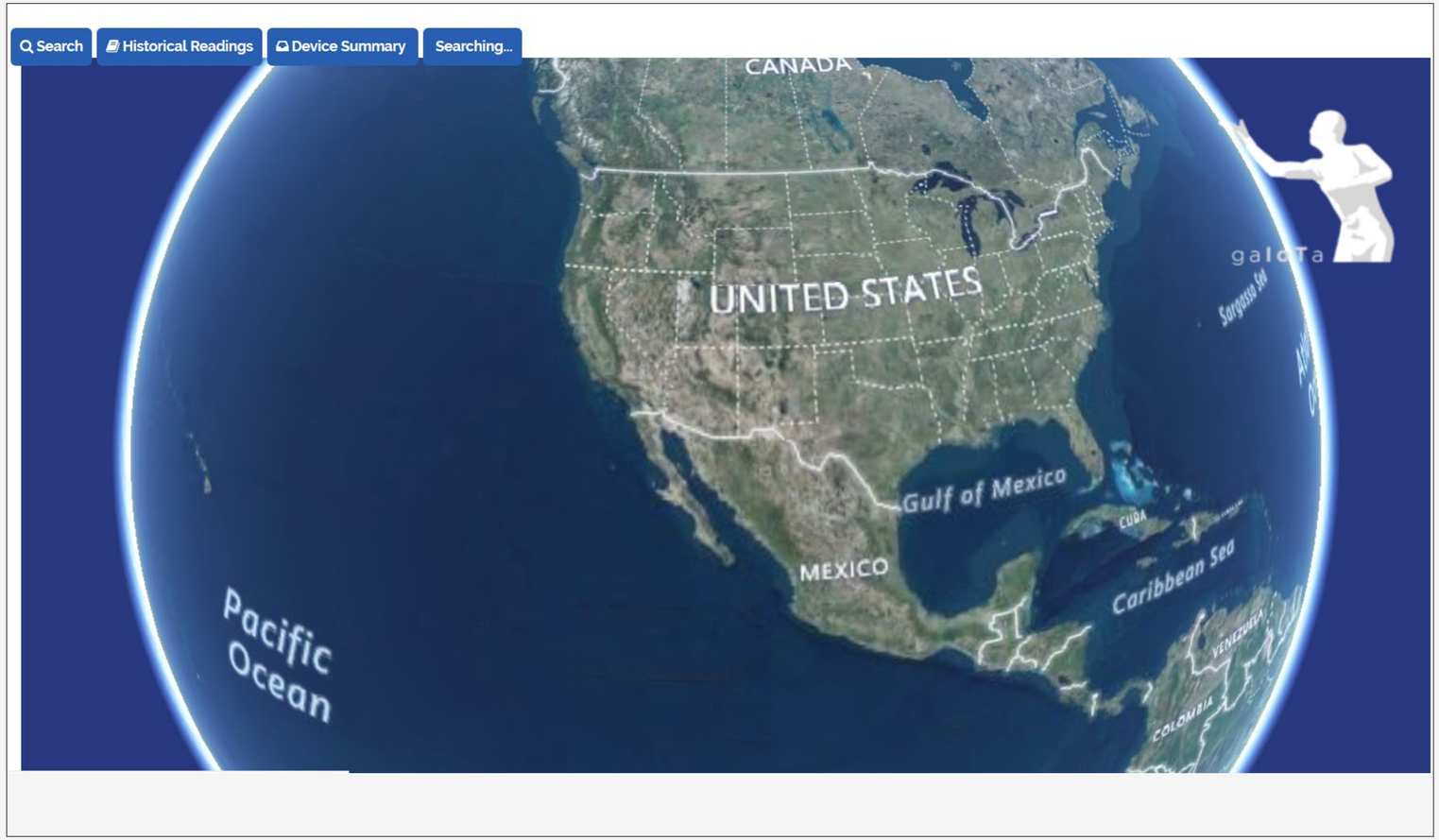


Figure 2. initial layout of the galoTa application

GETTING STARTED & USER MANUAL

- The app has three main panels/tabs, namely “Search”, “Historical Readings”, and “Device Summary”.

- When app page is initially opened, the app automatically initiates real time query to a number of IoT providers. When the “Searching” box is visible, this indicates that the query and visualization process is currently underway.

- 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 shown on the World Wind globe (See Figure 3). The discovered IoT devices are “clustered”/ grouped together for performance reason, but individual devices are visualized when the viewing range reaches certain “low” point closer to the ground (See Figure 4).

GETTING STARTED & USER MANUAL

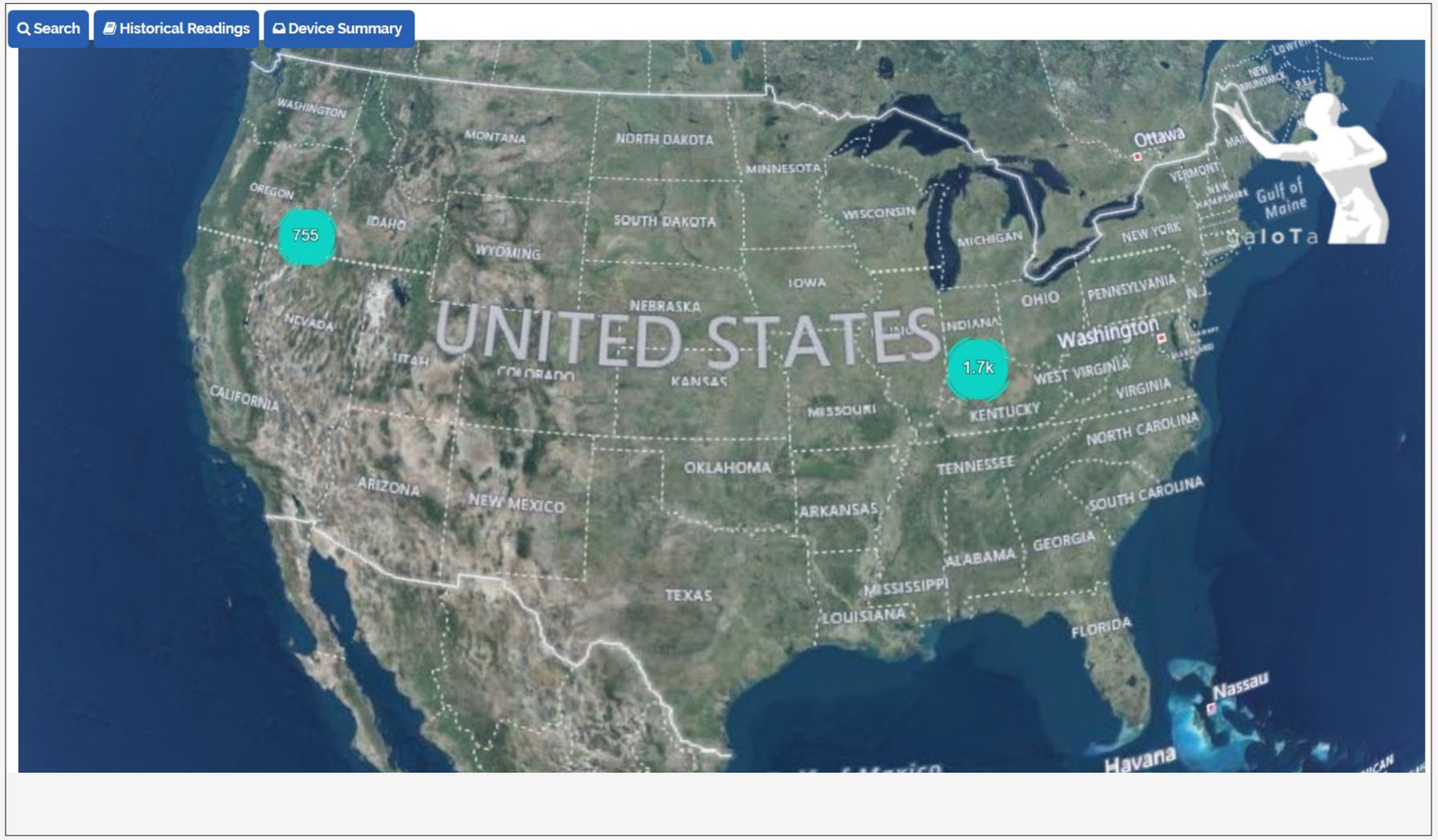


Figure 3. Discovered IoT devices shown on the World Wind globe

GETTING STARTED & USER MANUAL

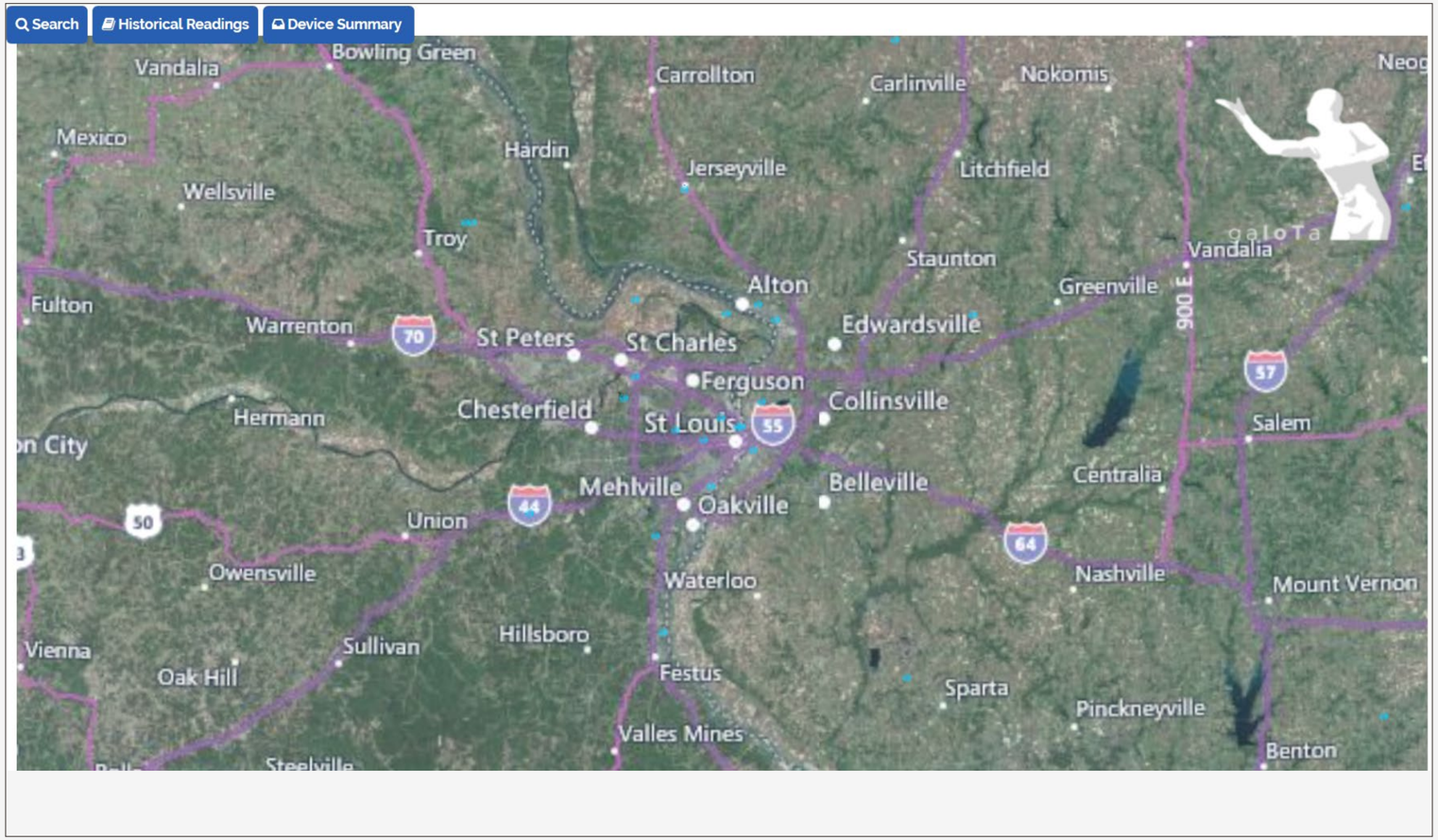


Figure 4. Individual IoT devices shown on the World Wind globe when viewing range is closer

GETTING STARTED & USER MANUAL

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 “Go To Location” search field (circled in blue color), which can be shown by clicking the Search button tab (circled in orange color) and type in the location that they want to use and click the blue magnifying icon. The globe will then utilize built-in World Wind reverse geocoding function and move to a particular geographical location according to the input in the “Go To Location” search field (see Figure 5).

GETTING STARTED & USER MANUAL

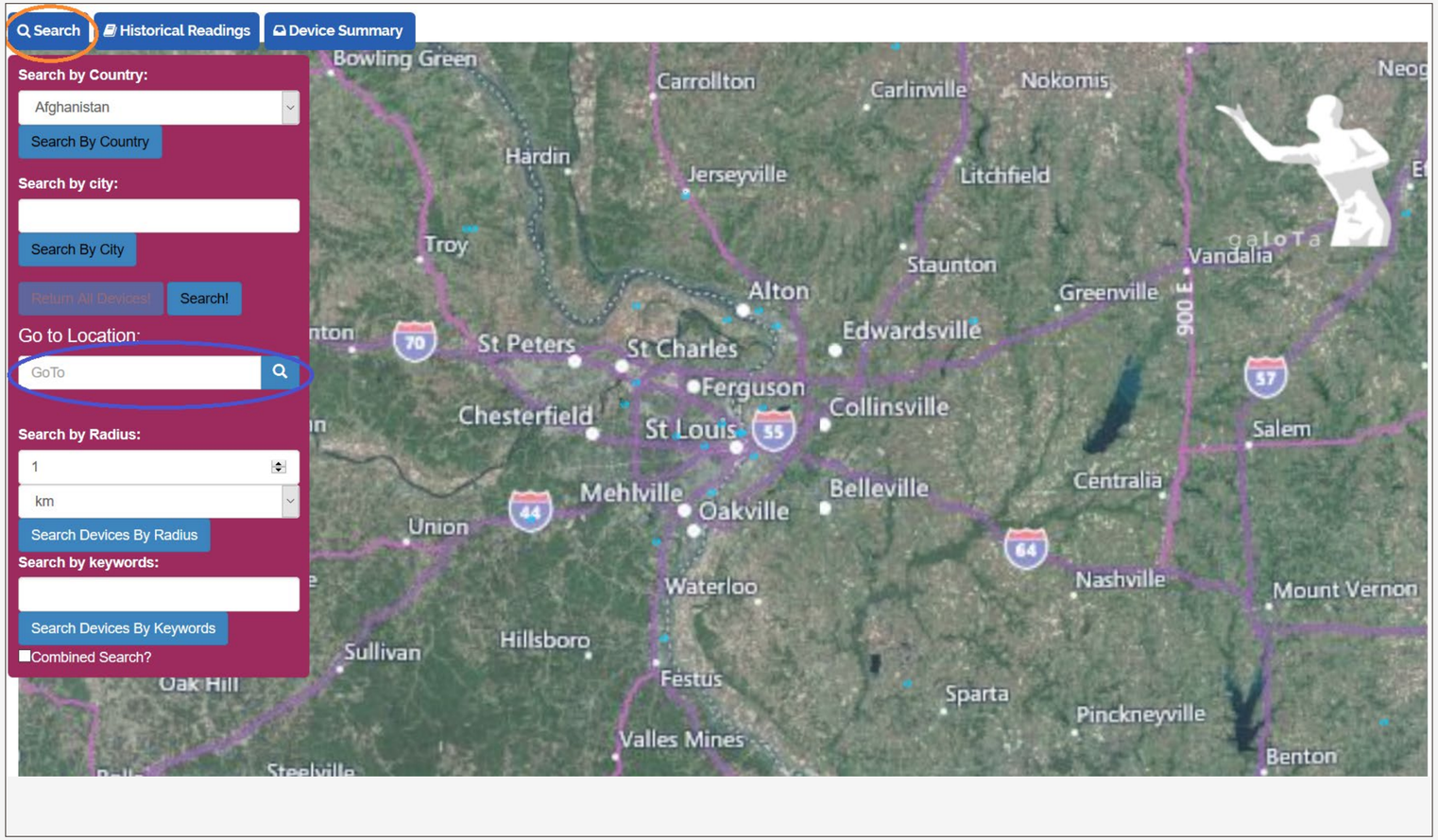


Figure 5. The “Go To Location” in the Search tab

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 gaIoTa allows for filtering based on the country and city where the IoT devices are located. A drop down menu with a list of countries is provided which users can select to see IoT devices 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 method applies to searching by city, where user 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 6 shows where the inputs for the above functions are located, and Figure 7 shows an example of the results of Search by Country function showing all IoT devices in Germany.

GETTING STARTED & USER MANUAL

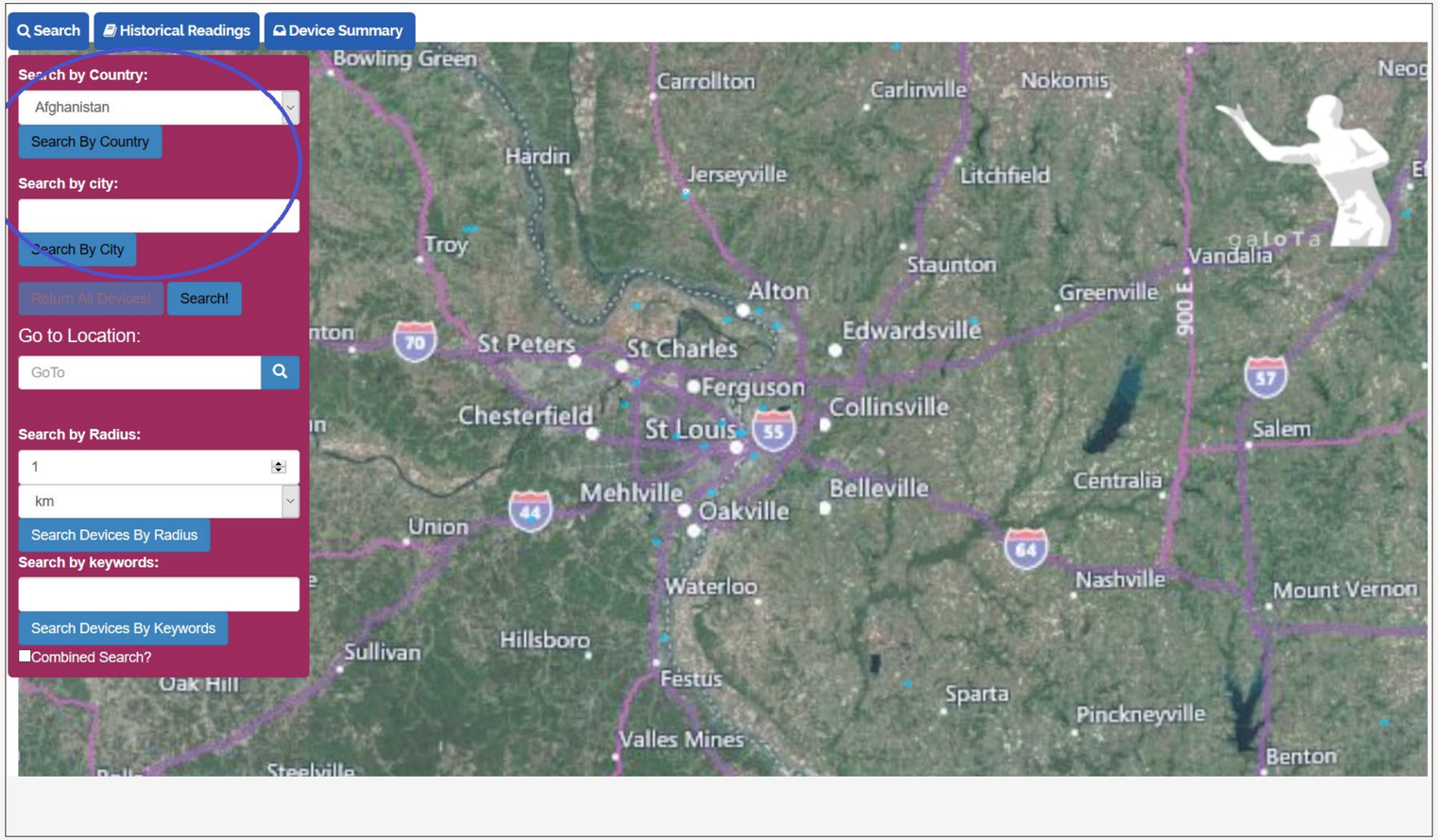


Figure 6. The Search by Country and Search by City search functions (in blue circles)

GETTING STARTED & USER MANUAL

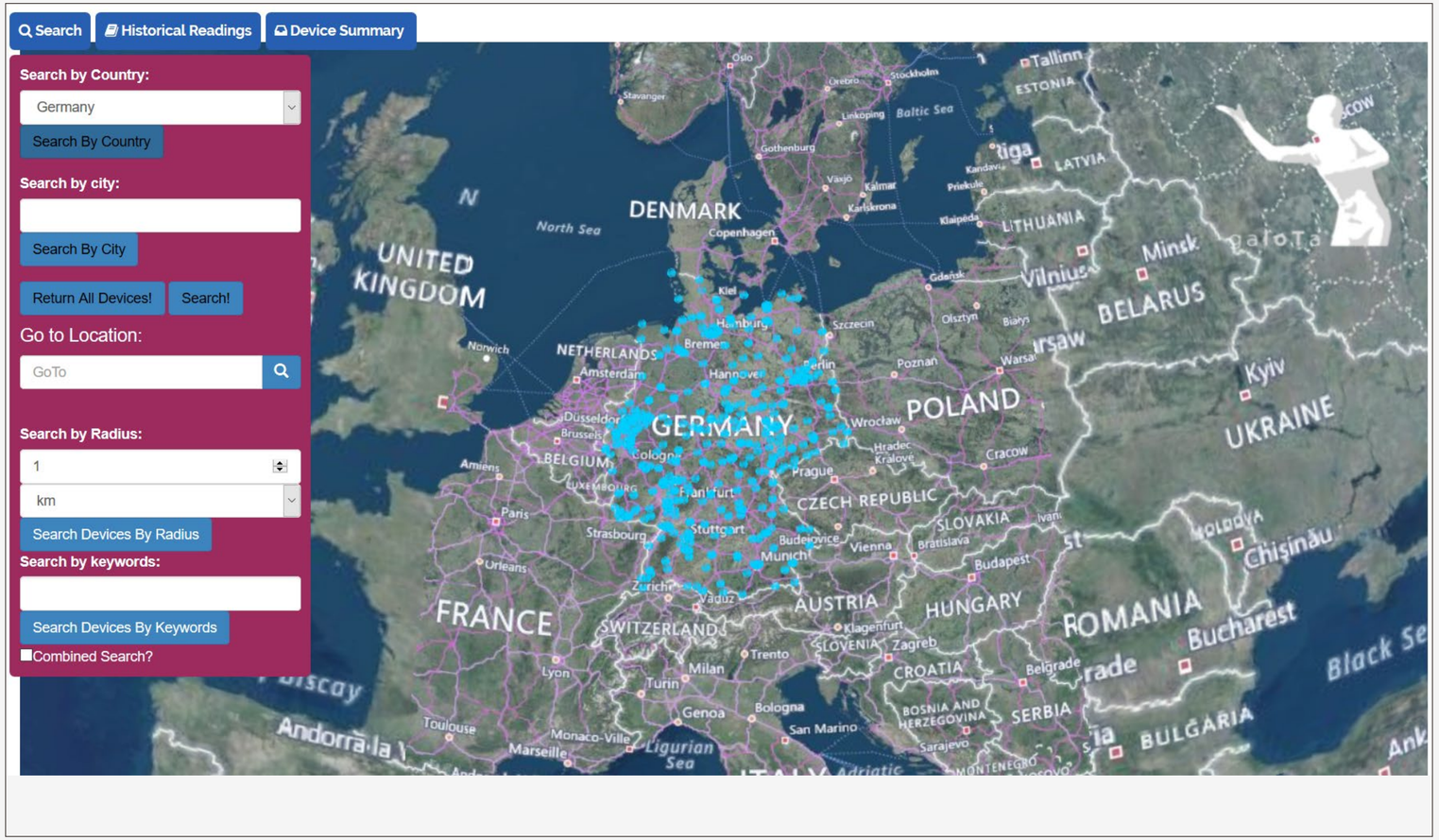


Figure 7. Search By Country result example showing IoT devices in Germany

GETTING STARTED & USER MANUAL

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 8.

Users who wish to see get updated list of IoT devices can trigger a search query function to rediscover IoT devices through the “Search!” button. See Figure 8.

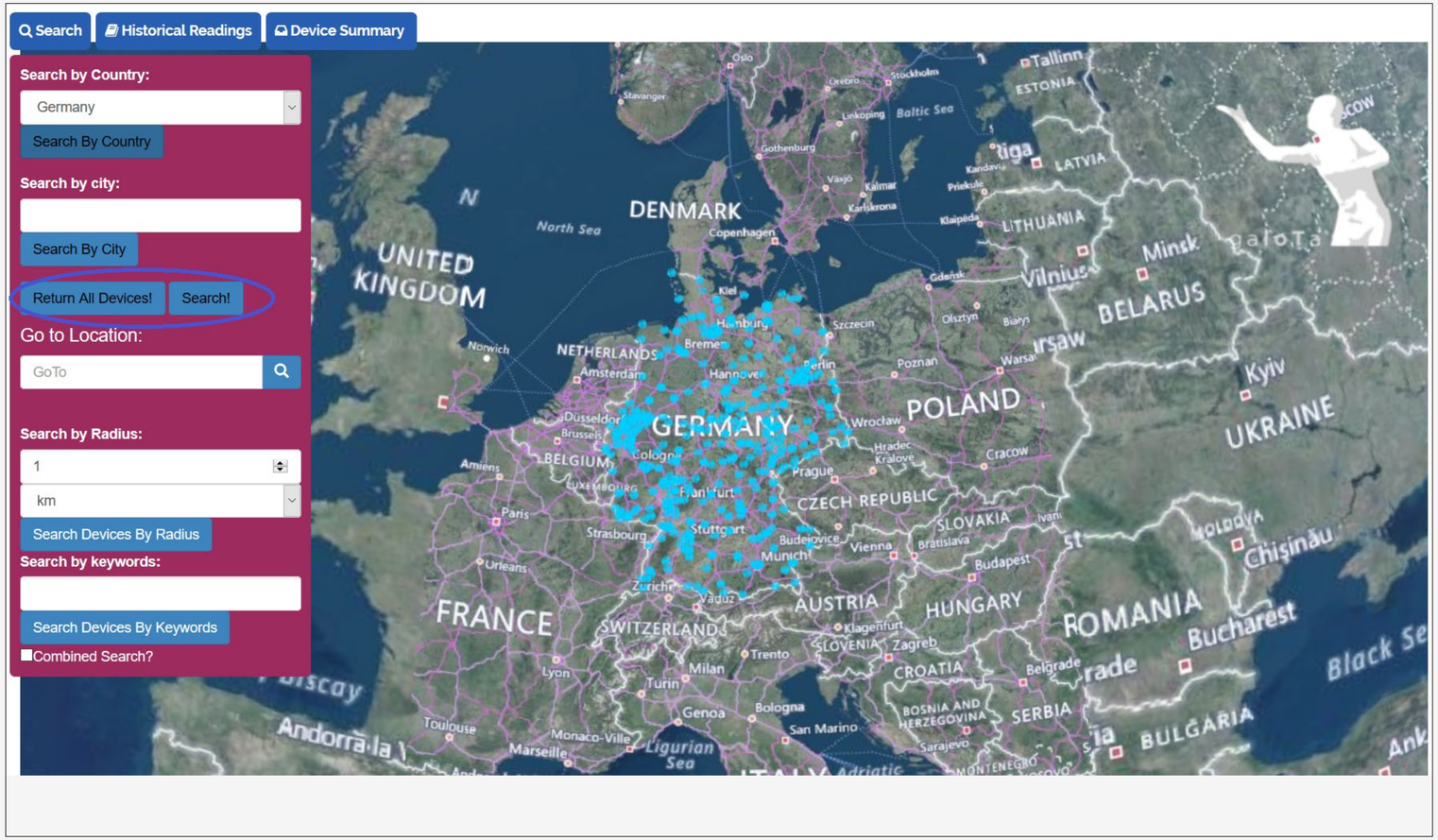


Figure 8. “Return All Devices” and “Search!” devices (in blue circles)

GETTING STARTED & USER MANUAL

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 right side of the app below the “Device Summary” section. An example is shown in Figure 9, 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.

The “Device Summary” information includes name/label of the device, type of sensors attached to the device, latest measurement from the sensors, the timestamp of the latest measurement, and other information, for example in Figure 9, the source of the data and averaging period which signifies that the value uploaded by the IoT device is an average value of sensor readings over certain time frame.

GETTING STARTED & USER MANUAL

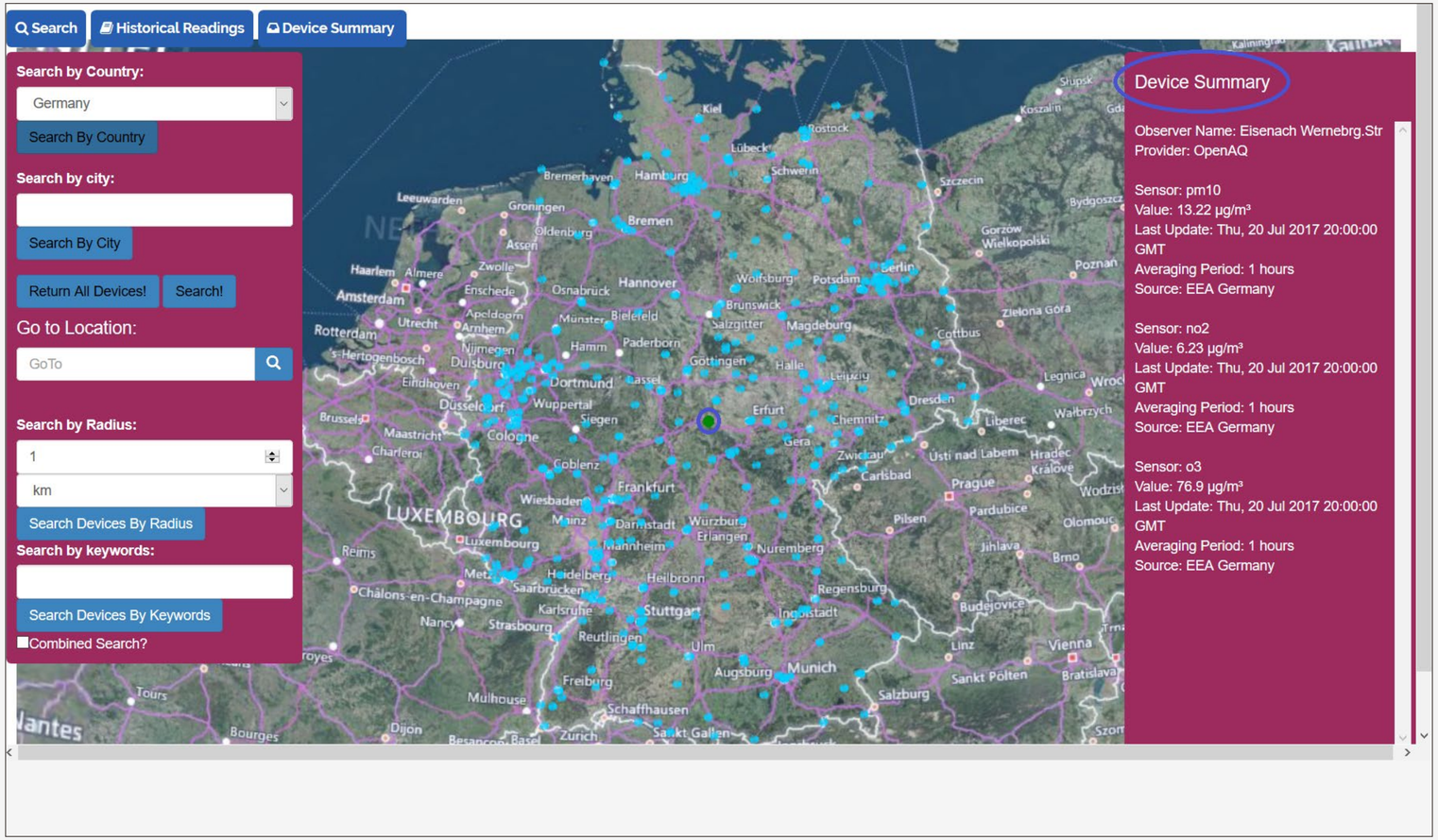


Figure 9. Selected IoT device and its' summary (see blue circles)

GETTING STARTED & USER MANUAL

If desired, the users can observe historical measurements/readings of the selected device. The “Historical Data Readings” section at the left 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), 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 10.

GETTING STARTED & USER MANUAL

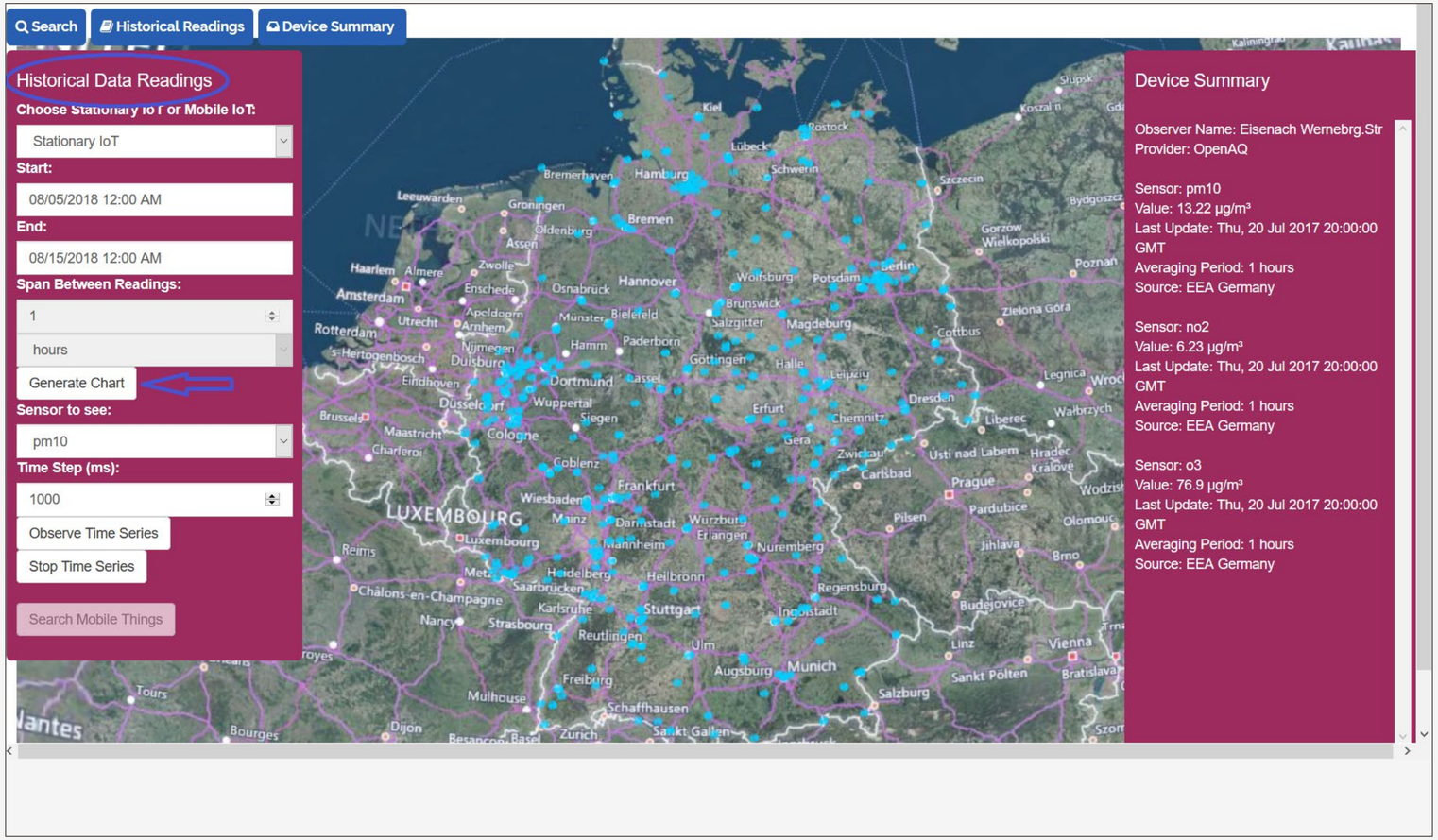


Figure 10. The ”Historical Readings” section at the right side of the app (blue circle) and the “Generate Chart” button (blue arrow)

GETTING STARTED & USER MANUAL

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 will open a new browser window and generate a chart of the sensor readings based on the provided parameters (see Figure 11). 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, or instead generate a CSV file shall they wish to do their own further data analytics through the “Generate and Download CSV” button.

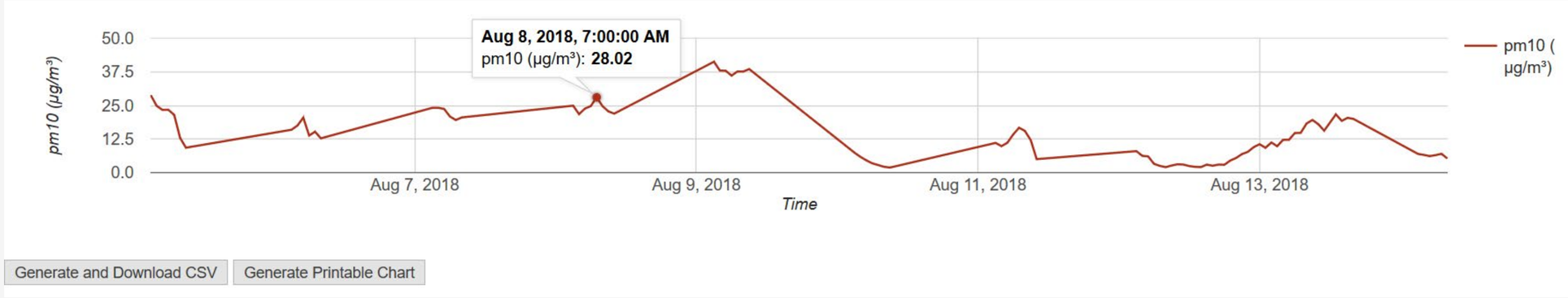


Figure 11. Example of generated 2D chart.

GETTING STARTED & USER MANUAL

Alternatively, other than 2D chart, users can also generate a 3D/4D time series of the sensor readings and visualize them on the WorldWind globe directly. This is made possible using the functions triggered by the click of the button “Observe Time Series” shown in Figure 12. 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 additional parameters of time step which will determine the interval of the sensor reading animation. This parameter is set by the “Time Step (ms)” field, which set the interval in milliseconds (ms) unit.

GETTING STARTED & USER MANUAL

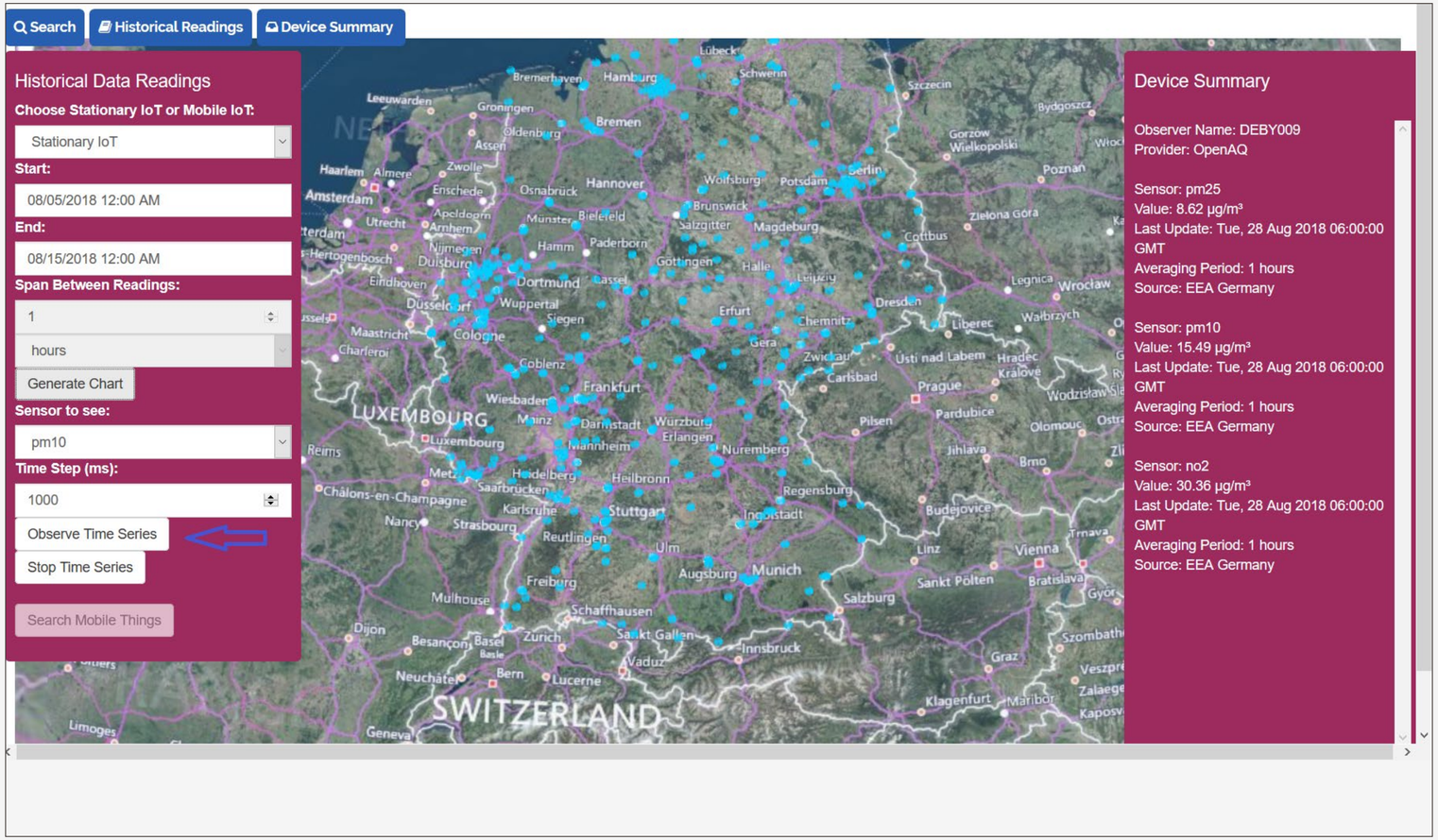


Figure 12. The "Observe Time Series" button to trigger 3D/4D visualization

GETTING STARTED & USER MANUAL

Once the 3D/4D time series generation is triggered by the user, the app will automatically zoom in closer to the location where the IoT device is on the World Wind 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 13. Once the users are satisfied, the visualization can be turned off through by pressing the "Stop Time Series" button pointed by the cyan colored arrow.

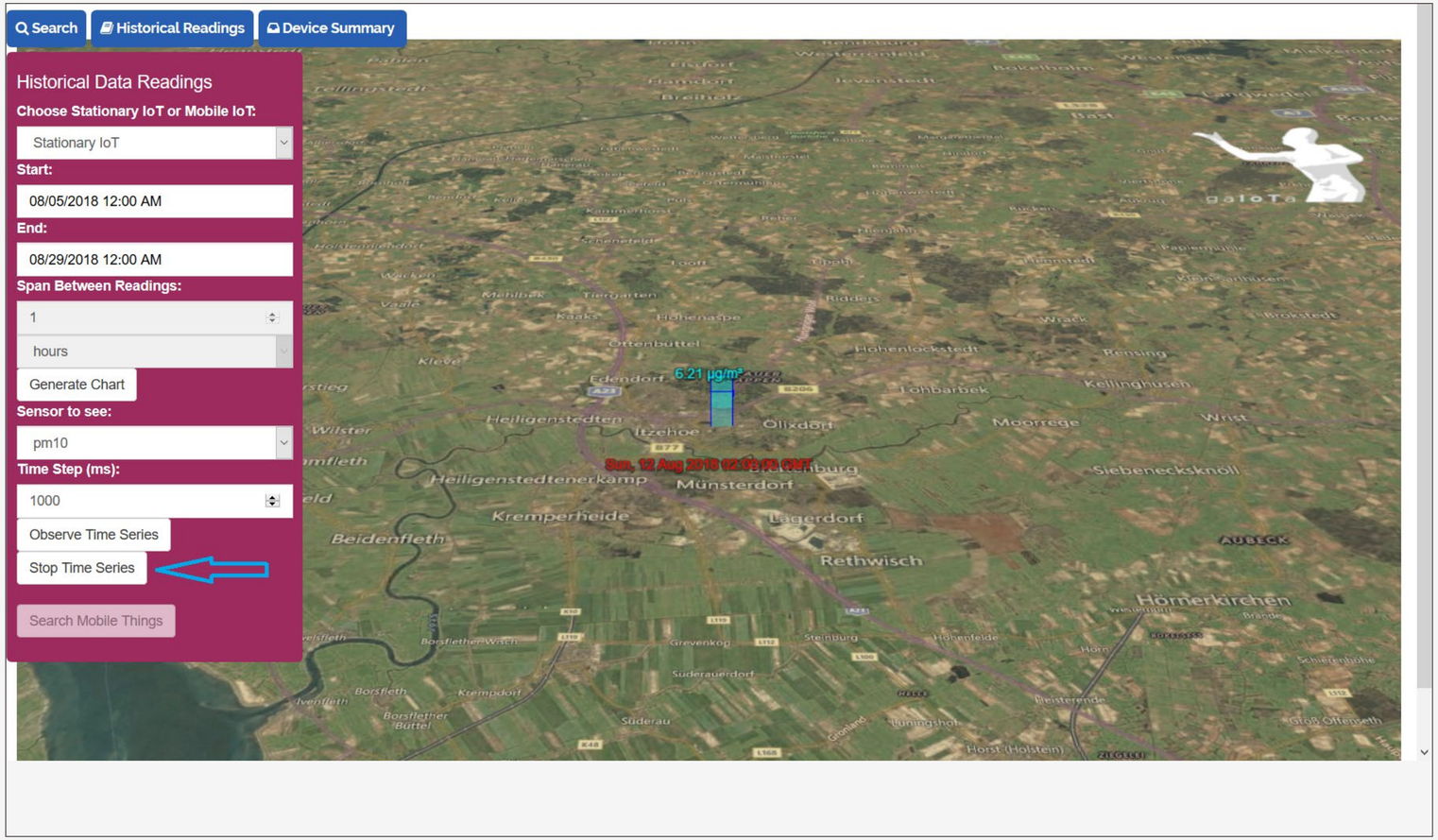


Figure 13. A snapshot of 3D/4D visualization of historical sensor readings.

GETTING STARTED & USER MANUAL

Some of IoT are “mobile”, that they change their geographical location at any point in time. By default, the app shows “Stationary” IoT devices. However, it is also possible to search for “Mobile” IoT devices by choosing the “Mobile IoT” option on the “Choose Stationary IoT or Mobile IoT” dropdown menu (circled by a cyan-colored circle in Figure 14). Due to the total amount of data being visualized can be very large and that the presence of mobile IoT devices changes arbitrarily, initially Mobile IoTs are not shown. The users need to select the range of the time of interest, which is the parameters when the mobile IoT devices and their data are available. Then, once the time range has been provided, users can search for available Mobile IoT data through the “Search Mobile Things” button (pointed by the cyan arrow in Figure 14)

GETTING STARTED & USER MANUAL

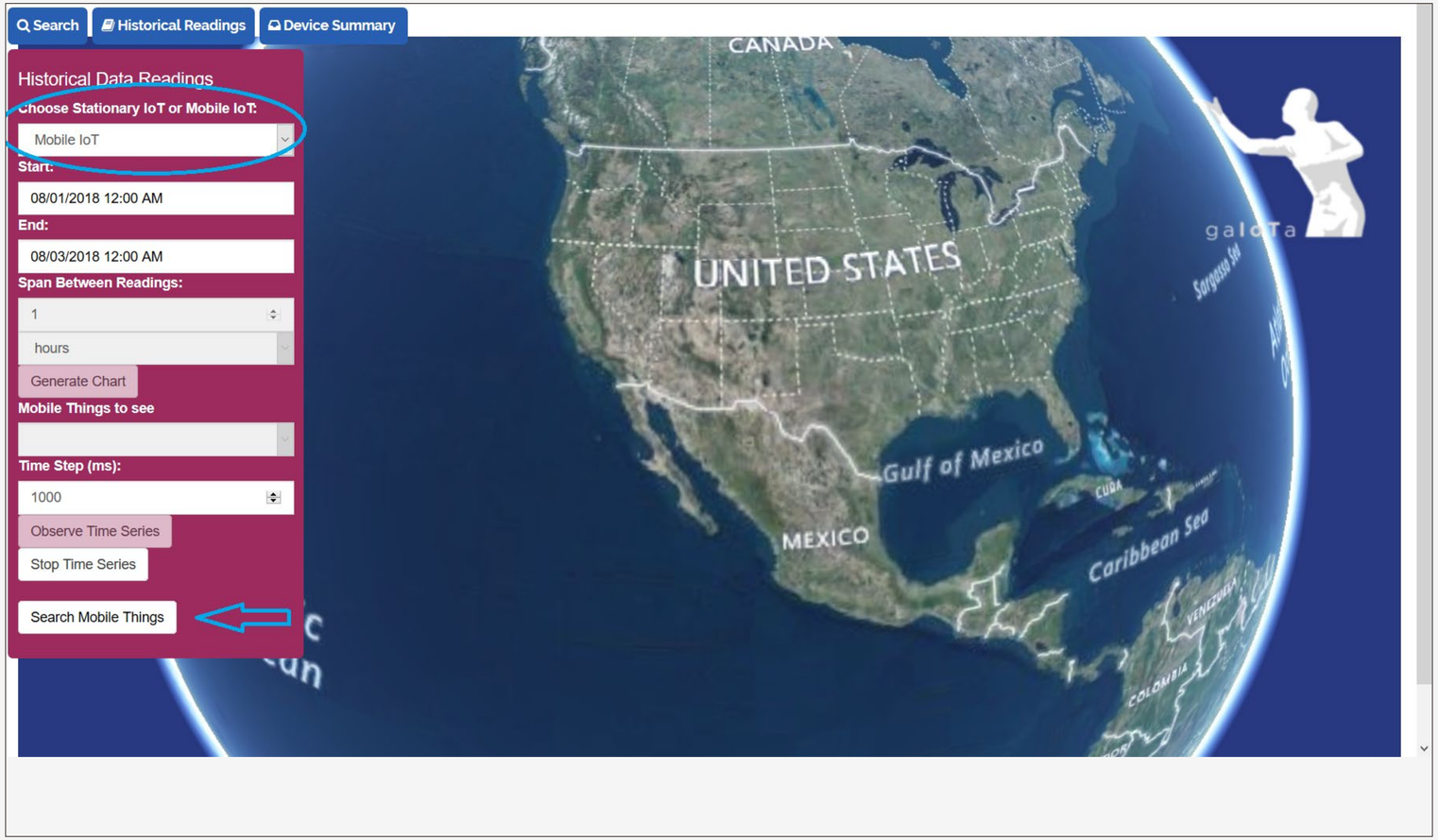


Figure 14. The Stationary and Mobile IoT options and "Search Mobile Things" feature

GETTING STARTED & USER MANUAL

Once the search is completed, the "Mobile Things to see" dropdown menu (pointed by the red arrow) will list all mobile IoT devices (identified by numbers "as-is" due to them being anonymized by the IoT provider) which data become available during the selected time range.

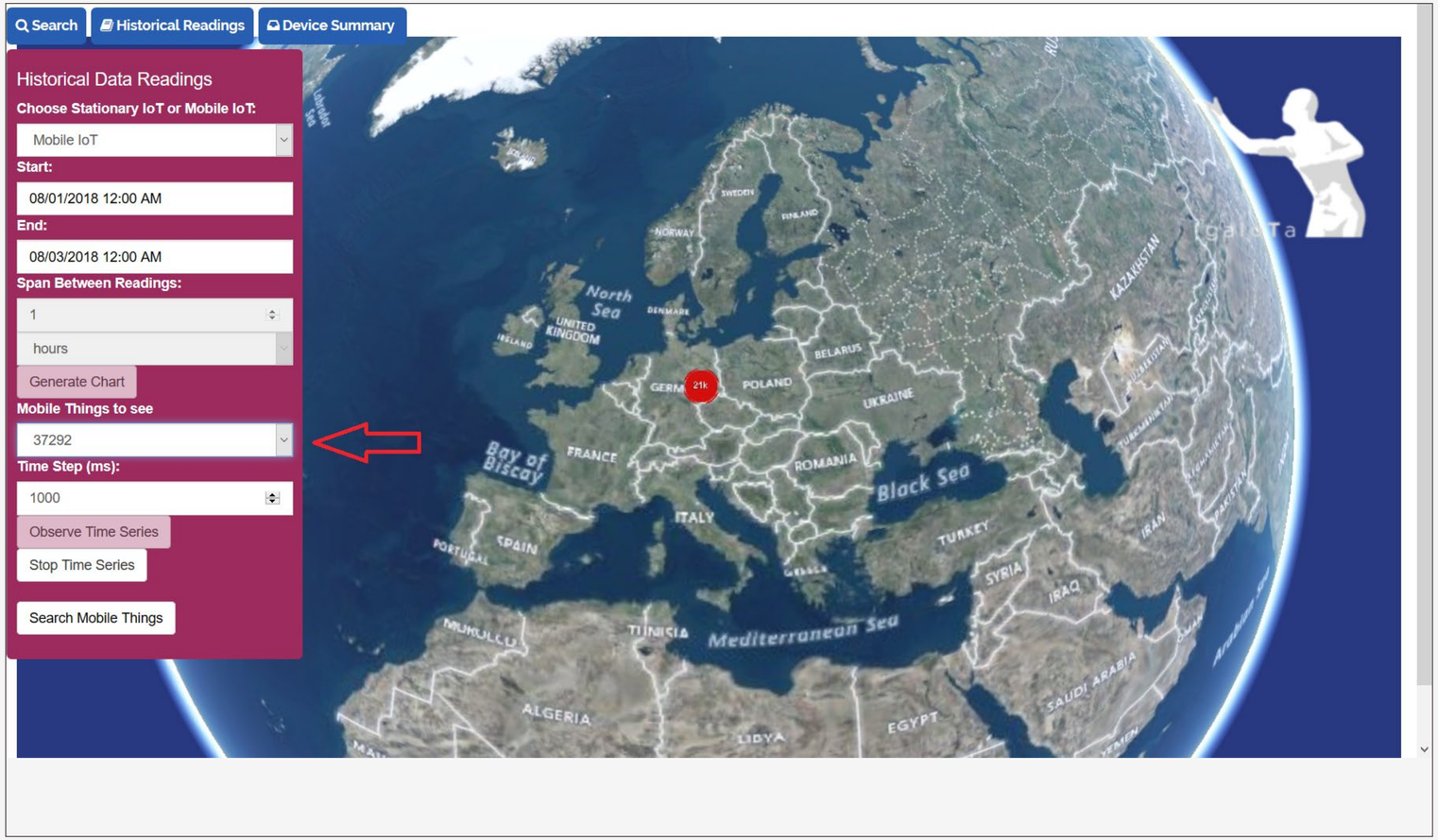


Figure 15. "Mobile IoT" search results

GETTING STARTED & USER MANUAL

Users can select from one of the lists on the “Mobile Things to see” dropdown menu, as seen in the example in Figure 16. In this example, mobile IoT named “37284” located in Frankfurt, Germany was visible during the selected time range and moved around while doing measurement, in this case, nuclear radiation measurement provided by Safecast project.

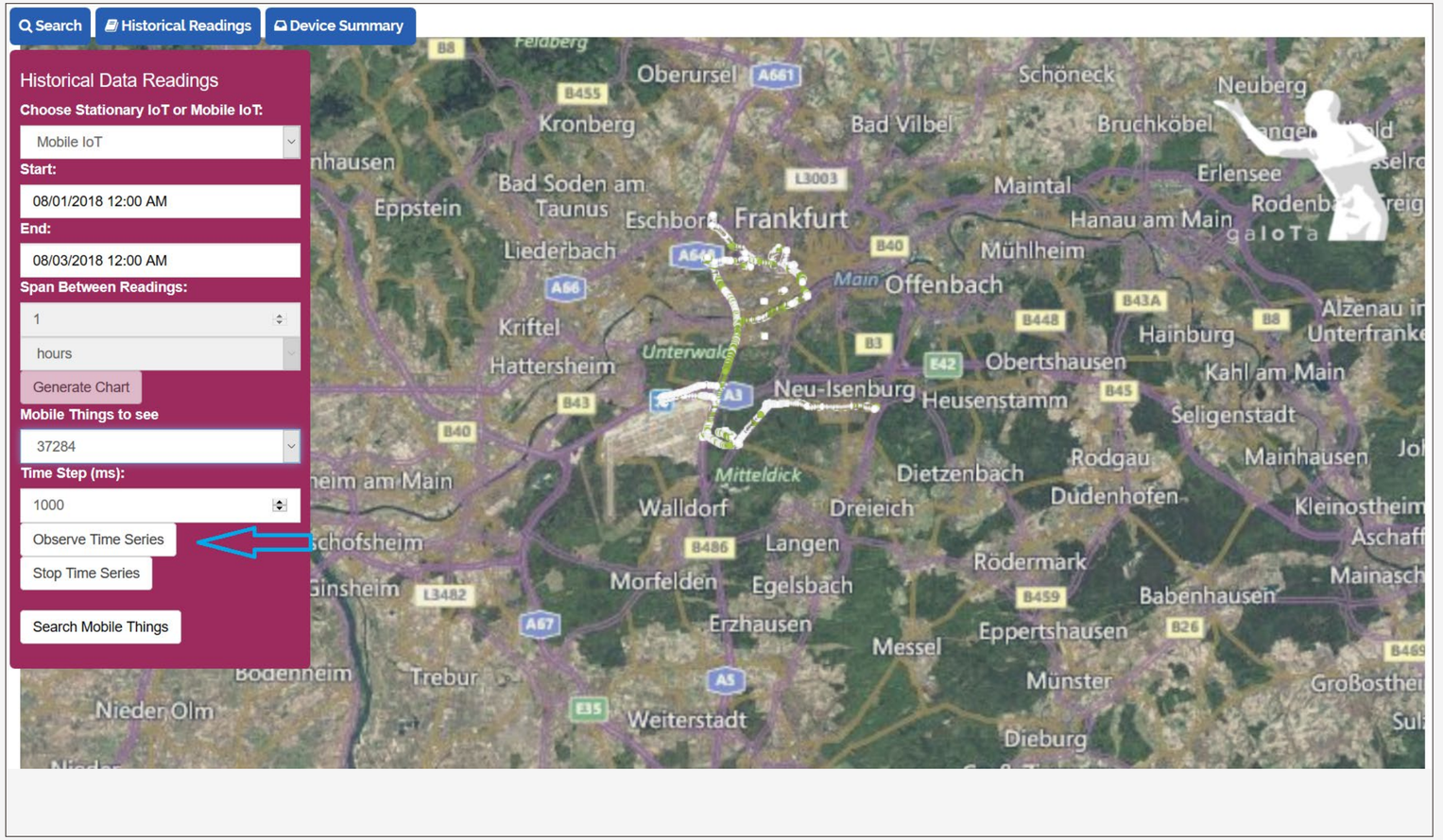


Figure 16. Selected ”Mobile IoT” showing the “track” (historical locations) of where this device has been.

GETTING STARTED & USER MANUAL

The track consists of a group of measurements which can also be accessed individually, as seen in Figure 17.

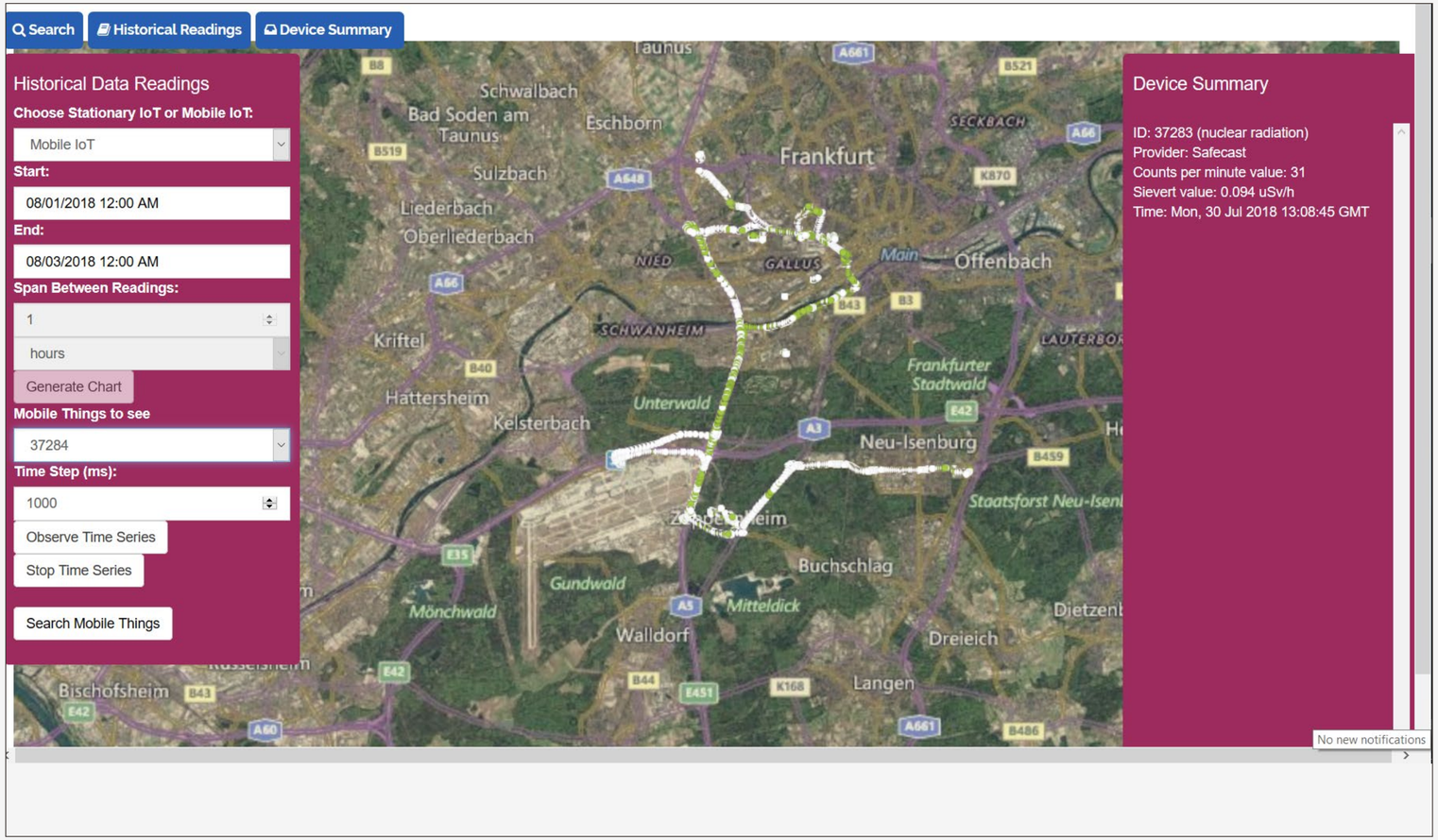


Figure 17. Individual measurement in a track being shown on the Device Summary panel on the right.

GETTING STARTED & USER MANUAL

With the Mobile IoT measurements, it is possible to initiate an animated 4D time series of the historical data (measurements and locations) of the selected mobile IoT. The Time Step parameter can be adjusted as the user wishes (the period of when the next data is shown), however by default, the value is set as 1000 ms (or 1 second). The “Observe Time Series” (pointed by the cyan-colored arrow in Figure 16) button starts the animated 4D time series. A few snapshots showing the example of a 4D time series of the mobile IoT is shown in Figure 18. The data being shown is nuclear radiation measurement, which are measured in count per minute (CPM) and Sievert unit generated by Geiger counter.

GETTING STARTED & USER MANUAL

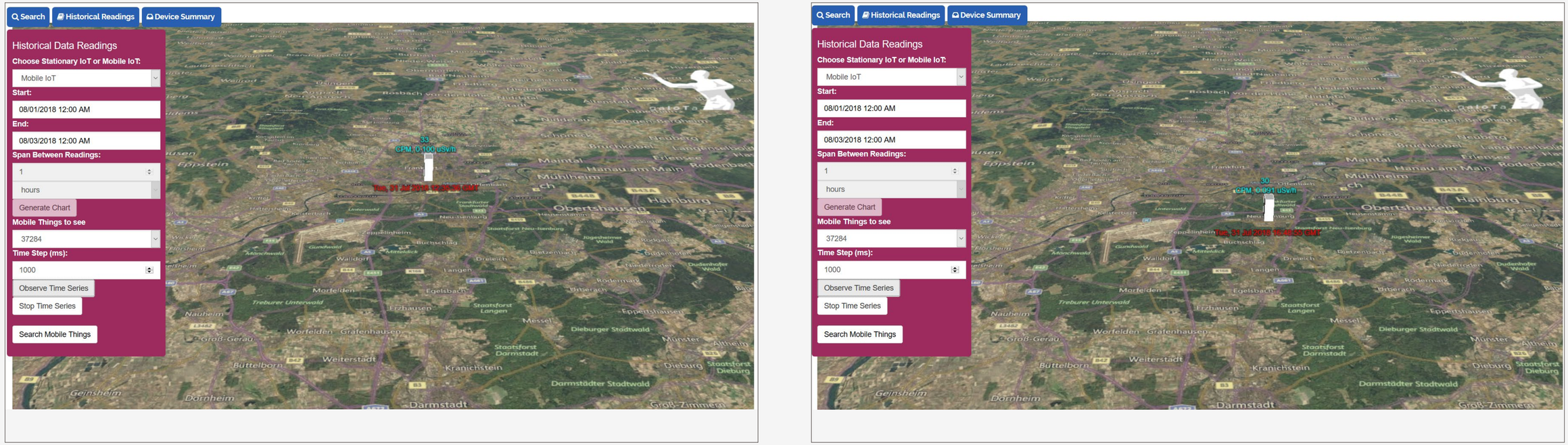


Figure 18. Animated 4D time series of the historical data snapshots (left and right), showing the changes of the device's location over time.

GETTING STARTED & USER MANUAL

Coming back to the Search panel, there are two additional search functions for the “Stationary” IoT, Search by Radius and Search by Keywords. The Search by Radius allows the filtering of IoT devices based on their distance from the center of the globe on the screen. The “Go To Location” search can be used for enhanced use of the Search by Radius, since it moves the globe to the location being entered on the query field. Figure 19 shows a snapshot of a use case example showing the “Search by Radius” function to search for IoT devices located up to 200 km from the city of Paris, France. In this use case example, users can enter “Paris” to the “Go To Location” field (pointed by the yellow arrow in Figure 19). Then, they enter the radius number that they wish and the distance unit (km or m) (pointed by green arrow), and finally click the “Search By Radius” button (pointed by orange arrow).

GETTING STARTED & USER MANUAL

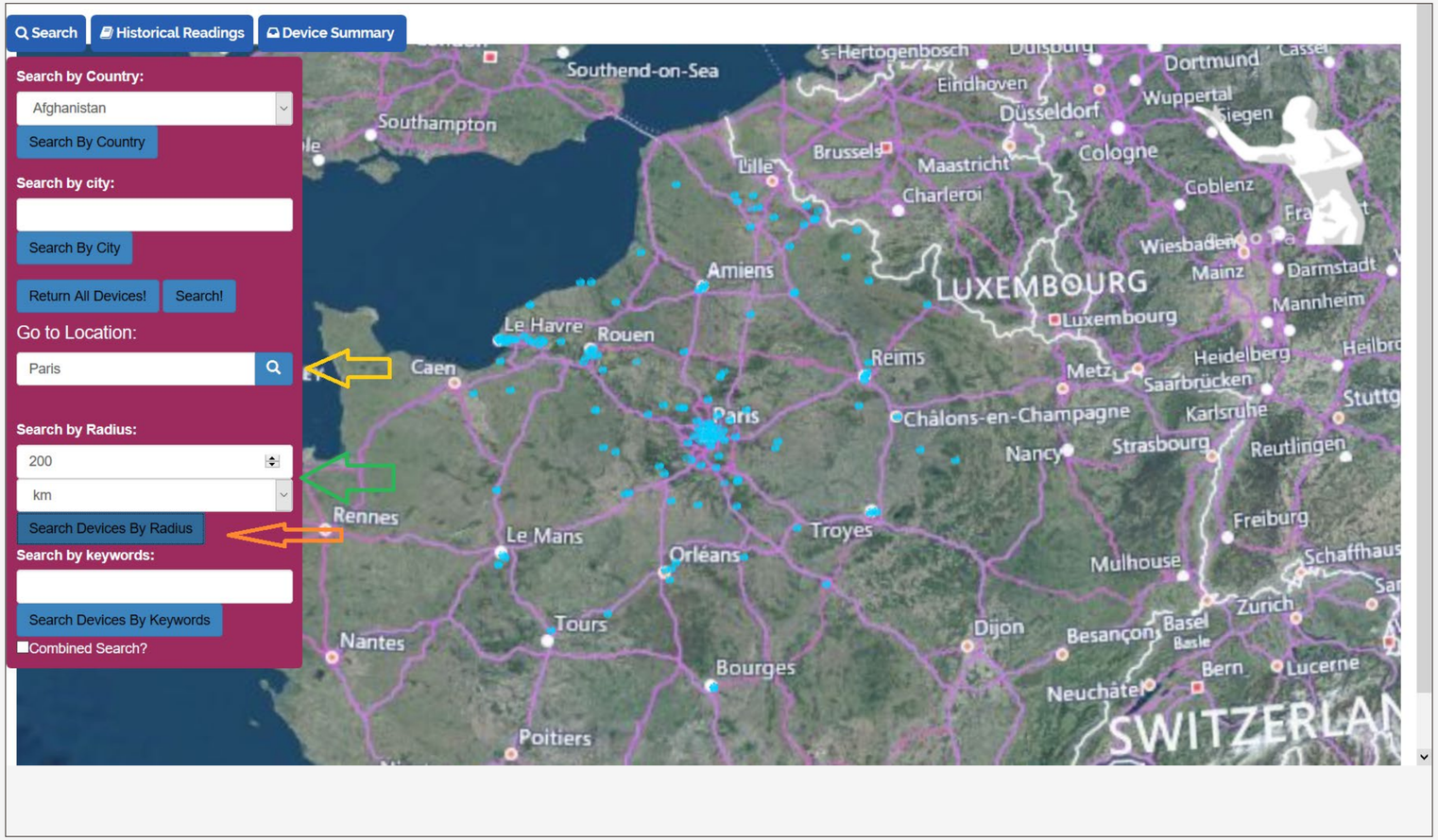


Figure 19. Search By Radius use case example to search for IoT devices 200 km around the city of Paris, France

GETTING STARTED & USER MANUAL

Meanwhile, the “Search By Keywords” is comparably simpler. Users only need to enter the keyword they wish to the “Search by keywords” field. An example of the use of Search By Keywords is shown in Figure 20. In this example, user puts in the keyword “temperature” in the field pointed by orange arrow and clicks the “Search By Keywords” button pointed by the green arrow. The app shows all the IoT devices relevant/related to the keyword “temperature”.

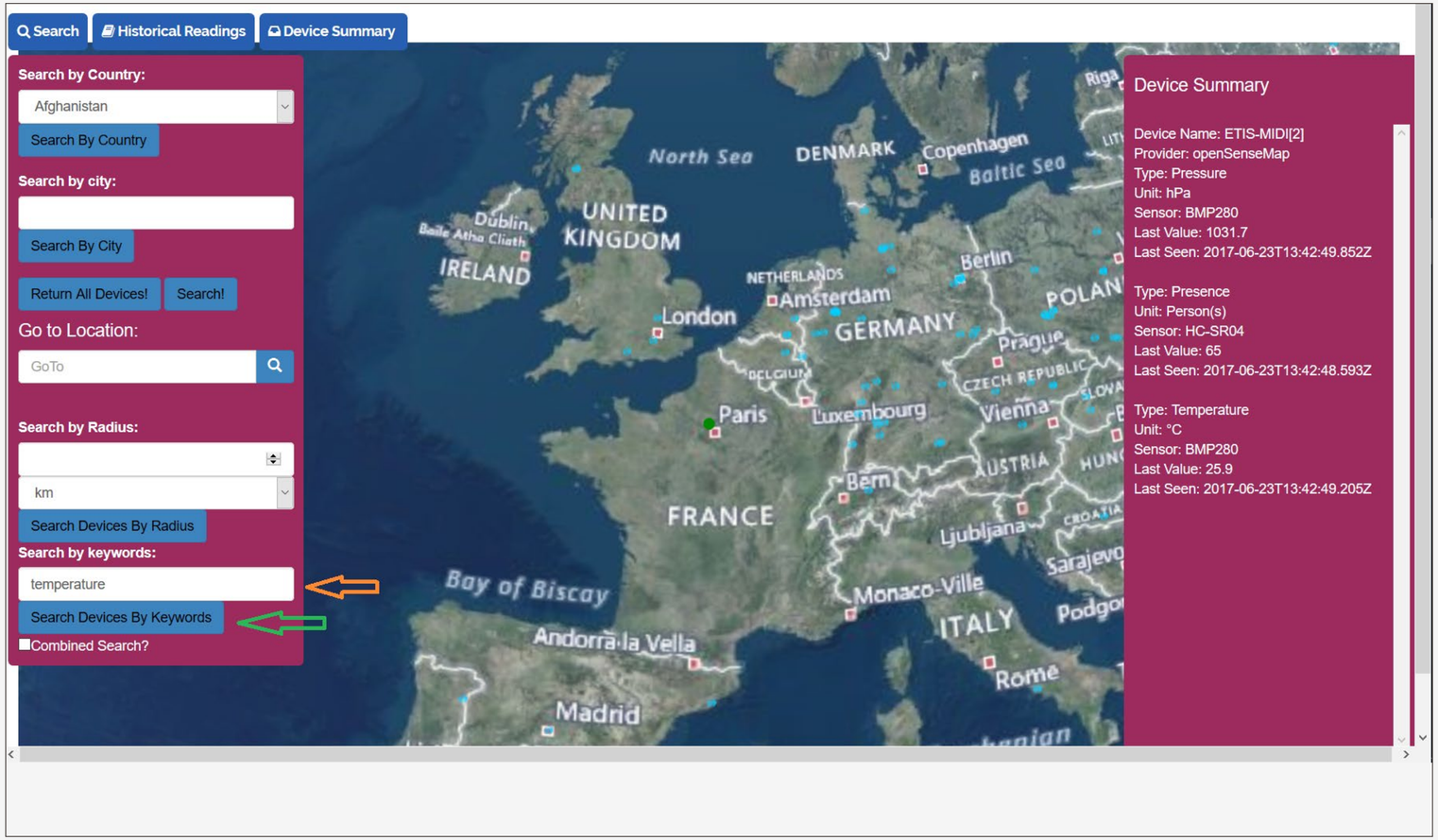


Figure 20. Search By Keywords use case example to search for IoT devices relevant to the keyword “temperature”

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
- UK Environment Agency: http://environment.data.gov.uk/index.html
- Safecast : https://blog.safecast.org/
- Barcelona City Council : http://ajuntament.barcelona.cat/imi/en

  and the list is growing!

Other resources

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

BUSINESS MODEL CANVAS

KEY PARTNERS

1. **Open source API for IoT data platform**
   - Thingful
   - Thingspeak
   - Specific fields of IoT data sites
2. **Public sectors**
   - Public organizations
   - NGO's
   - Academy
3. **Media**
4. **Service providers related to IoT industry**

KEY ACTIVITIES

- Building algorithm for search engine
- Connect with open source API IoT platforms
- Data analytics
- Web app interface
- IoT community exposal

KEY RESOURCES

- Open source API IoT data
- Domain & hosting
- Team & supporters

VALUE PROPOSITION

gaIOTa enables internet users to find and make use of massive available IoT data around the world via:

- Search & access to IoT data from different open API sources
- Request for IoT data alerts
- Connect with data providers

CUSTOMER RELATIONSHIPS

- GaIoTa Newsletter
- Forum discussion & users engagement
- Online discussion
- User involvement in continuous development
- Short tutoring video
- IoT news

CHANNELS

- IoT communities in social media & forums
- Start-up communities & events
- Partnership channels

CUSTOMER SEGMENTS

1. **Researchers**
   - Data scientists
   - Engineers
   - Academia
2. **Businesses**
   - Data-driven business
   - Innovators
   - Corporates, SME, Start-ups
3. **Explorers**
   - Students
   - Travelers
   - Whoever

COST STRUCTURE

Labor costs
Infrastructures including domain, hosting & other online services
Community outreach activities

REVENUE STREAMS

Short-term: Idea Competition prize - Sponsors - Fundraising
Long-term: IoT Data trading - IoT scientists, IoT outsourcing match making - advertisement

SUSTAINABILITY

SUSTAINABILITY TRANSITIONS IN IOT

GaIoTa 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 gaIoTa 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, gaIoTa 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 gaIoTa 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, gaIoTa 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 values are within gaIoTa's team culture. We aim to create a positive impact and we believe that the platform such as gaIoTa 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.

GaIoTa 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 actitivies:

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.

Impact ecosystem

Aalto-based team wants to solve global challenges with access to Internet of Things data

A new application called galoTa has a mission: to provide access to open Internet of Things data all around the globe. The app developed by Aalto-based team is one of the six finalists in The World Challenge to be held on August 27-30 in Helsinki.

A multidisciplinary team of Aalto Master students, Postdoc and an artist has been busy during the summer. The team has been developing a new search tool for the Internet of Things, and the result is an application called galoTa. It enables users to find public and open IoT devices and data based on the geographical location and other

Recent News

Recruitment

Open Position: Project Specialist

The Project Specialist will be responsible for the coordination of the Strengthening problem-based learning in South Asian Universities (PBL South Asia) project funded by Erasmus+ Capacity Building in Higher Education programme. PBL South Asia will be coordinated by Aalto University's Aalto Global Impact (AGI) and implemented in collaboration with 10 partner higher education institutions Read more >

https://aaltoglobalimpact.org/aalto-based-team-wants-to-solve-global-challenges-with-access-to-internet-of-things-data/

TEAM MEMBERS

Mcha Khamis

Software Developer

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

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

Web development, UI Design

Viktorija Piaulokaite

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

REFERENCE

https://github.com/WorldWindLabs/WorldWeather/wiki

http://aworldbridge.com/real-time-projects/nasa-europa-challenge/nasa-europa-challenge-2016/esp-station-documentation.html

https://www.scribd.com/document/355804752/FarmsNTech#from_embed

https://ogcaisproject.github.io/OGCAISproject.github.io/OGC%20Testbed%2013%20-%20Client%20Use%20Summary.pdf

https://github.com/GabrielePrestifilippo/MuViAS#muvias

GaIoTa
2018