Water UNDERGROUND

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Information Technology Trust

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‘Water Underground’

One of the 4 best innovative technology solutions

in the category of ‘Climate Change’

in the region of Europe

(2020 Call for Code competition)

Dr. Mavroforakis Michail, CTO

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The Issue : Water Sustainability Problem

- Water, a precious natural resource essential to life, is being drastically impacted by climate change.
- Irrational use affects the availability of underground waters
- Over-pumping, fertilizers and other types of pollution gradually and steadily deteriorate water quality.
- Lack of information and awareness on underground waters sustainability
- Climate Change

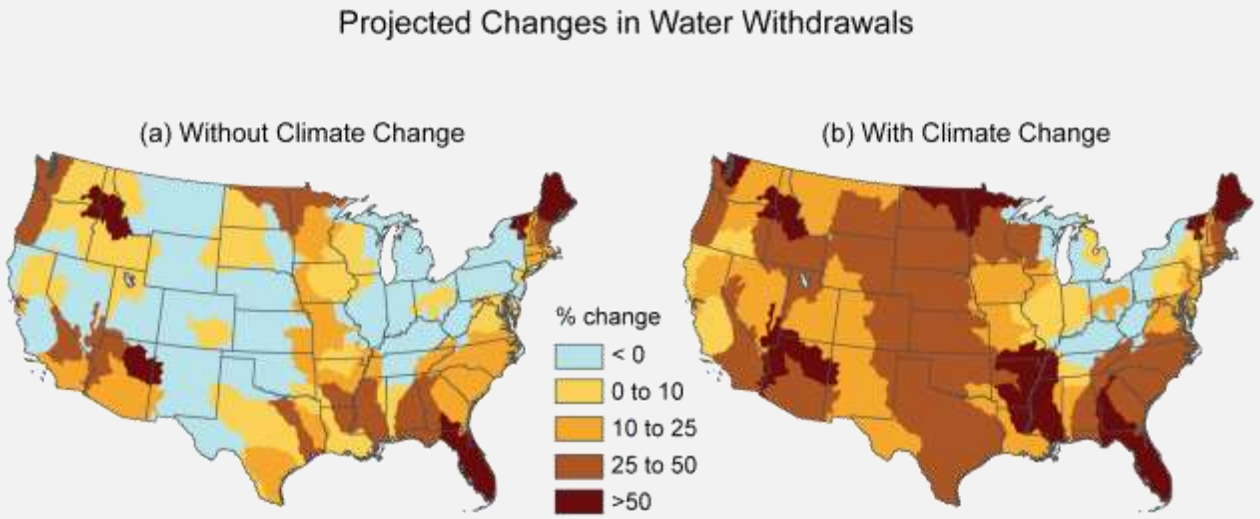
Climate Change and Water

- Higher temperatures and more extreme, less predictable, weather conditions are projected to affect and deteriorate water quality.
- As of 2019, 12% of the world population drinks water from unimproved and unsafe sources. (United Nations, 2020)
- Climate change is projected to increase the number of water-stressed regions. (United Nations, 2020)
- Scientists, farmers and the business community consider ‘extreme weather events’, as one of the most likely production risks over the next ten years (WEF, 2015).

Climate Change and Water

- Rising sea levels are causing fresh water to become salty.
  Source: https://www.unicef.org/stories/water-and-climate-change-10-things-you-should-know

- Climate change will change how we use water and how much we need. Higher temperatures and evaporation rates could increase the demand for water in many areas.
  Source: https://blogs.ei.columbia.edu/2019/09/23/climate-change-impacts-water/

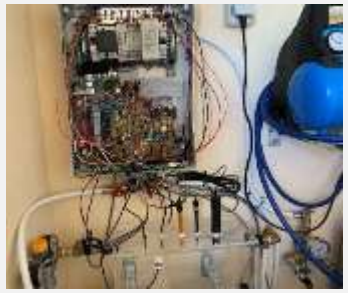


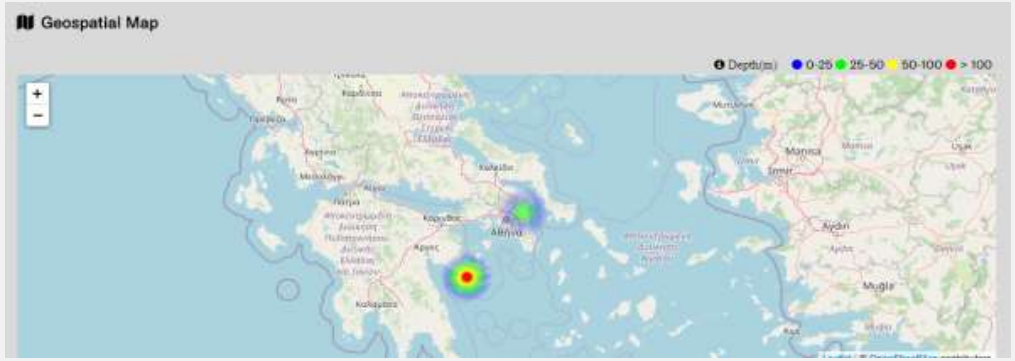
- Maps show % change from 2005 to 2060 in projected demand for water assuming (a) change in population and socioeconomic conditions, and (b) combined changes in population, socioeconomic conditions, **and climate**.

Source: Brown et al. 2013, via NCA

The Solution : **‘Water Underground’**

- A combination of h/w and s/w providing real-time monitoring information, trends of the quality and quantity of underground waters with relevant map representation.





- Using IBM Cloud services and Machine Learning technologies, as well as specifically designed IoT devices, InTTrust built an integrated solution.

- https://visualiot.eu-gb.cf.appdomain.cloud/

Top European ranking for ‘Water Underground’

A platform empowered by InTTrust

‘Water Underground’ platform by InTTrust has been ranked **among the 4 best solutions** in the category of ‘Climate Change’ **in the region of Europe**
https://developer.ibm.com/callforcode/2020-solutions/

2020 Call For Code Competition:
A global celebration of tech for good

- The Call for Code initiative is the largest tech for a good initiative of its kind
- 400,000+ Innovators participated since Call for Code began in 2018
- 179 nations contributed to create 15,000+ apps for humanitarian issues

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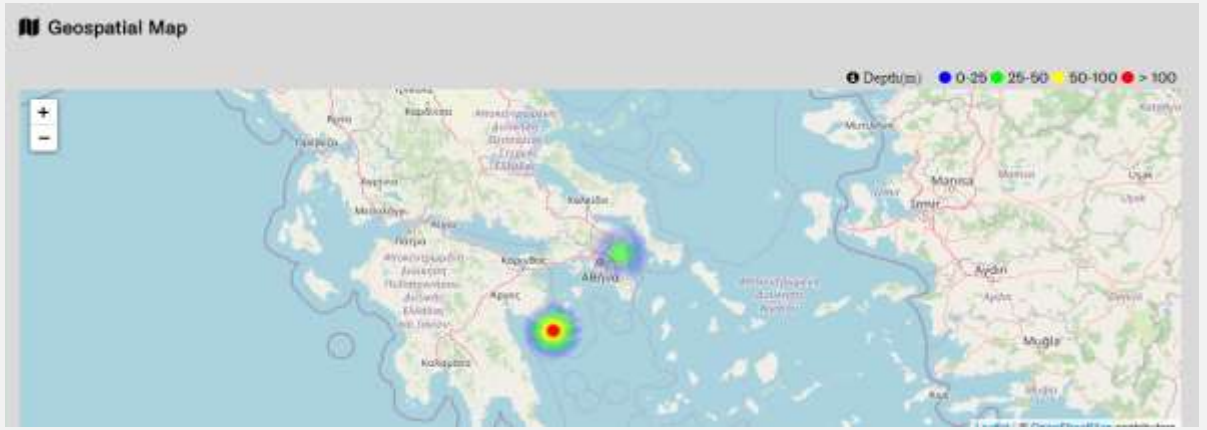
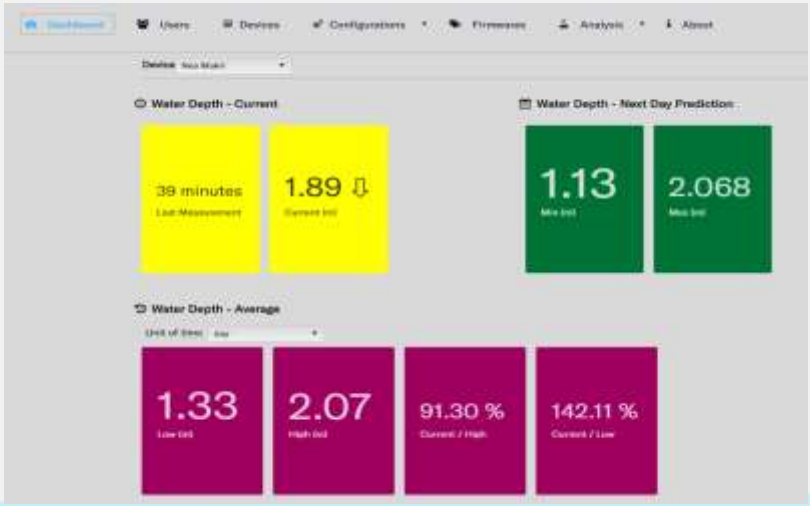
Solution Components (h/w – s/w)





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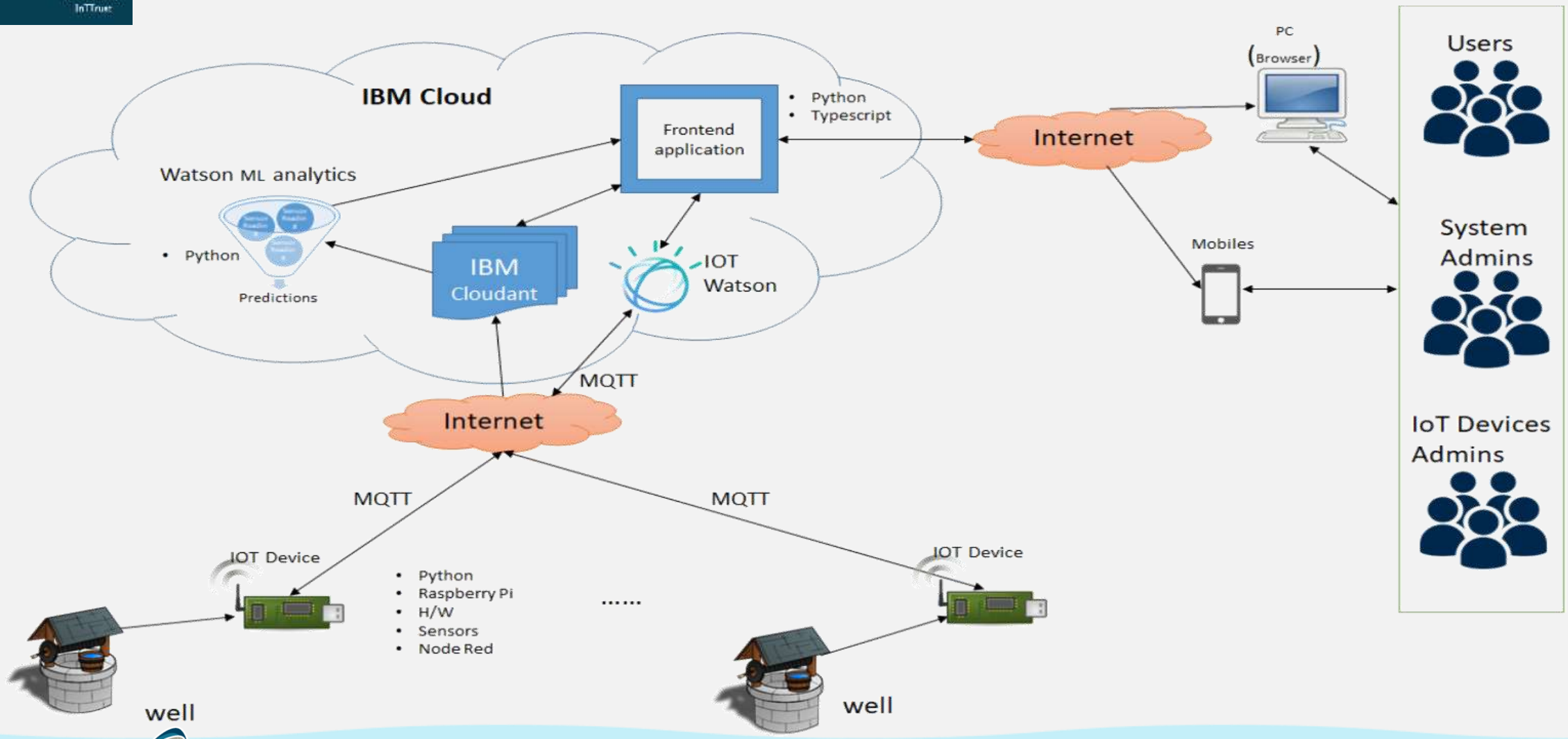
Solution Architecture

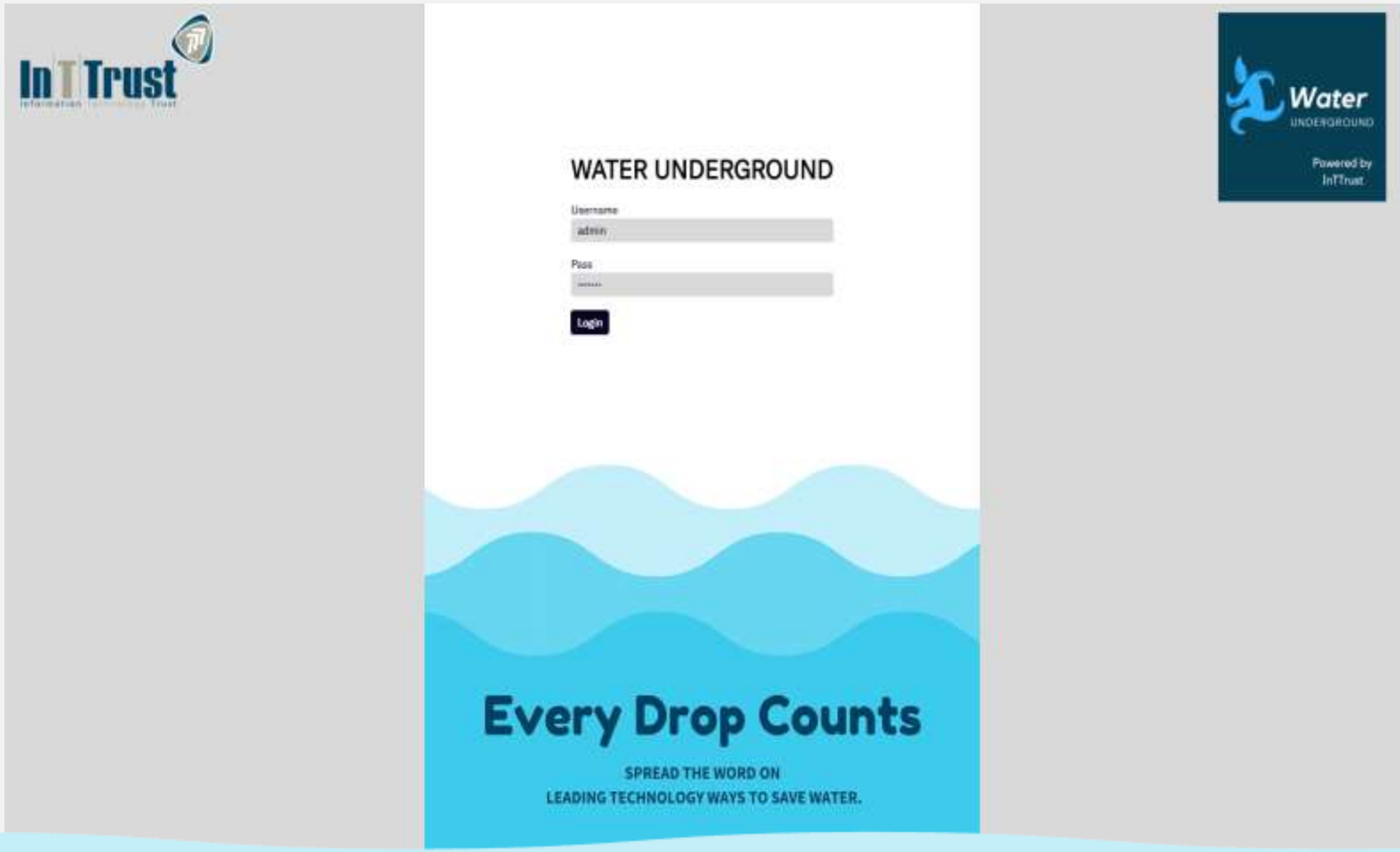


Functionality

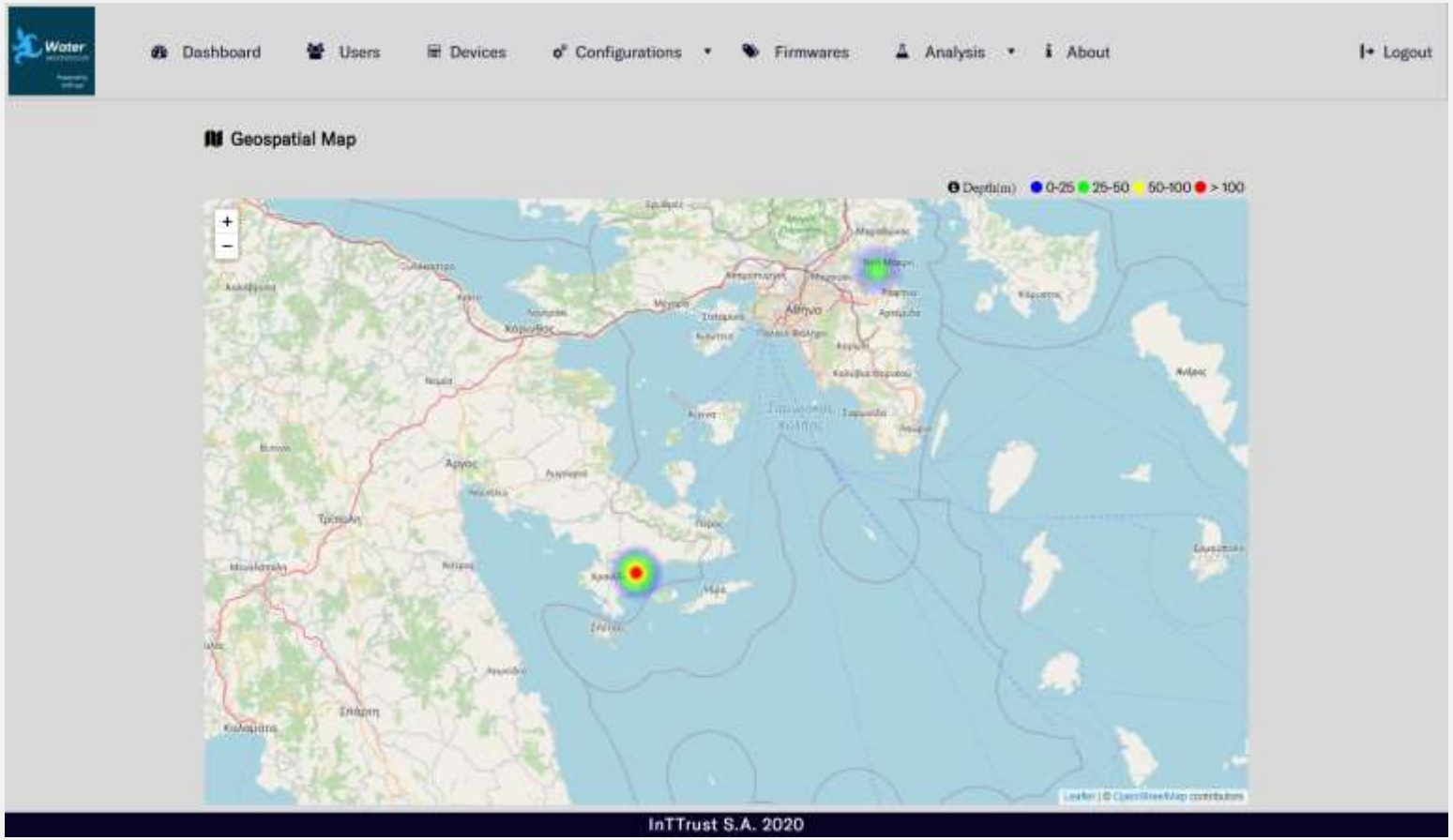
- User roles
- Map representation
- Dashboard - Metrics
  - Depth
  - Prediction
  - Trends
  - Statistics
  - Quality
- Time Analysis
  - Water level graph from sea/surface
  - Water height
- Configuration
  - Application, System, Device
- Remote IoT Device Updates

User Roles

- Provision for 3 user roles
  - System Admins
  - IoT Device(s) Admins
  - End Users – Viewers of selected data

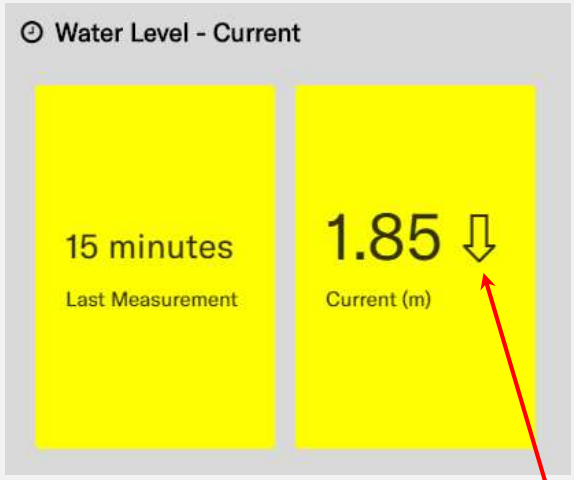


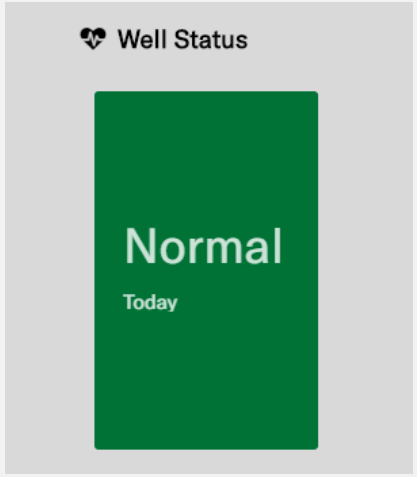
Map Representation

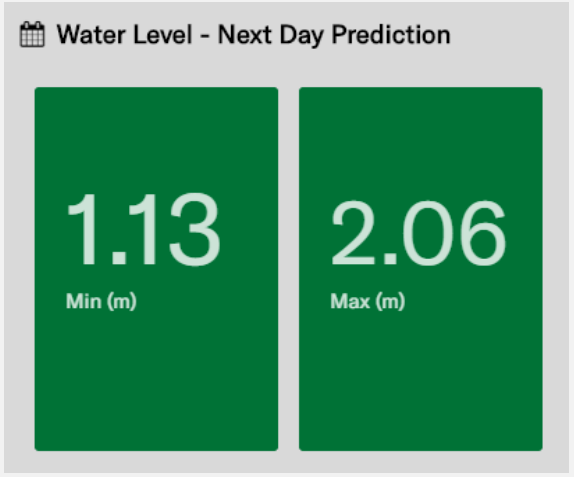


- Mapping of wells that are monitored
- Color based representation of underground water level

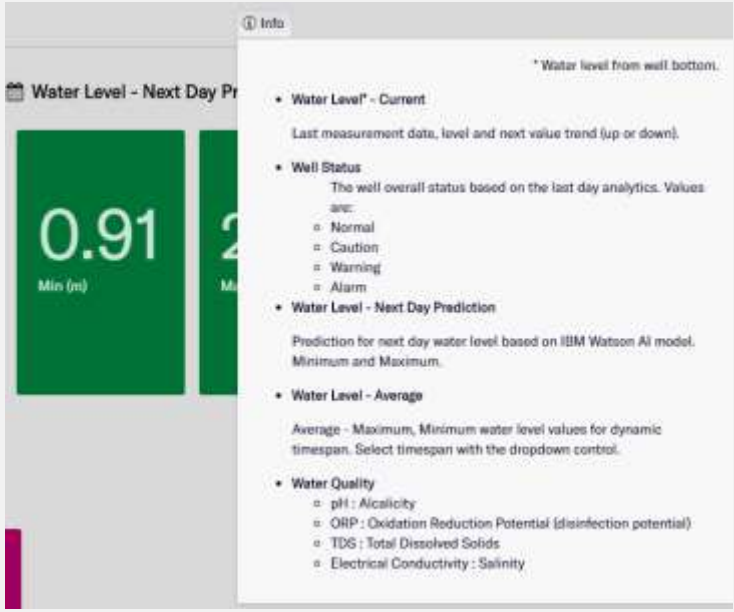
Dashboard – Water Level Metrics / Predictions



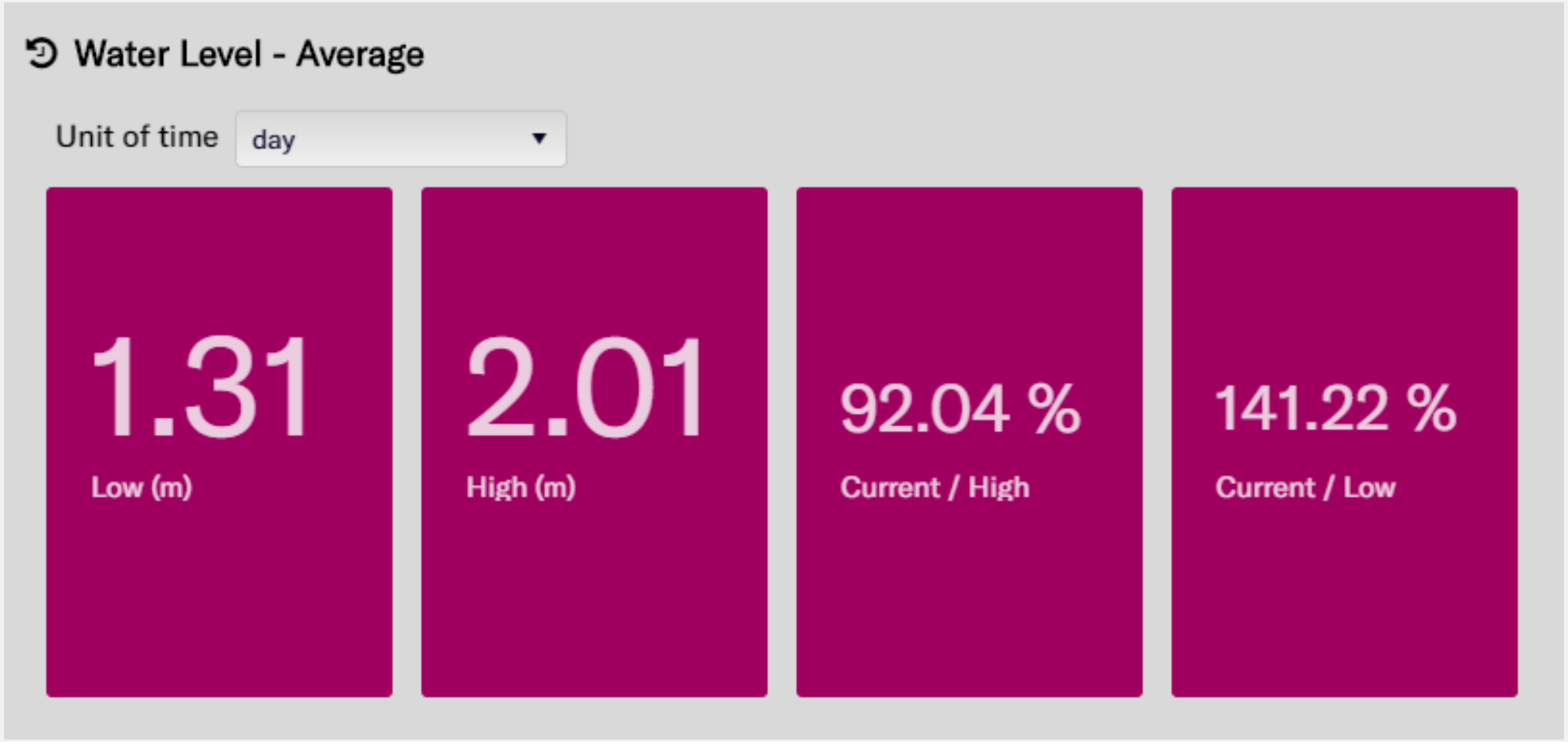




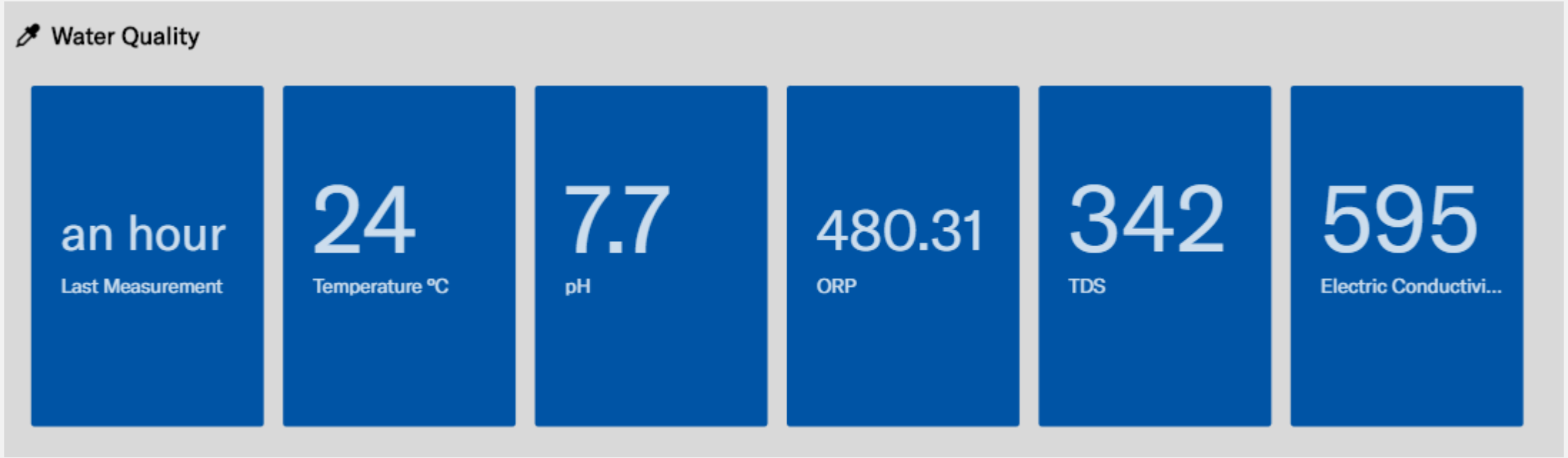
Future Trend



Dashboard – Water Level Statistics

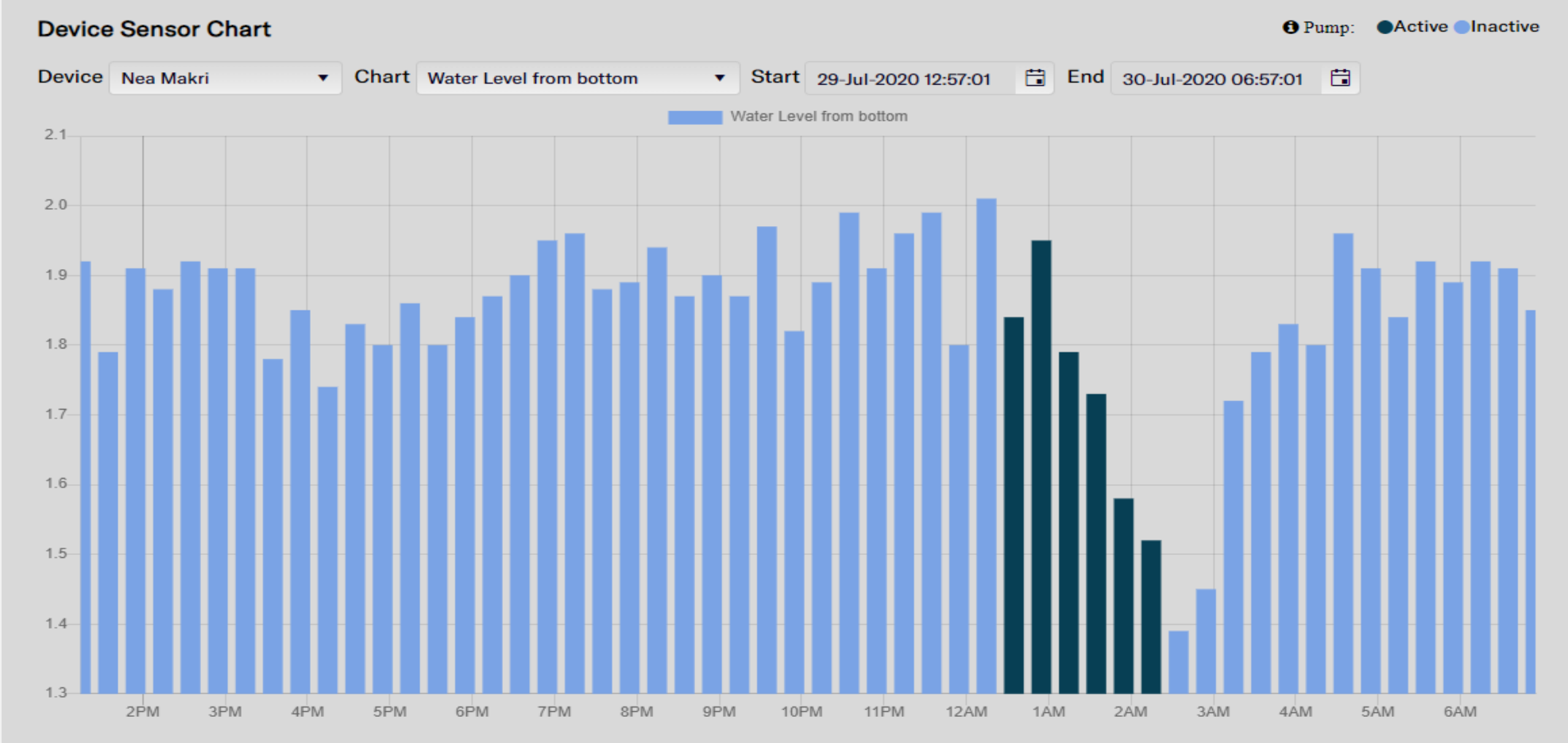


Dashboard – Water Quality Metrics



- pH : Alcalicity
- ORP : Oxidation Reduction Potential (disinfection potential)
- TDS : Total Dissolved Solids
- Electrical Conductivity : Salinity

Time Analysis – Water Level, Pumping Status



User controlled configuration

default hardware configuration

Name: **default hardware configuration**

Airline depth: **1**

Well depth: **8**

Airline pressure sensor installed: **false**

Airline compressor installed: **false**

Water pum current sensor installed: **false**

Environment sensor BME680 installed: **false**

Water flow sensor installed: **false**

Water temperature sensor installed: **false**

Water pH sensor installed: **false**

Water EC sensor installed: **false**

Water TDS sensor installed: **false**

Water ORP sensor installed: **false**

default system configuration

Name: **default system configuration**

Status checking interval: **2**

Pressure threshold: **0.1**

Volts threshold: **0.01**

Pressure offset: **0**

Volts offset: **0**

default application configuration

Name: **default application configuration**

Counts: **500**

Checks: **30**

Samples test: **5**

Samp time: **0.3**

Periodic AC use interval: **40**

Depth measurement interval: **10**

Pump off AC use interval: **20**

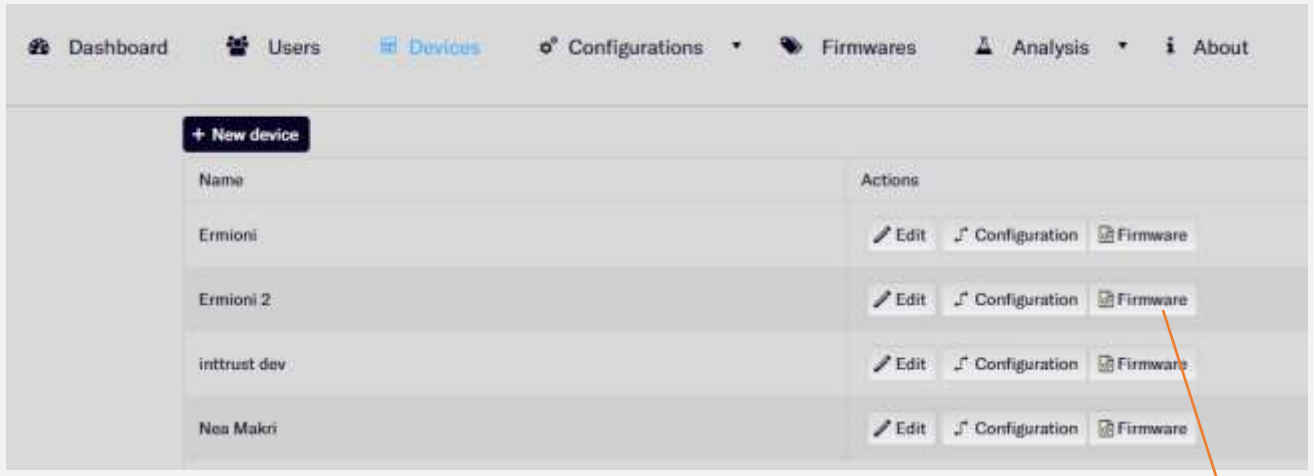
Samples quality: **8**

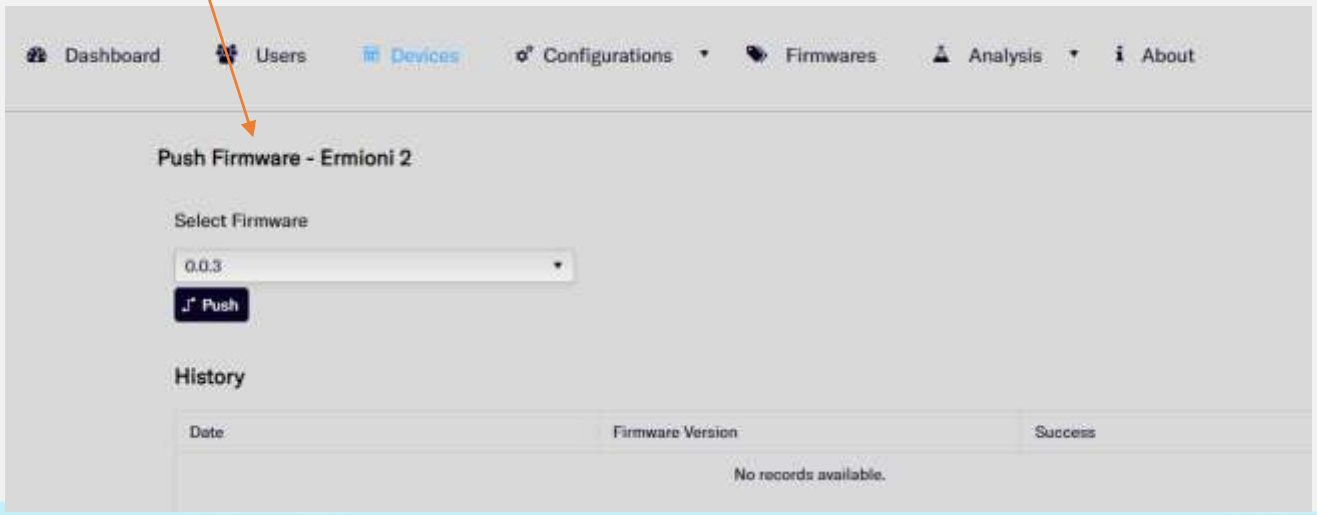
Power samples: **7**

Schedule:

- 00:00:00 - 23:59:59

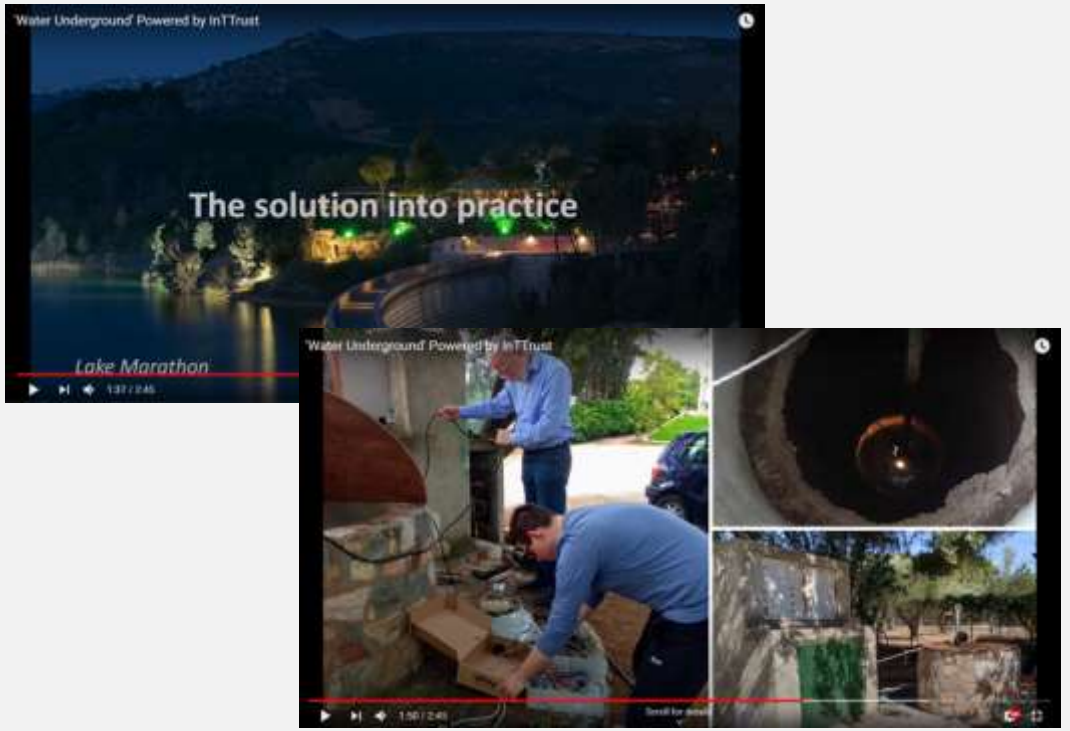
Remote IoT Device Updates





Use case – Historic Municipality of Marathon

- Municipality area : 222.75 km^2
- Municipality Population : 33,423
- Municipality Mayor : Stergios Tsirkas



- 4 wells - Depths : 45m – 163m

Stergios Tsirkas, Mayor : *"The 'Water Underground' solution enables us to have real-time data on the quality, quantity and future trends of our underground water resources"*

Benefits

- A systematic, continuous, on-line and real-time monitoring of the quality and quantity properties of underground waters
- Map representation of underground waters
- Modeling the behavior of underground waters under user action, in local area
- Modeling the emptying/refilling rate of the well
- Prediction of the behavior of underground waters under usage
- Alarming and alerting for unusual well usage and quality issues
- Information publically available to any device for any user (upon municipality consent)
- Underground water resources management optimization
- Awareness for underground water resources sustainability

Next Steps

- Combine data from neighboring wells to derive wide area predictions, warnings and alerts
- Further utilization of AI technology to provide suggestions for more rational and efficient underground water usage
- Combine underground water data with environmental data

  (rainfalls etc.)

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Because…

Every Drop Counts