Powering the
IoT Revolution

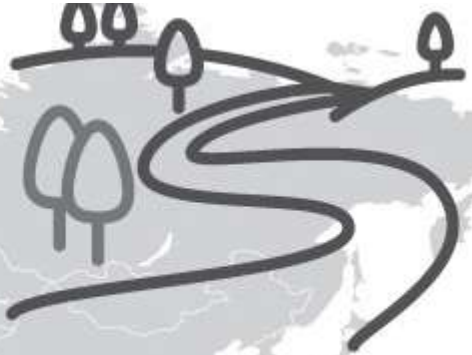
Drones, Sensors and Blockchain

libelium

Some Facts and Figures

- More than 25% of the fresh water in the world is located in Russia.
- More than 50% of this water does not meet sanitary standards.
- More than 10 Mpeople in Russia do not have access to quality drinking water.
- Less than 8% of the wastewater is correctly treated .

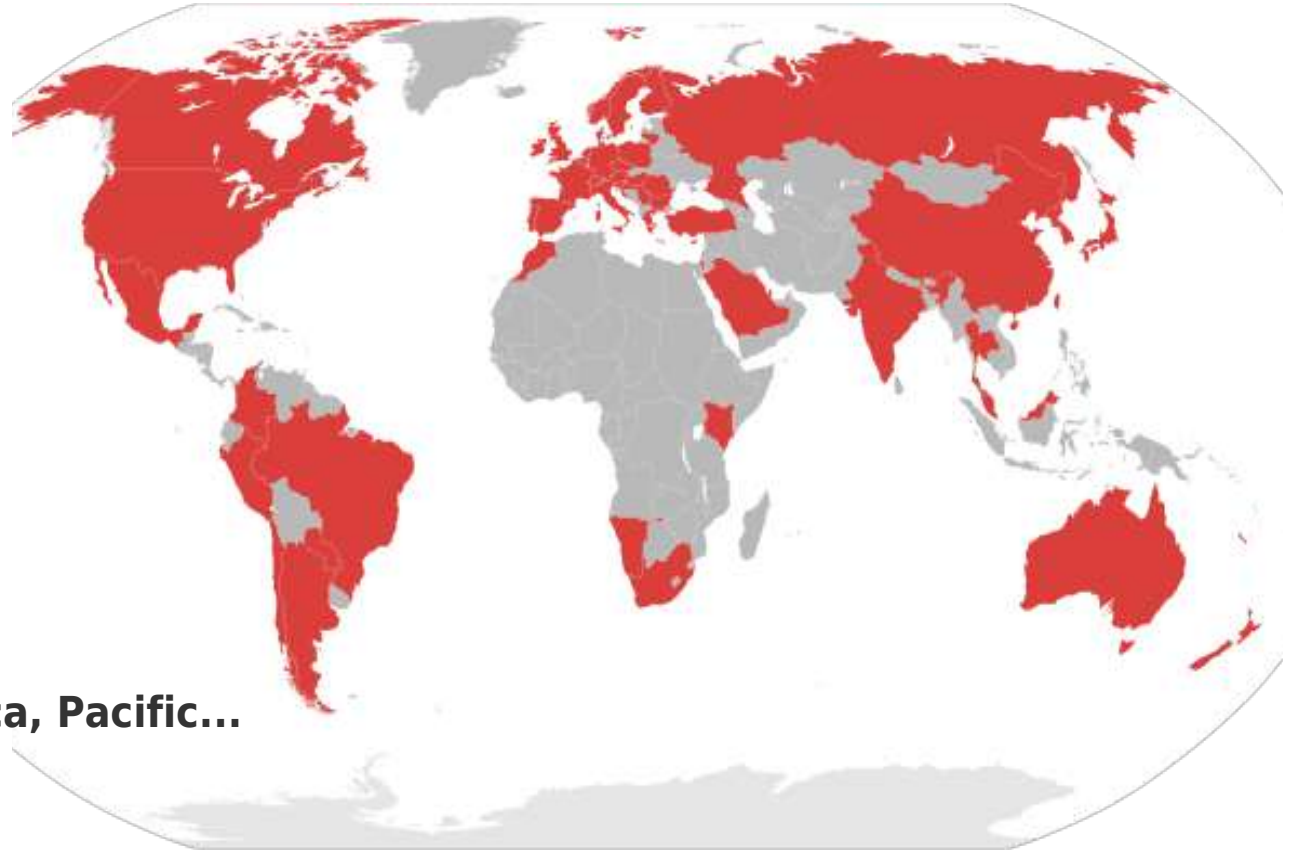
The project.



Kuybyshev Reservoir.
Monitoring: temperature, pH, dissolved oxygen, water conductivity, Ions: NH4+, NO3-...

Libelium overview
Quick numbers

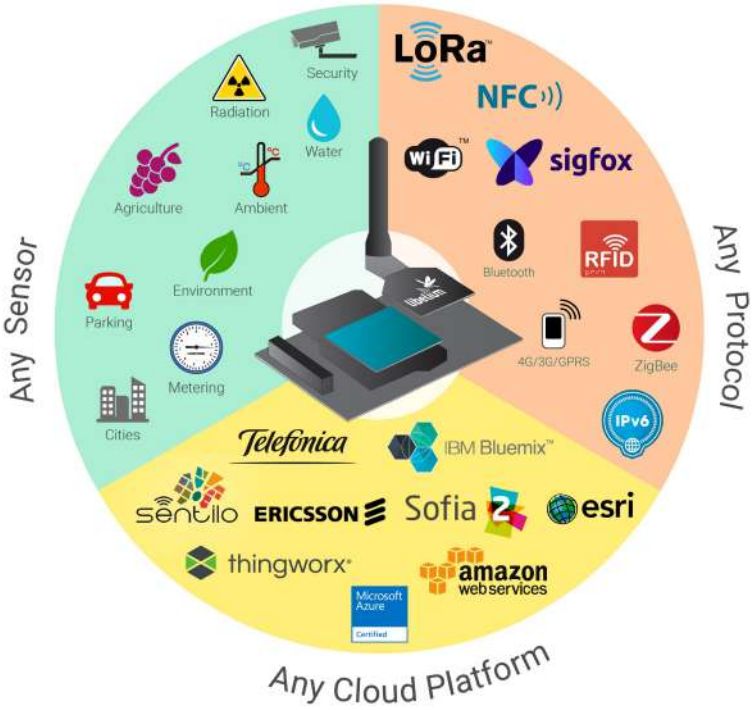
- **Founded 2006.**
- **IoT is our only business.**
- **Customers +120 countries.**
- **90 partners worldwide.**
- **44 distributors in**
- **America, Europe, Asia, Africa, Pacific...**



Libelium's Technology

- **Connect any sensor**
- **Using any communication protocol**
- **To any cloud platform**

Libelium main target: Interoperability!!!



Waspmote, Meshlium and Plug & Sense!

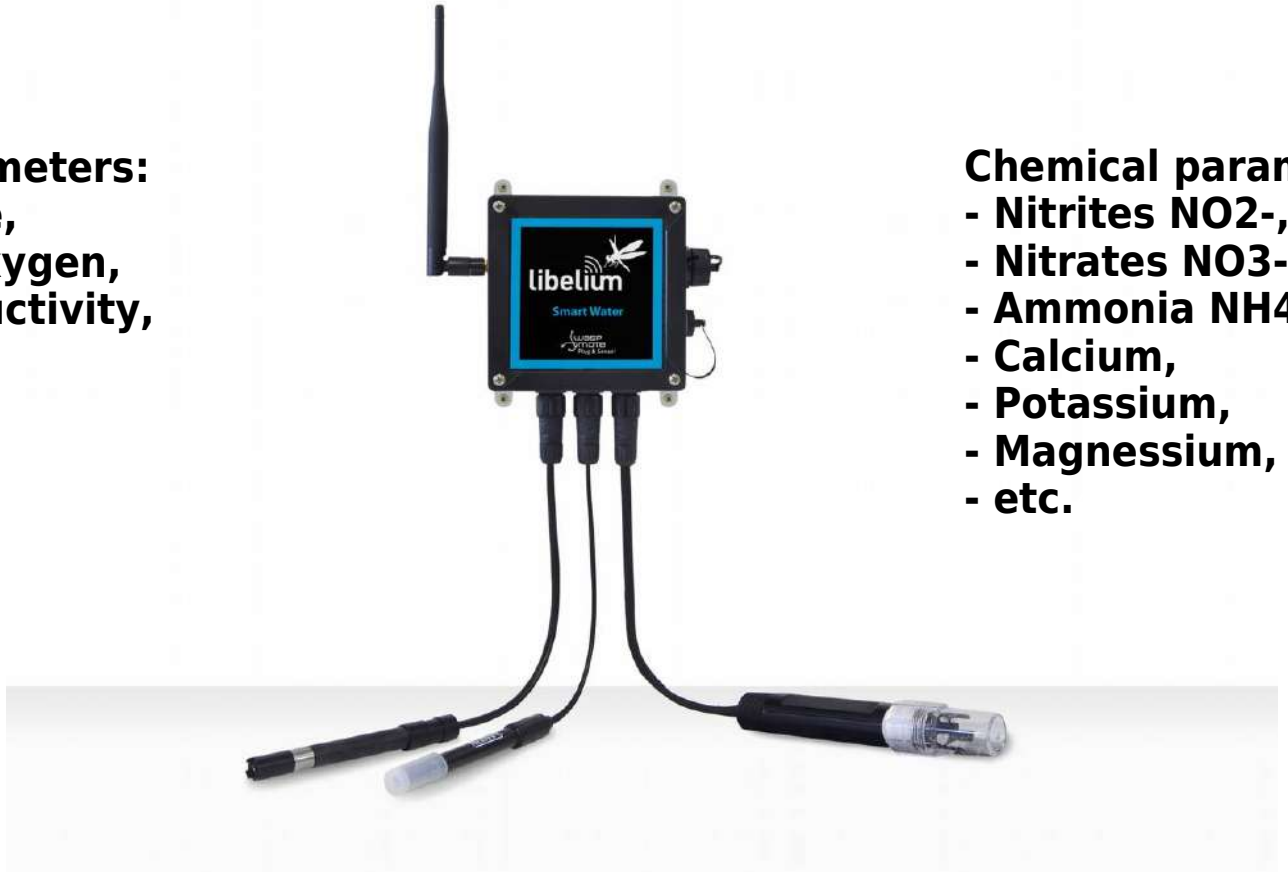
New IoT sensor platform worldwide certified

Plug & Sense!

meshLium

Libelium's experience.

Physical parameters:
- **Temperature,**
- **Dissolved Oxygen,**
- **Electroconductivity,**
- **pH,**
- **ORP,**
- **Turbidity.**



Chemical parameters:
- **Nitrites NO2-,**
- **Nitrates NO3-,**
- **Ammonia NH4,**
- **Calcium,**
- **Potassium,**
- **Magnessium,**
- **etc.**

Smart Water Xtreme.

- Higher accuracy,
- Top level sensors,
- Lower maintenance and calibration,
- New parameters (TSS, etc)
- Best performance even in salted water.

Libelium's Advantages

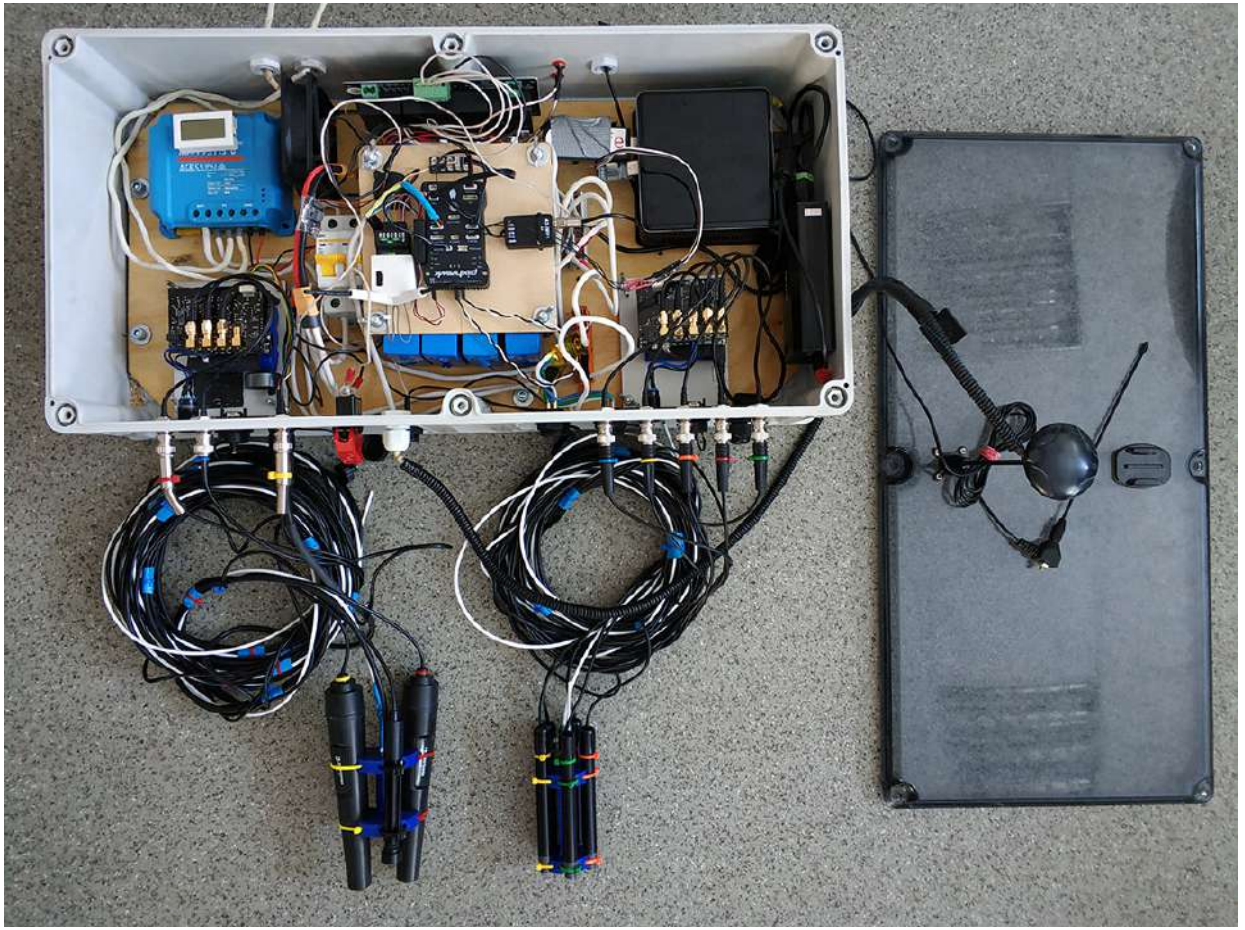
- **Flexibility,**

- **Quick development,**

- **Completeness,**

- **Good ratio**

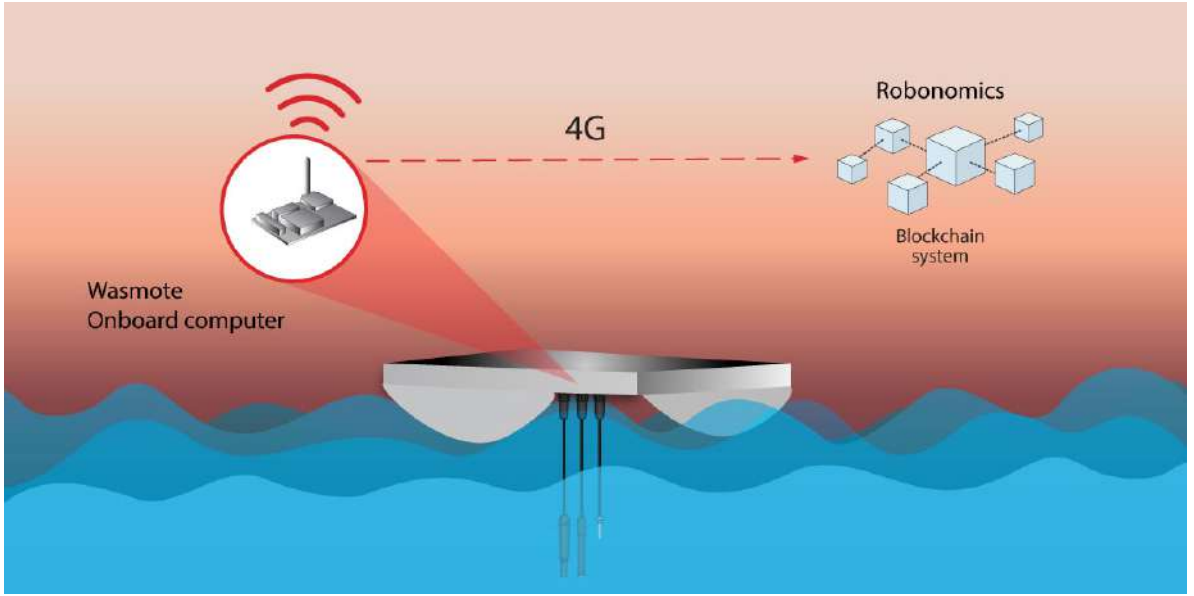
  Accuracy / Cost



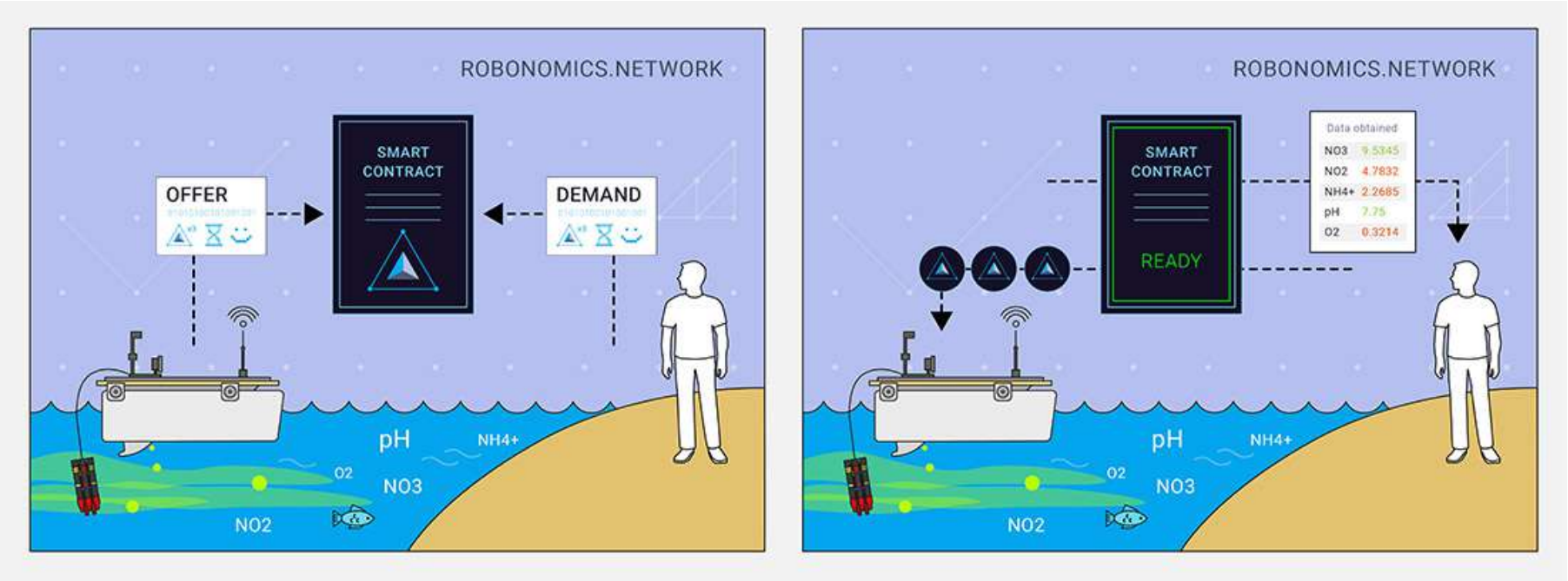
Aqua Drone

Aqua-Drone in the Volga

Airalab Rus, Smart IoT distribution and Tolyatti University Solar Team designed a solar-and-battery-powered water drone able to navigate the reservoir measuring water quality parameters in different points.



Robonomics platform



ROBONOMICS.NETWORK

Drones, Sensors And Blockchain For Water Quality Control In The Volga River To Promote Transparency

AIRA

DCZD TECH

ITMO UNIVERSITY

About me

- PhD and Associate Professor at ITMO University
- 8 years, Head of the Robot Engineering Department, ITMO robotics
- 3 years, Head of the regional group of IOT-OPEN.EU Erasmus+ program
- World Robot Olympiad (WRO) regular judge
- Robocup@Work team coach
- Robotics MOOC author for EdX
- Since 2015, co-founder of Airalab and Drone Employee projects

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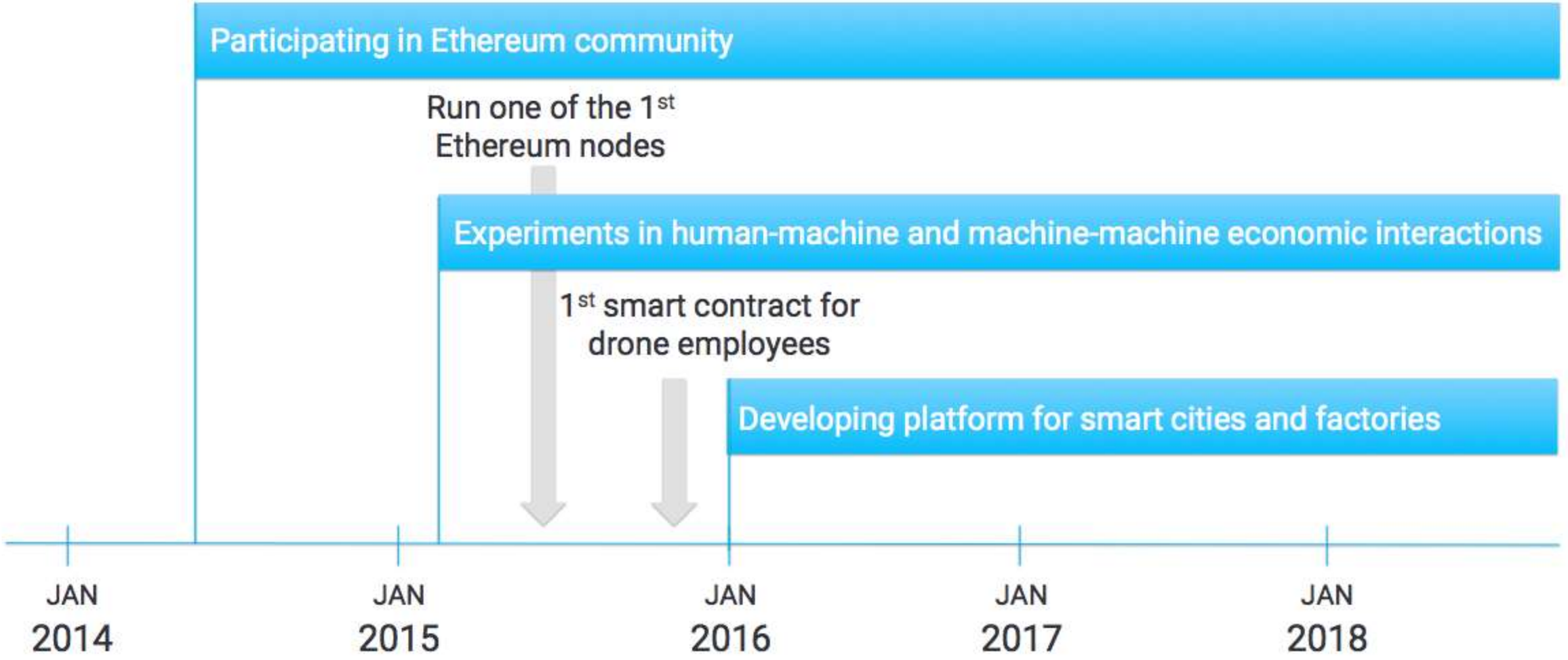
AIRA

Airalab team



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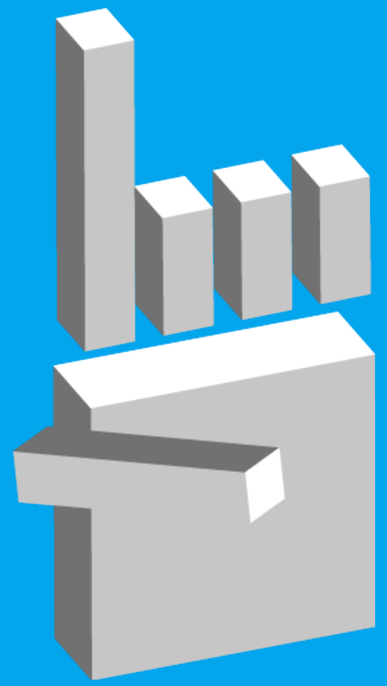
Outline

Problem statement and application areas

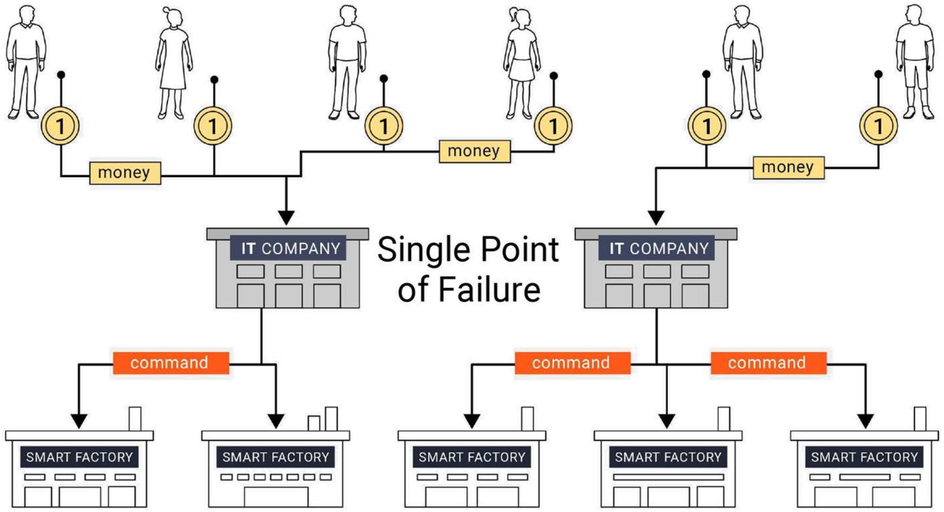
Background and mobile robotics projects

Marine drone on the Volga River

Discussion



PROBLEM



- Population growth and increasing complexity of supply chains require a full-scale deployment of Cyber Physical Systems (CPS) into human economy.
- Smart cities and smart factories of the future are designed as multi-vendor, heterogeneous environments with multiple streams of communication necessary between robots and humans.

BUT

- Current model of integrating robots into economy via a few centralized parties primarily serves the interests of those parties, and prevents market forces from regulating human-robot relations.
- Centralized parties pose a number of threats: from the possibility of malicious interests interference to data breaches.

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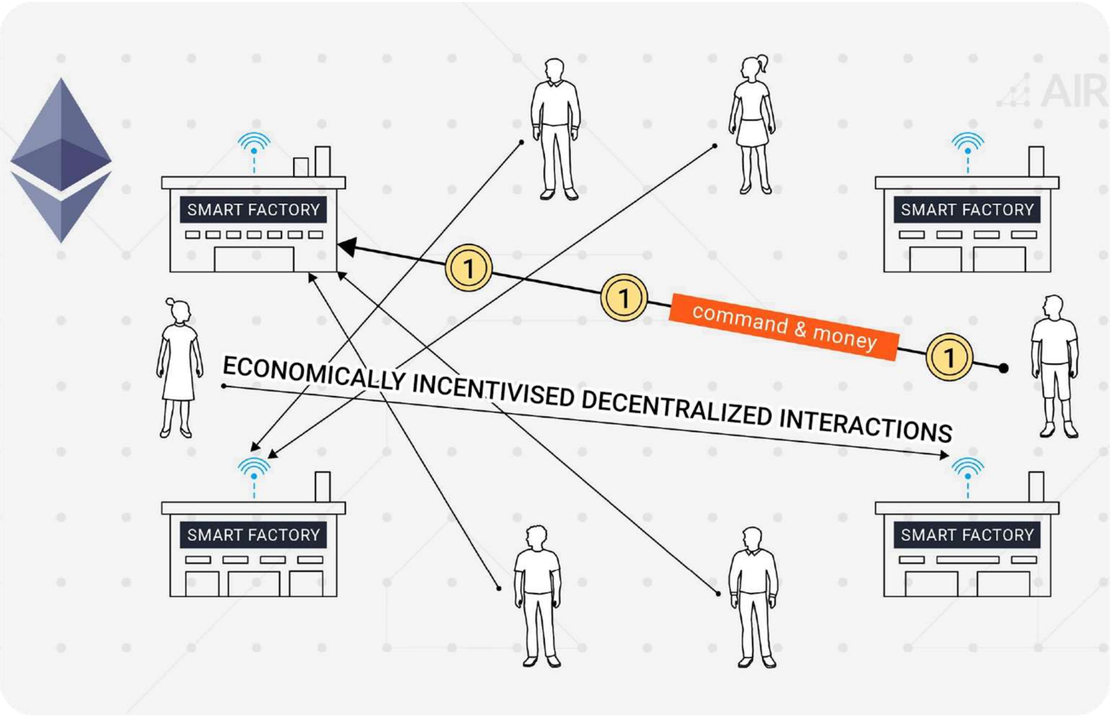
SOLUTION

- A global decentralized network where the market forces guide the participants is the most viable way of integrating Cyber Physical Systems into the economy.
- The current stage of robotics development makes it possible for CPS to communicate and exchange services among themselves and with humans directly.

Eliminating centralized third party intermediaries could:

- Improve the utilization of robots: machines can decide what actions to take within constantly changing environments;
- Minimize single point of failure risks and strengthen privacy protections;
- Incentivize multiple technological, legal, social and cultural innovations.



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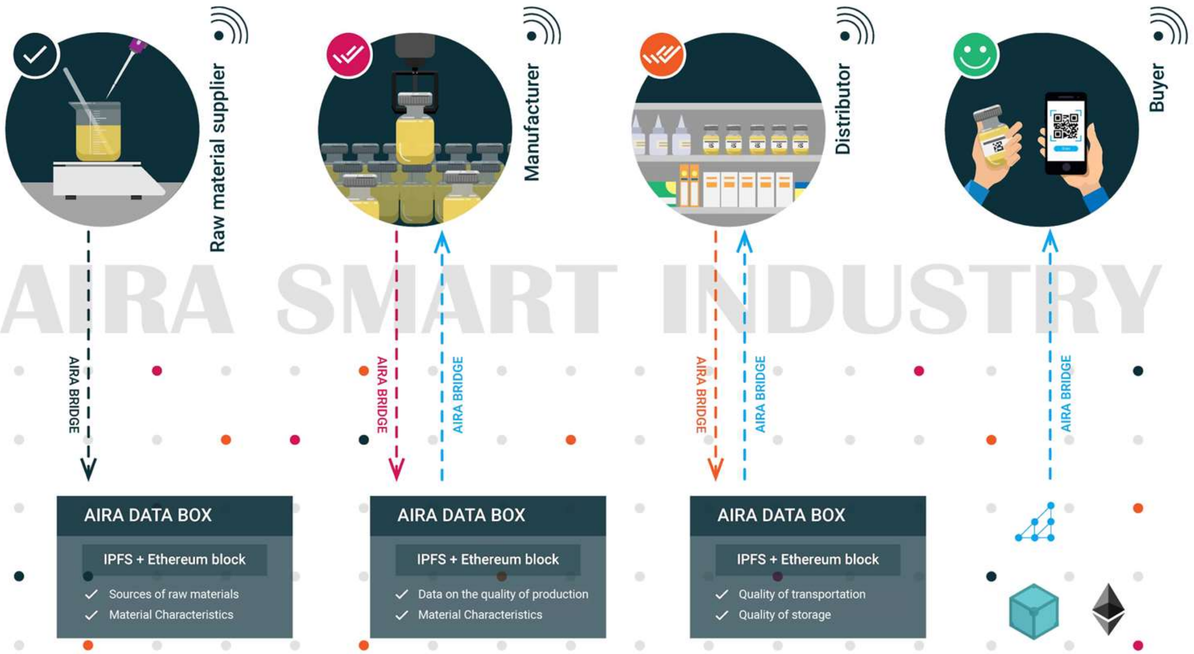
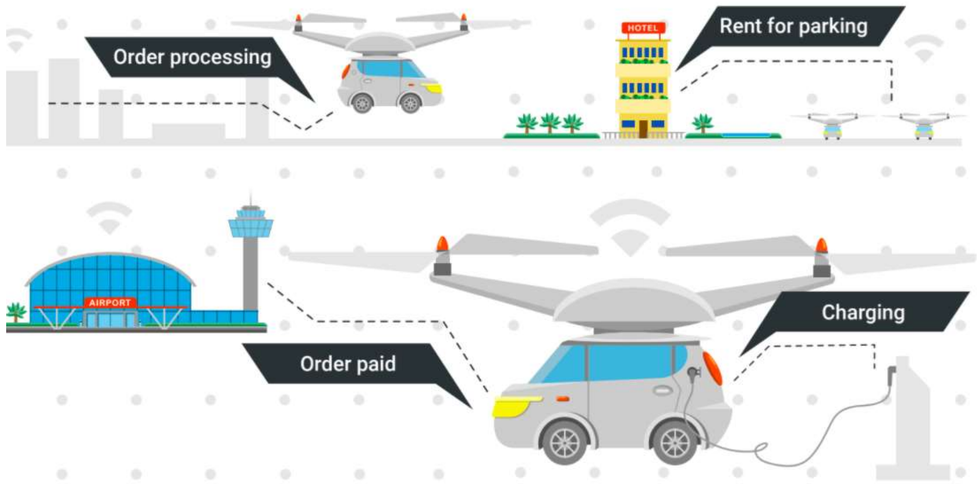
USE CASES

Trackable Supply Chain:
Transparent history of goods and services





Autonomous Service Providers:
Robot-performed services in smart cities

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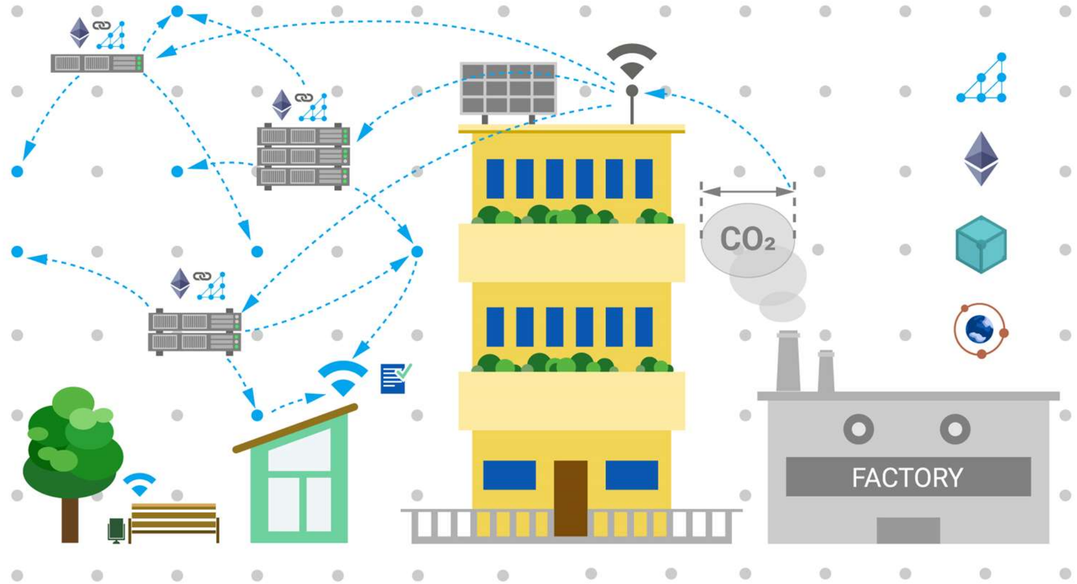
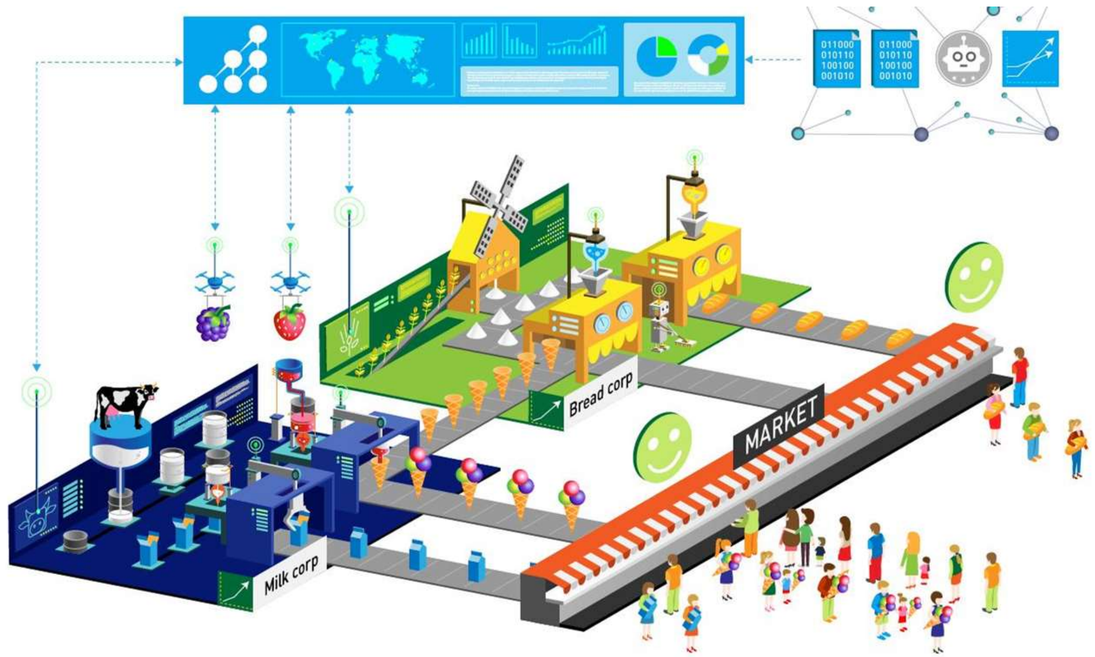
USE CASES

Decentralized IoT Data Marketplace:
Trade data, collected by IOT devices and sensors without intermediaries





Industry 4.0:
Direct communication between consumer and smart factories and among smart factories

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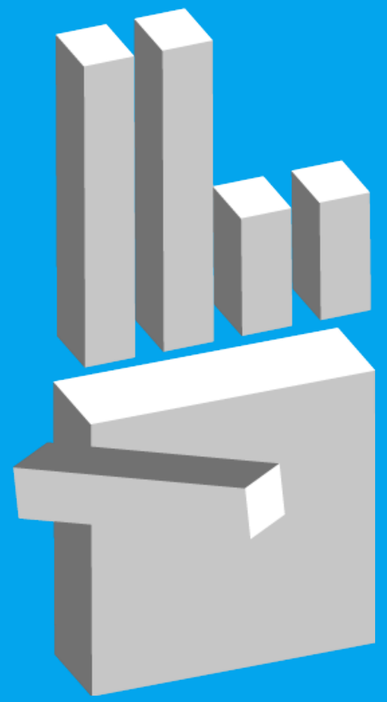
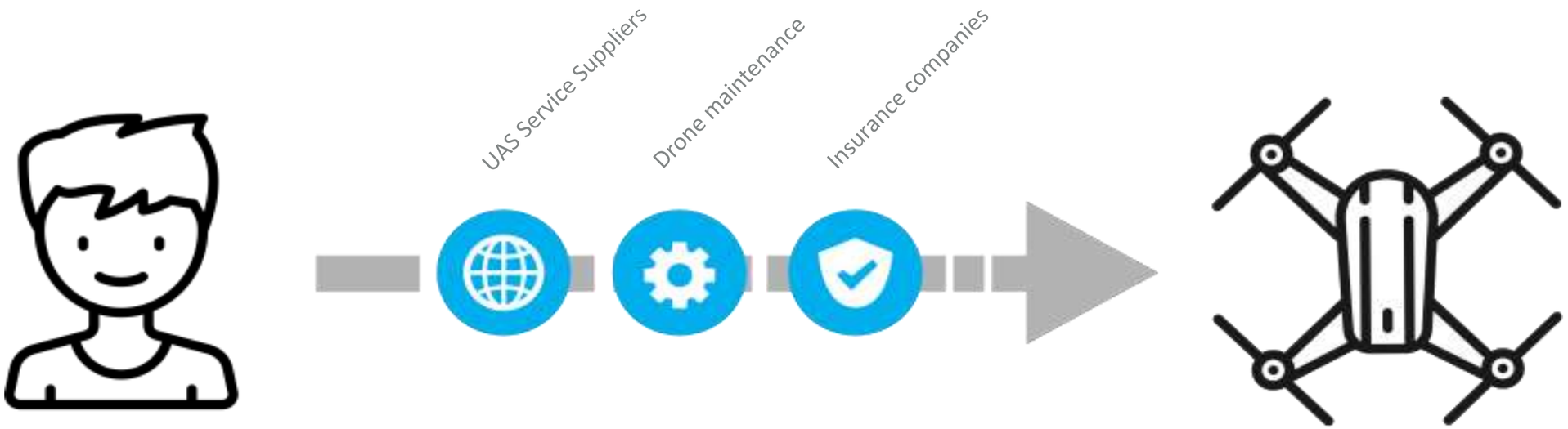


Full supply chain



We’ve built a set of Smart Contracts on
Ethereum Blockchain allowing high scalability and secure drone operations globally.

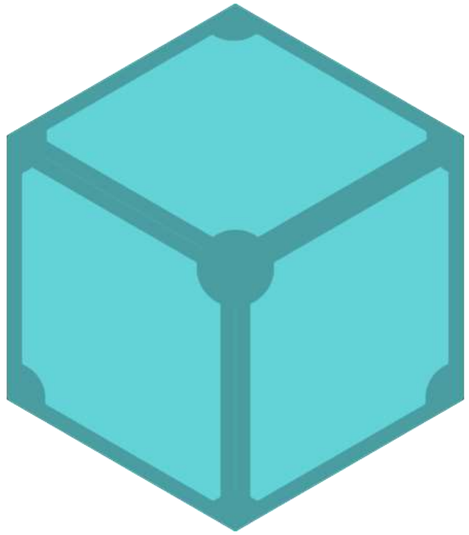
```
Cpu:  99% 47°C Mem:  7% | AndroidAP :   3K /   4K | [1] 3 : Full : 0:5.0 recordmydesktop      6 12:07 | -14dB | 4% / 0:08 | US
Buffer size adjusted to 4096 from 4096 frames.
Opened PCM device hw:0,0
Playback frequency 22050Hz is not available...
Using 44100Hz instead.
Recording on device hw:0,0 is set to:
2 channels at 44100Hz
Output file: out-4.ogv
Capturing!
   hutting down...
Done.
Written 345036 bytes
(232490 of which were video data and 112546 audio data)

..
Goodbye!
akru@krakov ~
$ recordmydesktop --on-the-fly-encoding --no-sound
Initial recording window is set to:
X:0   Y:0    Width:1366    Height:768
Adjusted recording window is set to:
X:6   Y:0    Width:1354    Height:768
Your window manager appears to be LG3D

Initializing...
Output file: out-5.ogv
Capturing!
```

```
 1:..t_blockchain_   2:~   3:~/px4_drone   5:recordmydesktop                    4.25 4.77 4.22
```

NixOS



IPFS

ROS

ethereum

#Airalab

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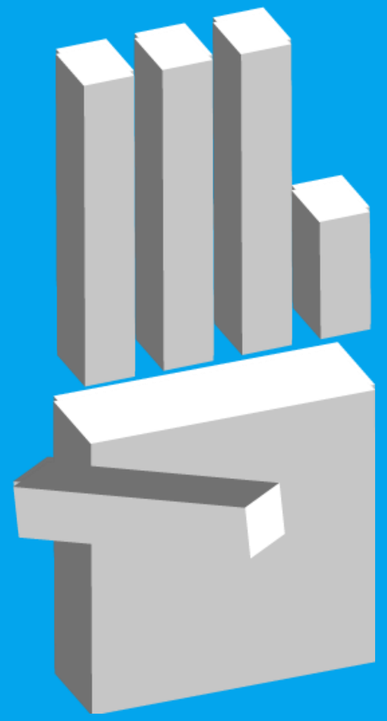


Main parts of the marine robot

Two hulls catamaran

Pixhawk autopilot

Libelium water quality sensors

SCAN ME

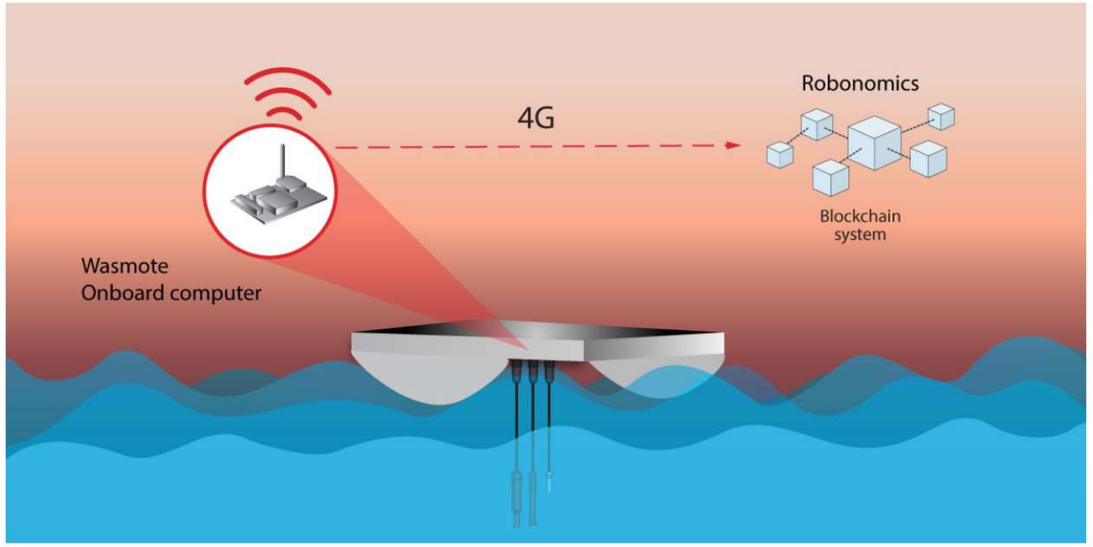
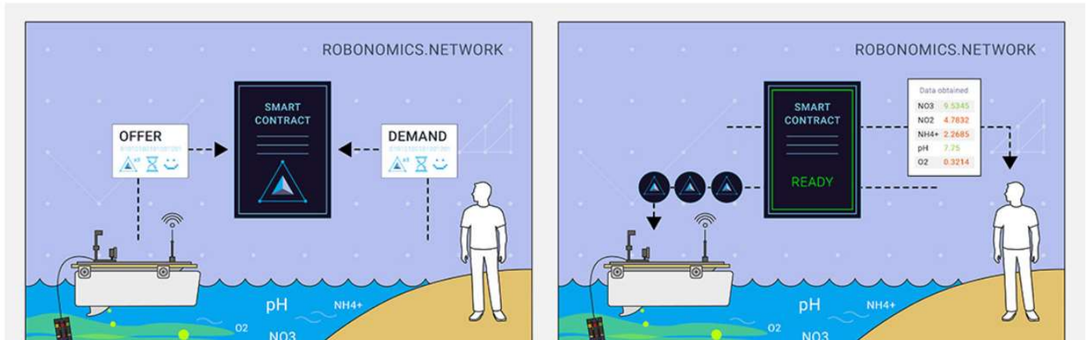


Diagram of the “Drone on the Volga” project

Decentralized technologies such as blockchain can help with devices and data source identification, trustworthy data, transparency and openness, marketplace ecosystem, data-backed contracts and assets. “We work in a world of IoT and blockchain projects, from identification and data signature up to marketplace protocols, so we have made an open source Robonomics platform and offer engineering support for developers from the proof-of-concept phase until complete solutions”, highlights Alisher Khassanov, Chief Engineer of Airalab Rus.

With this river project, the drone offers its services **through a web application allowing any user to demand a service**. Usually, the mission generates parameters such as **position of the drone, movement speed, measured water quality parameters and other secondary requirements**.



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