



ElectroCap 2025/2026

# Orbis: a disaster-ready drinking water system

Website: <https://orbis.applikuapp.com>

# Team



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# Problem Definiton

## Causes



Increasing risk of **war**



Imminent **seismic** activity



Potential **droughts** caused by climate change



**Compromise** of major **reservoirs**



High-risk **pathogenic** contamination for public health

## Problem

In an emergency situation, access to drinkable water is **crucial** in the first **72h**

# Solution Beneficiaries

Water network failure

Panic and hoarding  
of essential goods

Uneven allocation  
of resources



**A DISASTER-READY WATER STORAGE SYSTEM ENABLES USERS TO MAINTAIN ACCESS TO SAFE WATER WHEN THE PUBLIC NETWORK FAILS**

**High-risk population groups:**

- **Elderly** individuals
- People with **reduced mobility**
- Residents in **high-density** urban areas
- Tourists and temporary workers

**Everyone benefits  
from the panic free  
and equal distribution  
of water**

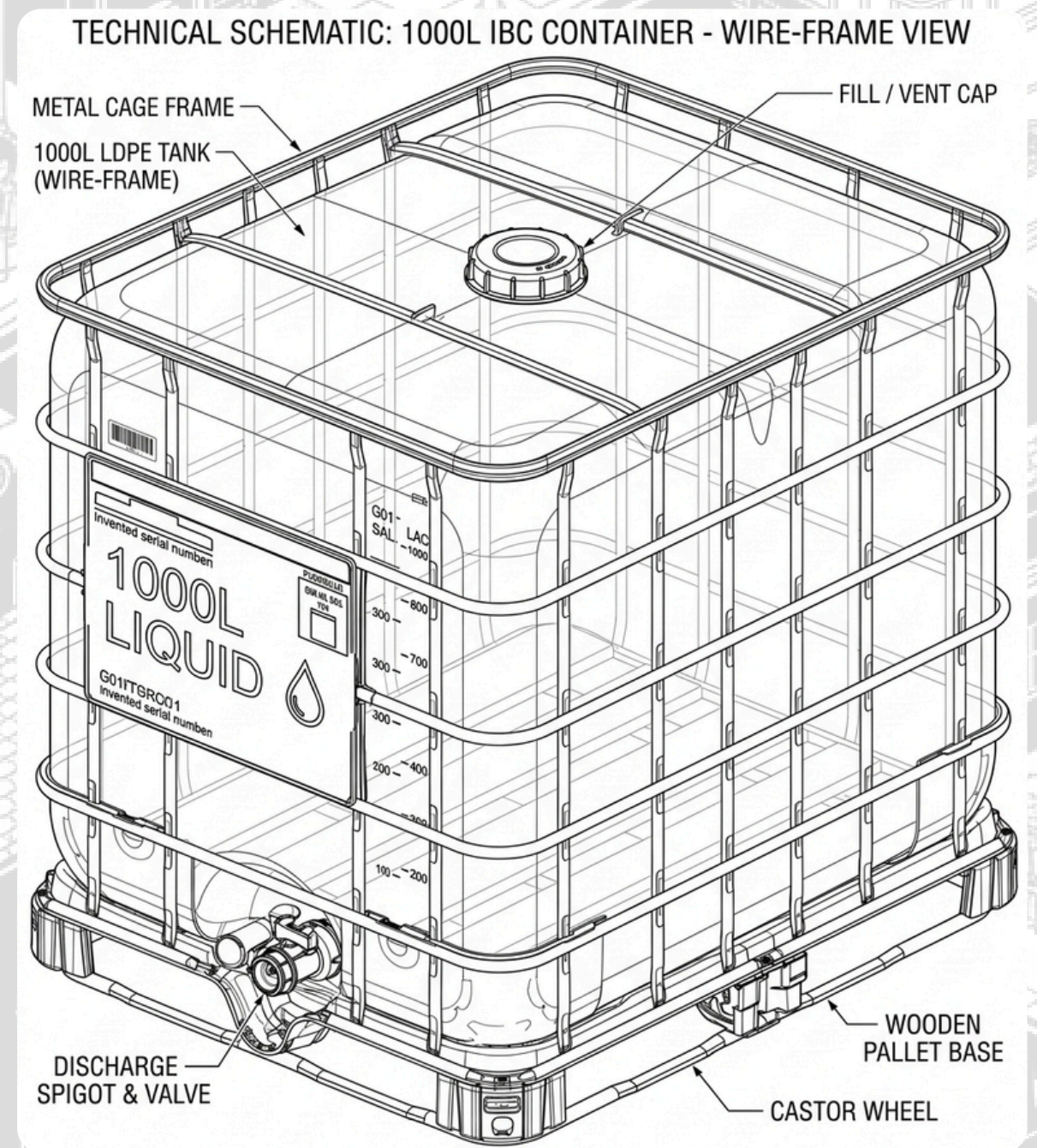
# Our Solution

**Modular** and automated **point-to-point storage** and **distribution network** for drinking water in disasters

Permanently **monitored** through a web portal with variable permissions and access levels

Can be activated as an **exceptional** measure or for **general access in developing contexts**

Can be used by **individuals** independently (self-service)



# Stages of Operation

## NORMALCY

1. Strategic installation of modules
2. Integration into the municipal water network
3. Monitoring:
  - a. water level
  - b. water quality
4. Define maintenance protocols
5. Inter-module communication and with the database under normal conditions
6. Real-time website for normal conditions

## DEPLOYMENT

1. Immediate availability in critical time
2. Monitor water level
3. Control access and limits
4. Ensure system resilience, even in case of power and telecommunications failure
5. Modularity and transport to the most affected areas

# Competitors & Previous Work

## Japan – Seismic Resilience & Decentralization:

Decentralized storage networks operate by distributing data across multiple small reservoirs located near users, rather than depending on a single central system. Seismic-resistant infrastructure is designed so that tanks and pipelines can withstand earthquakes, ensuring that essential systems remain operational even during significant seismic events.

<https://thedocs.worldbank.org/en/doc/448651518134789157-0090022018/original/resilientwssjapancasesstudywebdrmhubtokyo.pdf>

## UNITED KINGDOM – HUMANITARIAN MOBILITY (FASTANK)

Rapid-deploy modular tanks designed for quick assembly, allowing a single person to set them up in minutes without the need for tools.

<https://fastank.com/emergency-water-storage/>

## China – Redundancy Engineering (Center Enamel)

Bolted steel tanks with enamel coating, highly resistant to corrosion and seismic shocks, that can be quickly assembled to replace sabotaged or compromised water treatment plants.

[https://www.centerepoxytanks.com/bolted-steel-water-tanks-for-emergency-water-tanks\\_a14922.html](https://www.centerepoxytanks.com/bolted-steel-water-tanks-for-emergency-water-tanks_a14922.html)

# Competitors & Previous Work

## Kärcher Futuretech – Mobile Water Supply

Offers mobile water treatment systems for disaster relief and remote operations. Provides complete solutions including raw water tanks, drinking water storage, and distribution stations. Designed for rapid deployment and independent operation from municipal grids.

<https://www.karcher-futuretech.com/en/products/mobile-water-supply.html>

## PURIBEC – CONTAINERIZED WATER TREATMENT PLANT

Containerized water treatment plants integrating pumping, filtration, and storage within one or multiple ISO containers. Suitable for emergency response, remote communities, and industrial applications.

<https://puribec.com/en/commercial/our-expertise/containerized-water-treatment-plant/>

## Applied Membranes (AMI) – Disaster & Mobile Water Systems

Markets containerized and trailer-mounted emergency water systems capable of treating fresh, brackish, or seawater into potable water. Portable, air-transportable options available, including solar-powered configurations.

<https://www.appliedmembranes.com/pages/disaster-mobile-water>

# Competitors & Previous Work

## Husky Portable Containment – Pillow Tanks

Portable potable-water bladder tanks used for temporary drinking water storage in disaster and humanitarian contexts. Serves as storage component for deployable purification systems.

<https://www.huskyportable.com/bladder-pillow-tanks>

## READY CONTAINMENT – BLADDER TANKS

Provides potable and non-potable water pillow tanks for disaster relief, temporary storage, and container-conversion bladder solutions. Designed for rapid deployment and flexible capacity needs.

<https://fastank.com/emergency-water-storage/>

## Aqua Control (Ireland) – Mobile / Off-Grid Purification

Compact mobile water purification systems for humanitarian and emergency use. Can operate via mains power, generator, or fully off-grid solar. Designed for rapid rollout by land, sea, or air.

<https://www.aquacontrol.ie/mobile/>

# Competitors & Previous Work

## Solar Water Solutions – Containerized Solar RO

Containerized solar-powered reverse osmosis units for fresh or brackish water treatment. Example deployment shows self-reliant system (0.5 m<sup>3</sup>/h capacity, 0.75 kW power demand) suitable for disaster response.

<https://solarwatersolutions.com/news/portable-reliable-water-for-disaster-relief-and-emergency-response/>

## ROYAL EIJKELKAMP – OFF-GRID WATER

Mobile drinkable-water systems for disaster relief and remote operations. Plug-and-play systems with capacities up to 3 m<sup>3</sup>/h (WaterMiracle) and 20 m<sup>3</sup>/h (HydroNext).

<https://www.royaleijkelkamp.com/eco-innovation/water-works/solutions/off-grid-water/>

## Watergen – Atmospheric Water Generators

Produces drinking water directly from atmospheric humidity. Does not require connection to a water source, but depends on temperature, humidity, and electrical power.

<https://www.royaleijkelkamp.com/eco-innovation/water-works/solutions/off-grid-water/>



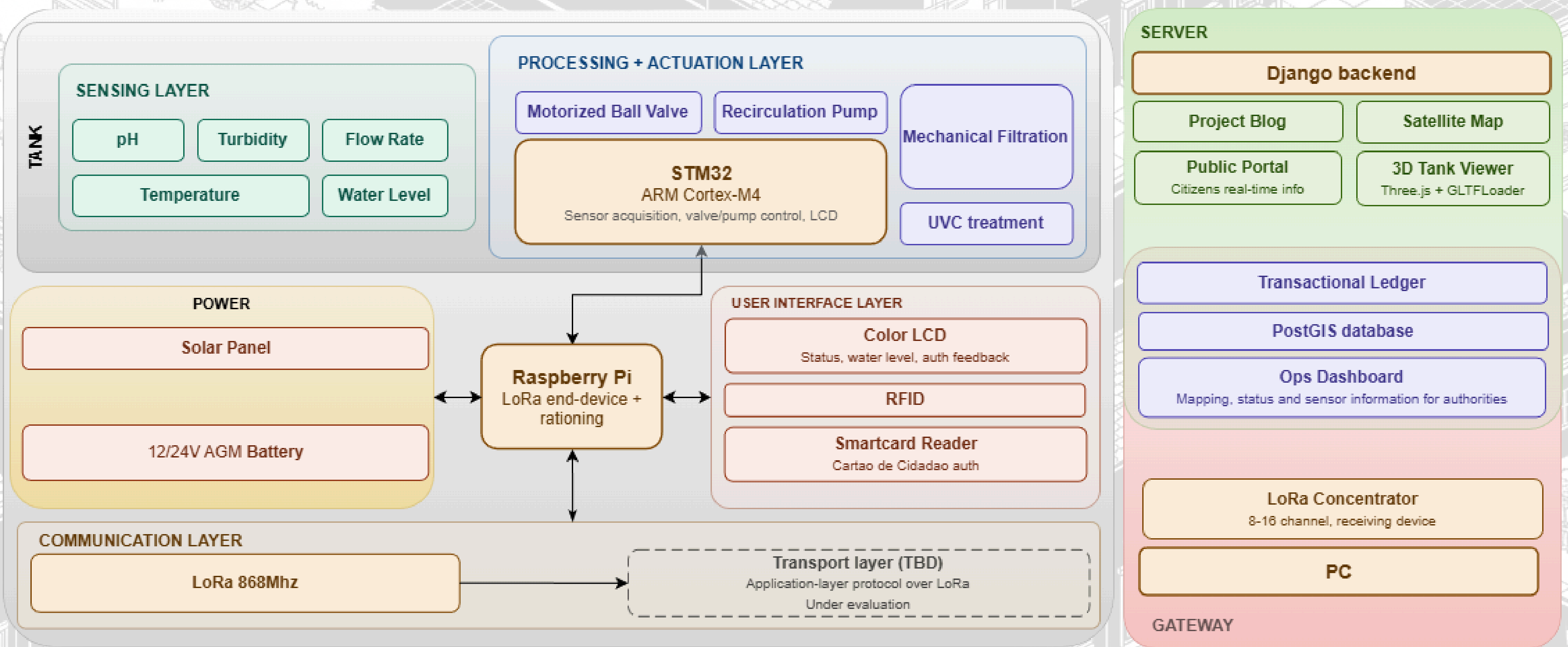
# Partners



**LAIST**  
LABORATÓRIO  
DE ANÁLISES DO IST  
TÉCNICO LISBOA

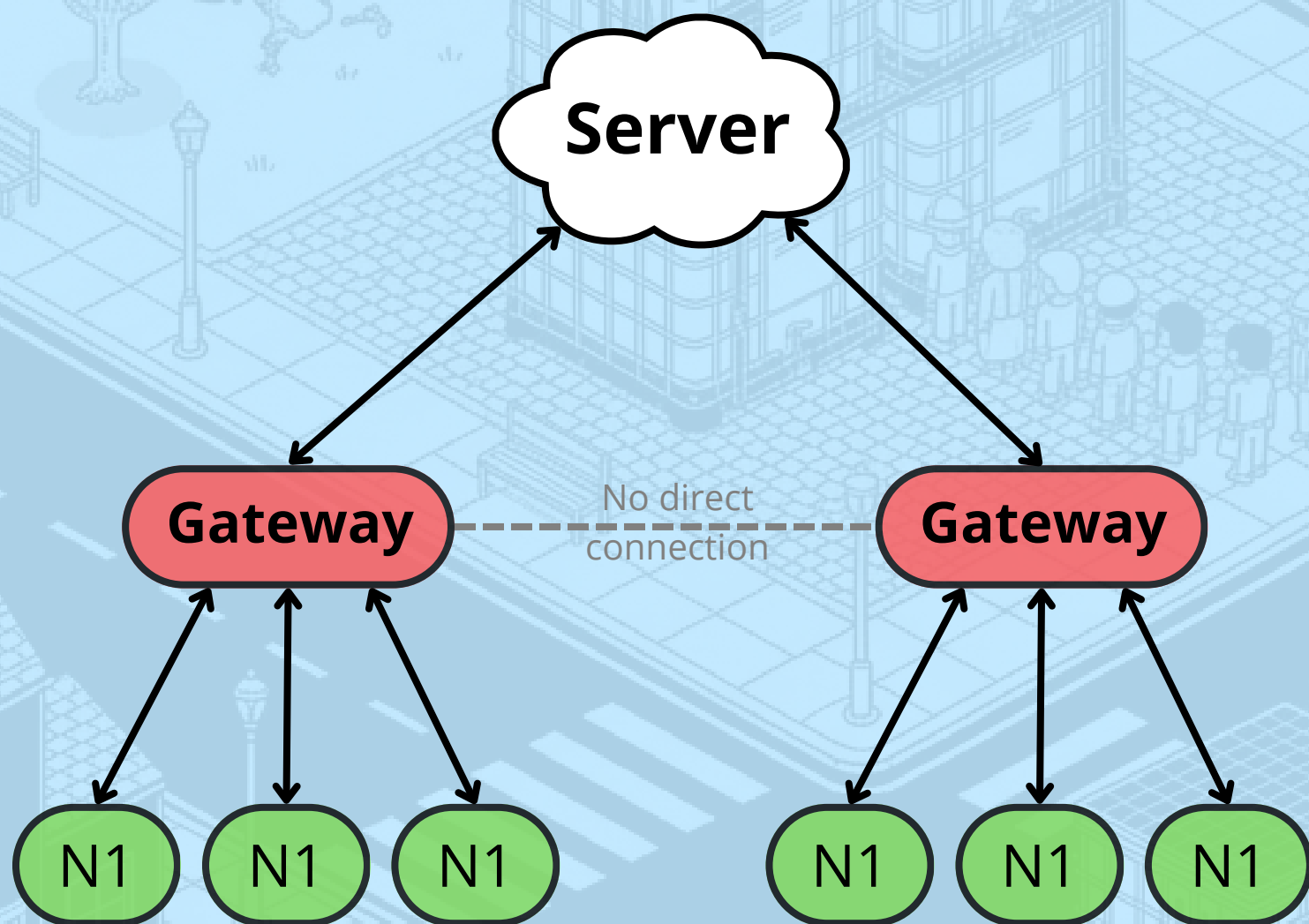
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# High-level system diagram

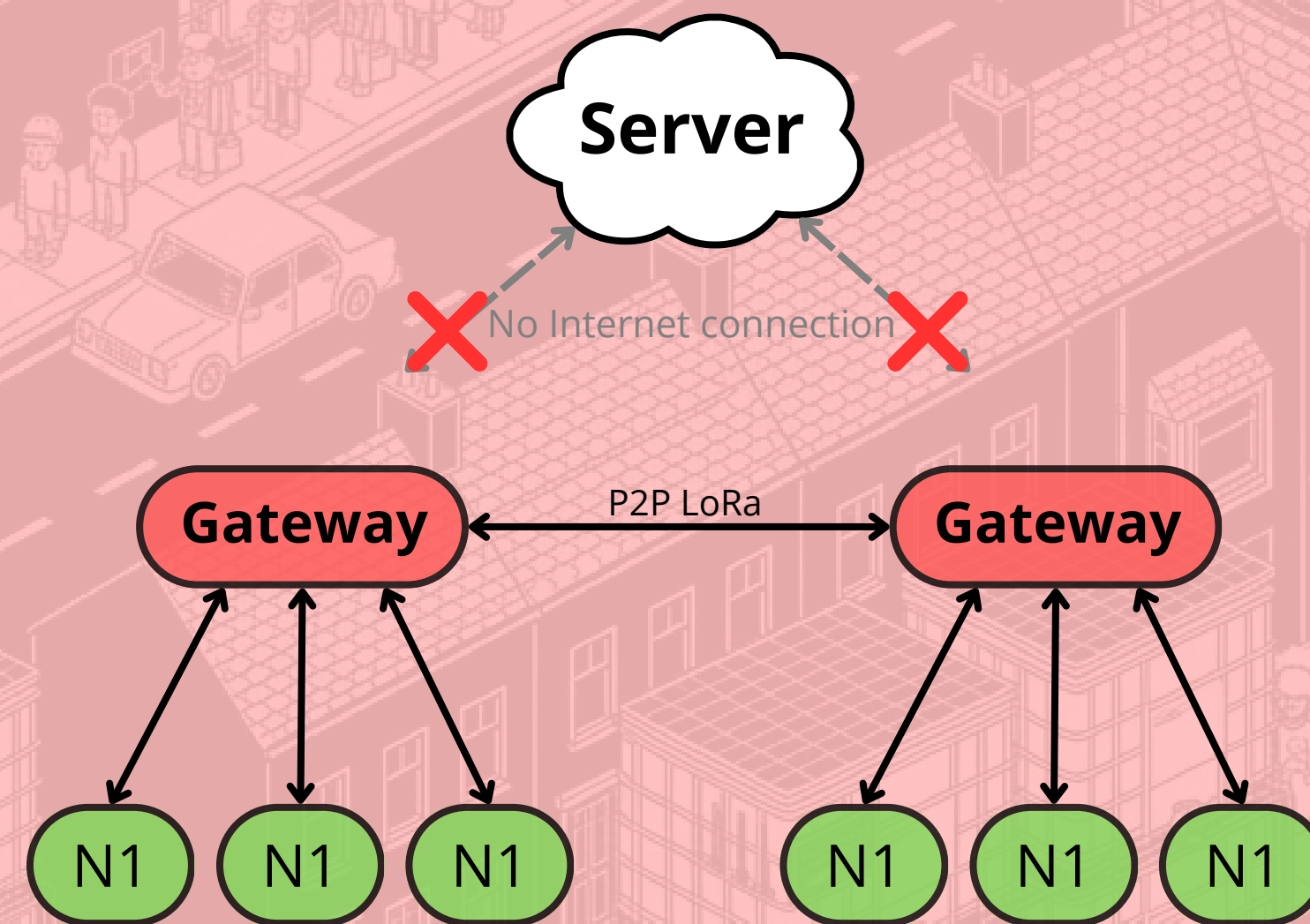


# Communication Architecture

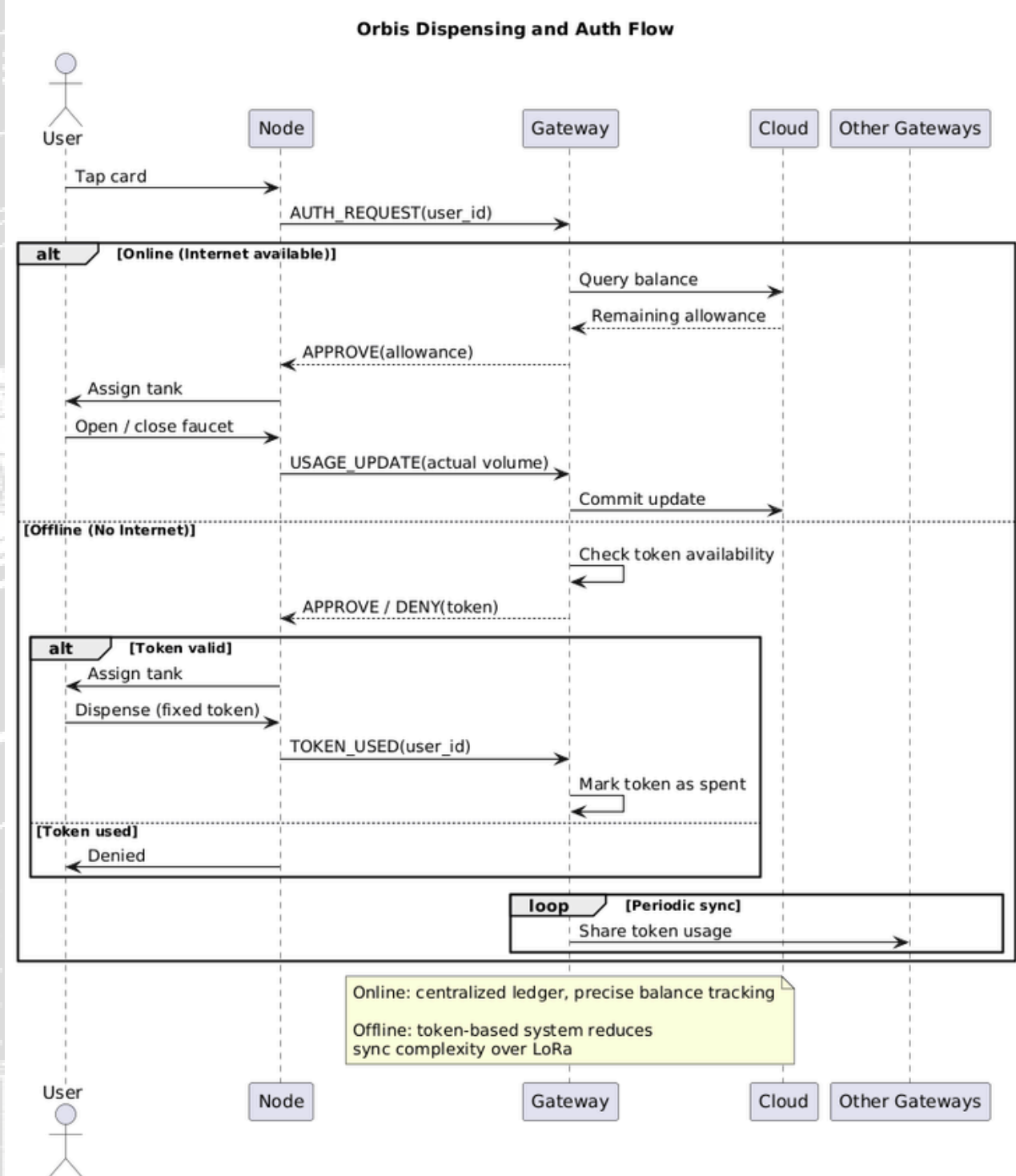
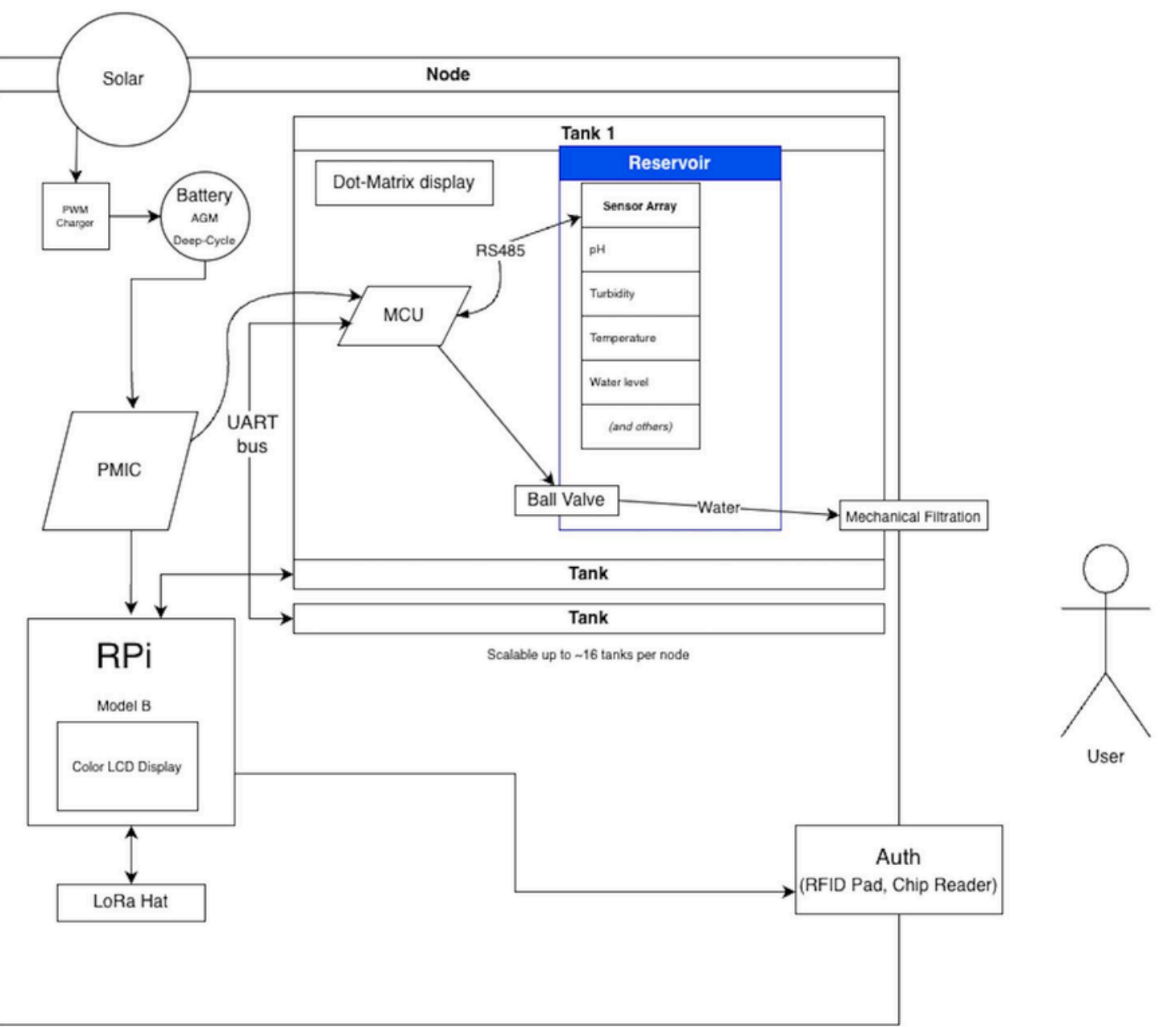
## Normalcy



## Disaster



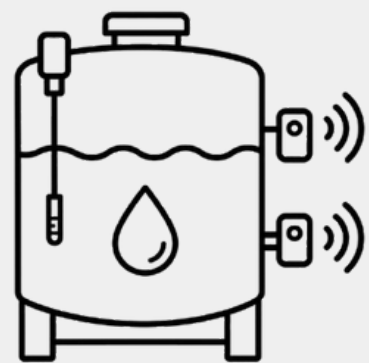
# Transactional and low-level UML diagrams



Online: centralized ledger, precise balance tracking  
 Offline: token-based system reduces sync complexity over LoRa

# Achieved results

## Monitoring System Operational



Tank monitoring and sensor based status tracking successfully implemented

## Authentication System Operational



User identification and controlled access to water distribution working

## Communication Validated



Data exchange between modules , nodes and platform working

## WebApp Map available



A website with map-based visualization available for system monitoring

Core system functionalities validated at prototype level

# WebApp Map Demo



The screenshot shows the main interface of the WebApp Map Demo. On the left is a map of Lisbon with various infrastructure elements like Gateways (GW), Nodes, and Tanks. A sidebar on the right contains several data panels:

- GATEWAYS:** A list of active gateways such as EXE-AMA-1, BSL-LIS-1, CML-LIS-2, EXE-LIS-1, EXE-LIS-2, CML-LIS-1, BSL-LIS-2, BSL-LIS-3, EXE-LOU-1, PCL-LIS-2, and APL-LIS-1.
- NODES & TANKS:** A list of active nodes and tanks with their coordinates and status, including VNN-4, MAR-1, ALV-1, ARO-5, MAR-2, ARO-7, ARO-8, ARO-9, ARO-10, and ALV-23.
- STATISTICS:** Summary statistics for the selected area.

This screenshot shows a detailed map view of a specific area in Lisbon. A legend on the left side of the map allows users to toggle various layers: Gateways, Nodes, Tanks, Show tank count, GW radius, Nearest GW routes, All GW routes, Parish Limits, and Municipality Limits. An opacity slider is set to 100%. On the right, a statistics panel for the selected area (ARO-8, ARO-9, ARO-10) displays the following data:

Category	Value
Nodes	348
Avg nodes / gateway	31.6
Total capacity	2492 kL
L / person / day	3,5
Target pop.	575739
Uptime	48 h
Required capacity	4030 kL
Covered capacity	2492 / 4030 kL (62%)
Covered population vs 575,739	355,947 / 575,739 (62%)

This screenshot shows a network diagram of tanks and nodes. A central node, ARE-20 (IST (9)), is connected to several tanks (20A, 20B, 20C, 20D, 20E, 20F, 20G, 20H, 20I, 20J). Each tank is labeled with its capacity (1000 L) and status (ACTIVE ok). The diagram also shows the nearest gateway, CML-LIS-1 (CM Lisboa). A sidebar on the right lists the nodes and tanks with their coordinates and status.

Check it out here!

<https://orbis.vps.tecnico.ulisboa.pt/navis/demo/>



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# Estimated Project Cost

## Initial Deployment (CAPEX)

**€12M - €15M**

- **Water Storage Modules**
- **Sensors, IoT and Control electronics**
- **Civil works and Installation**
- **Communication & Monitoring infrastructure**

## Annual Operating Costs (OPEX)

**Hardware maintenance: €10K - €15K / Year**

Replacement materials and consumables for the physical system.

**+**

**Software maintenance**

Hosting, dashboard updates, backups, cybersecurity and data management

**+**

**Personnel Costs**

(based on researched project-grade components and realistic municipal deployment needs)

# Team Contribution

Matilde Silva	Tomás Ribeiro	Carolina João
Implemented and tested the tank monitoring and power system	Interactive 3D tank model development for website integration	Hardware subsystem documentation
Dimensioned the deployment scale (with help from Proteção Civil)	Implemented and tested communication with tank monitoring	Sensor architecture definition
Estimated the project and prototype budget	Website UI redesign: login page and main page improvements	Energy architecture dimensioning
Project architecture definition	Attended firefighter field interview for requirements gathering	Components Selection
Final PitchDeck	Co-created the promotional video and poster	Bill of Materials



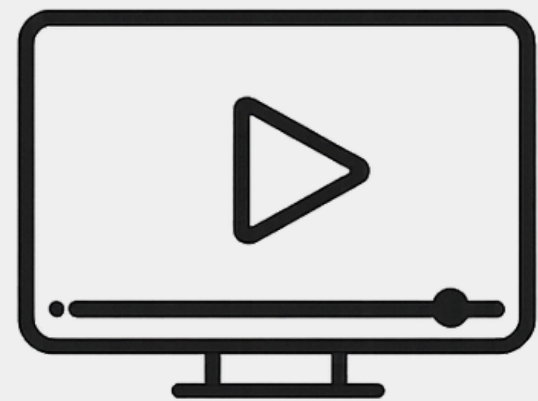
# Team Contribution

Francisco Caravana	Margarida Sebastião	Tiago Carvalho
Handled company outreach and scheduled all project meetings	Implemented and tested the tank monitoring and power system	Software engineering and technical architecture research
Authentication System	Handled company outreach and scheduled all project meetings	Worked on implementing the Django database and models for the web-server
Attended all company meetings, writing minutes and iteratively improving the presentation	Dimensioned the deployment scale (with help from Proteção Civil)	Implemented the remote mapping platform
Co-created the promotional video	Co-created the promotional video	Preliminary firmware proof-of concept on arduino
Prepared and developed project presentations for company meetings	Project architecture definition	Helped facilitate the partnership with INESC-ID



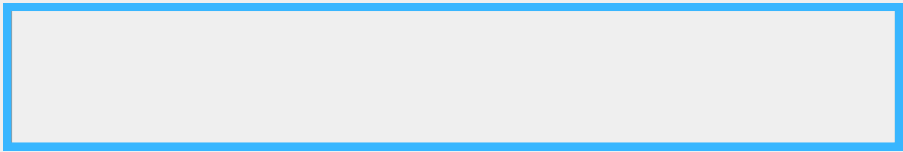
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# Important links



## VIDEO

Watch the project presentation video



## LANDING PAGE

Visit the project landing page



## BLOG

Read the updates about the project

