



Pre-location of water losses with cosmic rays

Finapp brings **CRNS** - Cosmic Ray Neutron Sensing - technology to the service of **environmental sustainability** to combat water wastage

What?

Finapp revolutionises the method of **pre-locating water leaks** by using **cosmic rays and CRNS technology** - Cosmic Ray Neutron Sensing.

Our **probes** use **neutrons** generated by cosmic rays to measure the **water content** at **depth**, 50cm under the asphalt, on a **large scale**, a radius of about 10m and **in real time**.

How?

The idea is very simple: water leakage from pipelines leads to an **increase in soil moisture**. Having an instrument that can detect these wet areas, even in an urban environment, is the key to pre-locating water loss.

Our vehicle-mounted probes enable a detailed soil moisture map to be obtained by traveling **up to 150 km per day in urban centres**.

Through initial training, a **neural network** was trained to **associate wetlands** with the **probability of a water leak**.

The Finapp pre-location identifies only **5-10%** of the network analyzed as areas prone to possible leakage, reducing the time of the subsequent verification phase.

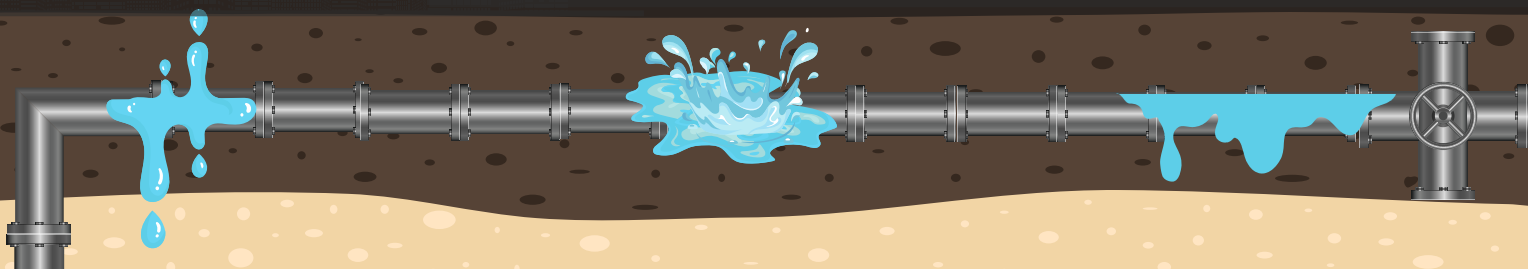
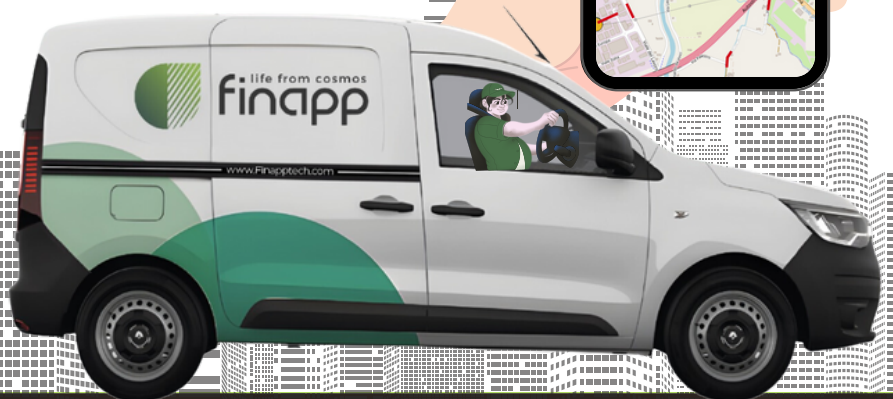
Why?

Along the Italian water network, more than **40% of the total water** emitted by aqueducts is wasted (source: FAI).

In many cases, the main problem lies in the antiquity of the infrastructure.

Hypothetically, the **total replacement** of the **network** would take **about 250 years!**

It is crucial to act promptly to repair water losses along the existing network, with pre-location tools that speed up the search time.



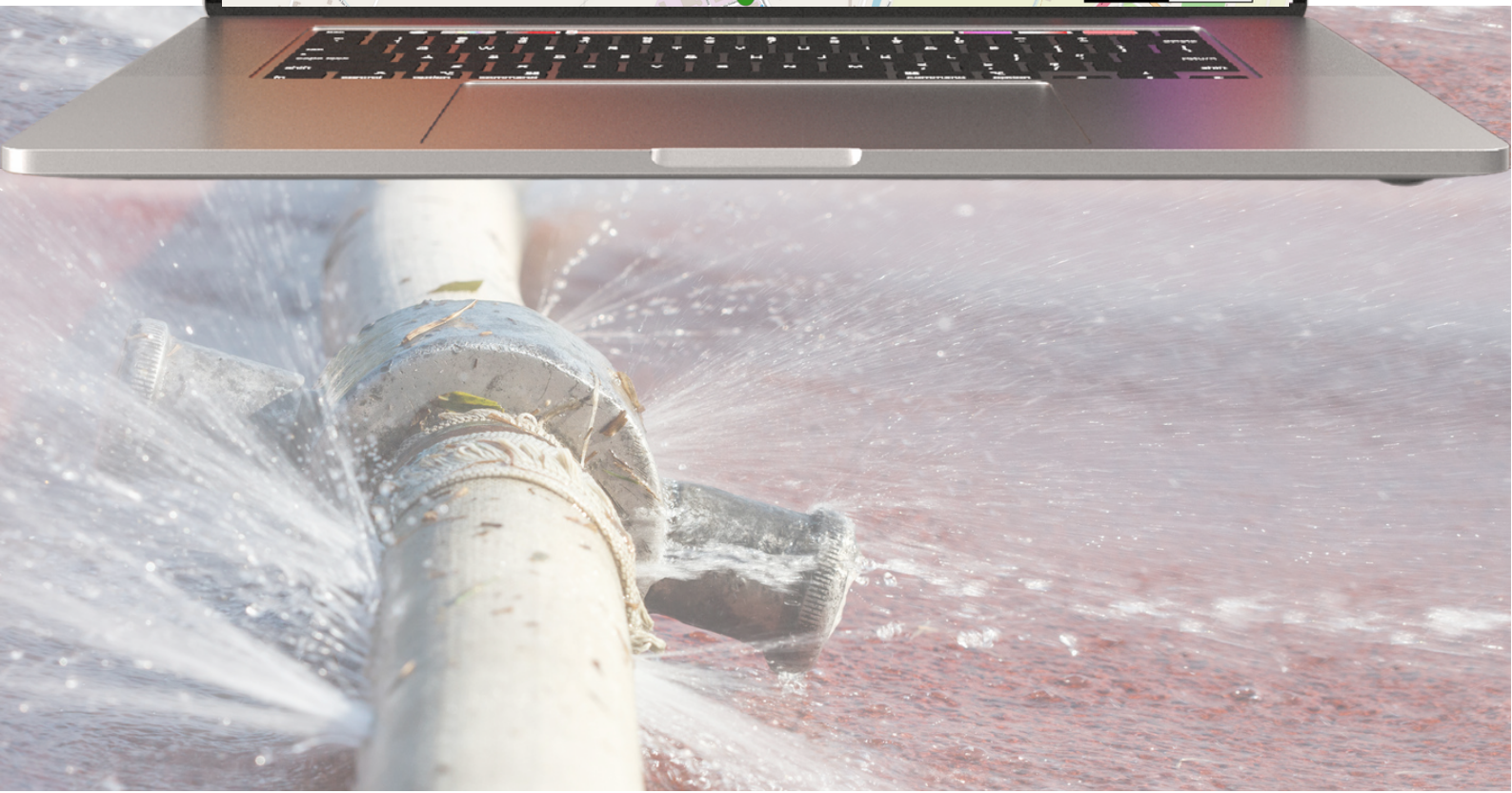
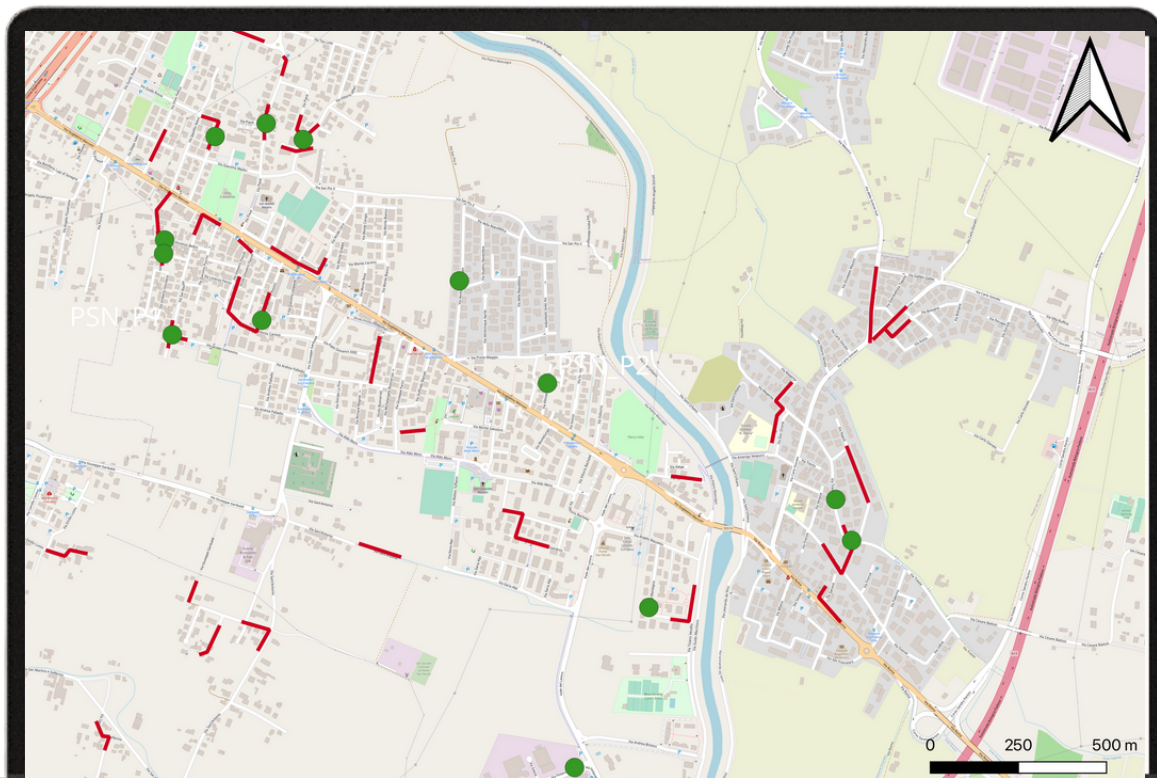
Information Obtained

Finapp overcomes the current limitations of pre-location technologies, of which it remains the best complement for proper water loss management.

At present, this action is based on districtisation, satellite technologies and systematic research using geophone and correlator.

The satellite returns superficial soil moisture, does not penetrate deeply and the presence of buildings, asphalt, vehicles, severely limits its use in an urban environment.

Conversely, the geophone has greater accuracy of analysis but requires specialized personnel and is carried out with very long execution times: an average of 5 /10 km per day is monitored.



Benefits

With **Finapp** you get essential **advantages** for this type of application:

Ease of use: setting the probe in motion is extremely simple, it does not require fixed installations, there is no need to break the road surface or open manholes, it is small in size and does not require external power supply.

It is not a dependent operator and does not require qualified personnel for its use.

Speed: depending on the number of probes used, it is possible to cover **150 km per day in urban centers** and up to 300 km in non-urban areas at a maximum speed of 50 km/h. In the same time interval, one is able to investigate **10 to 15 times the distances covered by traditional research.**

The usability of the data: simple and intuitive maps are generated where the aqueduct network is highlighted, the stretches covered by the Finapp probes, the **stretches where a possible leak as calculated** by the artificial intelligence algorithm has been detected. The results are available as an html page or as ESRI Shapefile and Geopackage.

Performance: Preliminary results show that pre-location using **Finapp** technology, compared to actual excavation, correctly **detects leaks in 50% to 75%.**

When: Pre-localisation with cosmic ray technology **can always be carried out** during both day and night hours.

The only limitation is the few hours after a heavy rainfall event, where the detection becomes insignificant.



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