



## **IIT-Istituto Italiano di Tecnologia (Italian Institute of Technology): COgITOR, the liquid cybernetic system inspired by cells**

*The COgITOR project has been funded by the European Union with approximately 3.5 million euros for the next 4 years. Coordinated by IIT, the aim of COgITOR is to create a spherical liquid cybernetic system to be used in extreme environments or on other planets.*

Genoa (Italy), 30 August 2021 - the COgITOR project is aimed at formulating a new concept of artificial cybernetic system, taking its name from Descartes's maxim "Cogito, ergo sum" and drawing inspiration from the new frontier of robotics that aims to reduce, if not completely cancel, system rigidity. The goal of COgITOR, in fact, is to create a liquid cybernetic system inspired by the cellular world and suited to the exploration of extreme environments or other planets. It will be spherical in shape, covered by a sensitive skin, similar to a touch screen, allowing interaction with the environment, and will be fitted with a power generation system based on thermal gradients.

COgITOR is a project funded by the European Union as part of the Horizon2020 research programme, with a budget of approximately 3.5 million euros for the next 4 years. The project has been conceived - and is coordinated - by Alessandro Chiolerio, a researcher from the IIT-Istituto Italiano di Tecnologia (Italian Institute of Technology), who has had experience working at the Max Planck Institute for Microstructure Physics in Germany and at the NASA Jet Propulsion Laboratory in the United States. The consortium includes Prof. Andrew Adamatzky (University of Bristol), Dr. Artur Braun (EMPA, Dübendorf), Dr. Carsten Jost (Plasmachem GmbH, Berlin) and Dr. Chiara Zocchi (Ciaotech Srl, Milano).

A cybernetic system is, by definition, a system of rules that govern the interaction between an individual subject and the external environment. The COgITOR researchers will take as their model a cell from a living creature, i.e., a system surrounded by a membrane and filled with a liquid substance and organelles that carry out specific functions, and with a nucleus in the centre. The COgITOR system will be composed of concentric spheres containing solvents enriched with nanoparticles and with a silicon chip in the centre.

"Our aim is to develop an initial prototype for an autonomous liquid cybernetic system that can, in the future, be used as an intelligent, active probe in extreme areas" - explained Alessandro Chiolerio - "allowing us to take a further step towards new frontiers in exploration and to examine a number of theories that we have formulated on amorphous architectures for parallel computation".

The COgITOR system will be created through a fully innovative project. To make the sphere, the researchers aim to develop a polymer capable of self-repair in the event of damage. Inside, ferroelectric nanoparticles will be used, which will be able to respond to the presence of an electric field via the use of electrodes on the inner surface of the sphere and arrange themselves in coordinated shapes, like a crystal.

This configuration can be activated or deactivated by switching the electric field on or off, creating a composition of schemes that can codify information.

“We will have to invent a new programming language for our system, something which, in sector jargon, is known as unconventional computing. We will not be able to apply binary logic, and instead will have to rely on a radically innovative holographic logic”, explains Chiolerio. “Our goal for the prototype is to have reduced memory capacity, the equivalent of one character (8 bits), but the aim for the future is to have a system that offers higher performance than current traditional systems”.

COgITOR will be powered by a system that draws on energy from the surrounding environment (energy harvesting) and that will take the form of a slim element located on the external surface. “If we are successful, the heat from the sun on the surface of the sphere will be enough to produce a few nanoWatts of electricity, sufficient to activate the base functions of the chip”, explains Chiolerio. An external power supply will in any case be present, at least for initial experimentation.

The idea is for COgITOR to be a robotic system that will be able to be employed in the future in extreme environments, such as the ocean floor, places with intense magnetic fields or for exploring gas giants.

Project website: <https://www.cogitor-project.eu/>

Social media accounts:

[https://twitter.com/COgITOR\\_project](https://twitter.com/COgITOR_project)

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