

Open Source Bioreactor

EPFL
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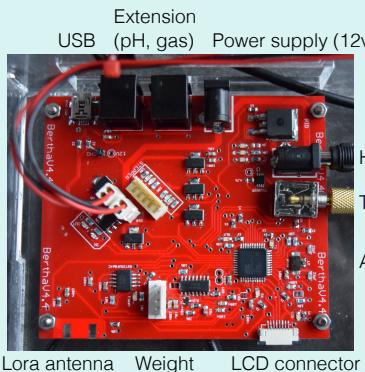
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Aims

Create a cost-effective, easy to build, fully automated, reliable, modulable, open-source, open-hardware bioreactor that allows to control its temperature, agitation, pH, input of gases and input/output of nutrients (semi-batch or continuous operation). Add-ons should allow to monitor conductivity and nitrogen concentration.

The main challenge : interdisciplinarity

A custom PCB controls the temperature, agitation, weight, peristaltic valves and keeps 1 month of logs.



PCB controlling all the main functionalities

Electronics

Embedded system

The main board does not require any computer and can control all the functionalities of the bioreactor. It is programmed in C directly from the Arduino™ IDE.

Biology

More than 90% of the microbial diversity is still undiscovered. During last century microbiologists developed tools to study and manipulate "pure" cultures. Such a bioreactor allows to explore the remaining diversity by growing bacteria consortium in conditions close to natural ones. The trick consists to "drive" the bacteria by controlling the experimental conditions like the pH, gas and stoichiometry of the nutrient.



CODEV

Applications

Aerobic and anaerobic bacteria culture

Directed evolution to create microbial consortium for

- Methane gas production
- Biopolymers production from sugar cane residues
- Wastewater treatment
- Production of bio-fertilizer from carbon dioxide and atmospheric nitrogen



Only mainstream components are used in the construction of the bioreactor. The enclosure is designed in FreeCAD and can be laser cut in Plexiglas® in 15 minutes.

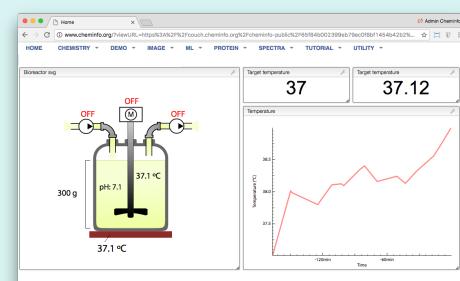


Laser cutting of wooden enclosure prototype

Mechanics

Database and user interface

A nodeJS service communicates via USB to the bioreactor, extract the logs (up to 1 month) and provides the data to a graphical web interface.



Control of the bioreactor from a web browser

Data mining

All the information about the experiments are stored in a database to be able to correlate the observed results and determine the experimental conditions to reach a specific goal.

<https://github.com/bioreactor>

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We need your help !

