Plant electro-mechanics project

Report 6 Feb 2017

Status:

We have built a number of 3D manipulators prototypes for the positioning of the electrophysiology probes, and the control boxes that allow controlling them via a cheap Playstation 2 controller. The micromanipulators plans are available on the project's a github repository, which contains also all the schematics and software for building all the tools we developed (https://github.com/calugo/OpenPlant-Electrophysiology). Instructions and more specific details about assembling the kits are or soon will available in the project's website (http://calugo.github.io/OpenPlant-Electrophysiology/).

The manipulators will be soon be enhanced to provide 5 degrees of freedom, and camera support in order to precisely and remotely position the electrophysiology probes on plants. A software to collect the readings from the electrophysiology boards and display signals live on screen has been developed. A new version that will allow signal analysis, and data collection/storage is under development.
Two boards that provide Chua's "chaotic" oscillators have been built and have been used to display non-linear effect in synchronized oscillation. These oscillators will be used to inject signals in plants in the next experiments.
We have also developed auxiliary tools (low-frequency signal generator) to test and calibrate the electrophysiology boards.

The tools developed till now have been used in public events with great success. Some of the electrophysiology boards have been built by members of the public, tested, and then distributed in the spirit of fostering and stimulate an open access to science.

It is worth mentioning that this project will be easily integrated in our other project "Desktop plant growth box" thus offering an open source, affordable controlled environment for the study of plant electrophysiology.

Expenses:

In general the funds where spent to acquire components, boards, mechanical tools used to test the ideas and produce the prototypes. More in detail the breakdown is as follows:

Electronics: £2364 (Prototype development boards, components, motor drivers)
Mechanics: £1405 (Motors, 3d printer filament, prototype frame beams)
Plants: £166

General (import duties, Makespace membership): £295

There is a overdraft of around £245 due to unexpected delivery costs, quantity discounts not applied and a missing item in our accounting. The difference will be rebalanced with the extra £1000 if granted or personally by M. Aita.

After rebalancing the overdraft, the rest of the extra £1000 will be spent on preparation of more electrophysiology boards, preparation of DAC boards, and motors for the micromanipulators.

Follow-on:

In the next immediate period we will build the extended version of the manipulators, which will include 5 degrees of freedom, and camera support. We will implement a DAC in order to inject signals into the plants (the response to which we will monitor with the existing recording boards). We will extend the software to analyse the electrophysiology data, remotely control the positioning of the probes and inject stimuli into the plants.

We will build and make available to hobbyists, schools and researchers more of the electrophysiology boards and manipulators. We will enhance, improve and expand on the documentation already existing.

Finally we will run a set of experiments to show the possibilities of the setup and prepare a publication to disseminate the findings.