Measurement of Electric Potentials in Plants

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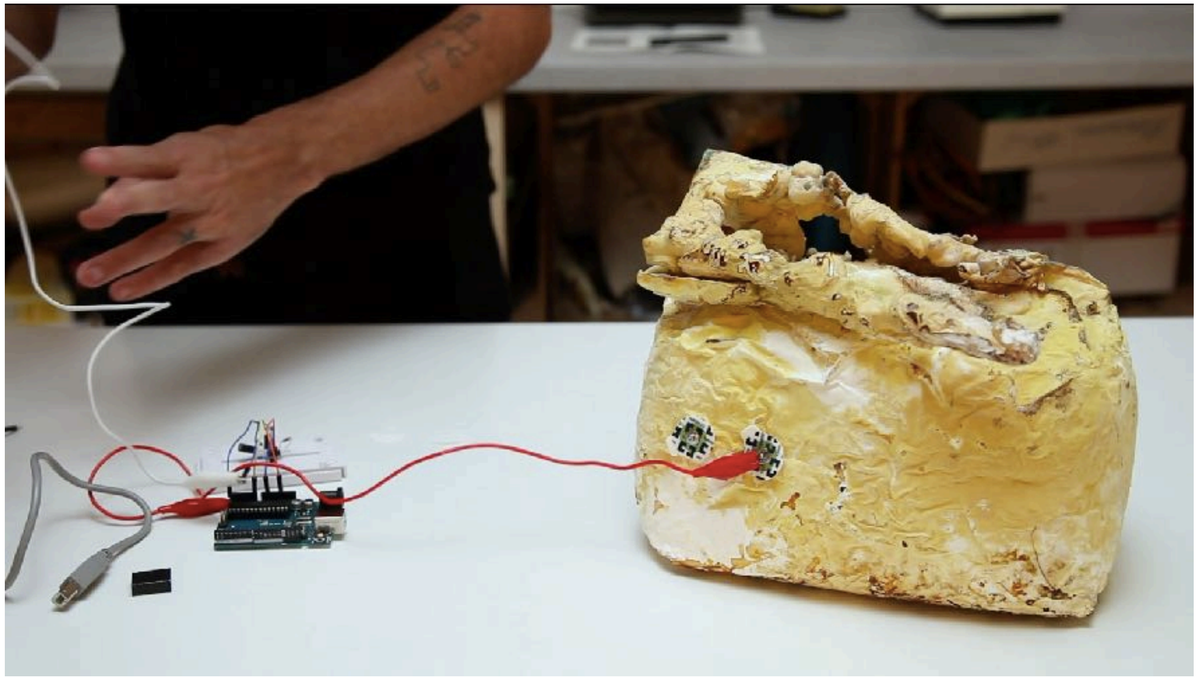
Motivation

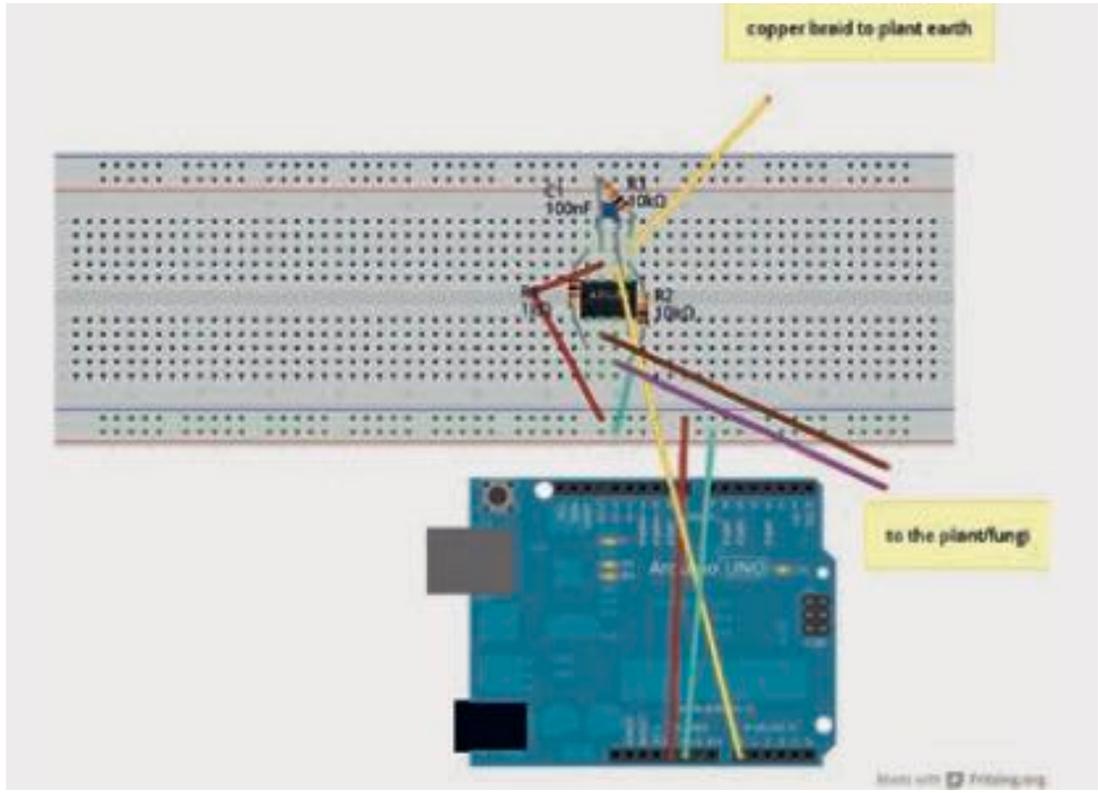
This experiment offers insight into the electrochemical activity of living organisms such as plants, fungi, or even humans. By tracking a specimen over time—especially across the day—you may observe fluctuations in its bioelectric activity, reflecting internal and environmental changes. The experiment builds on Martin Howse's Interspecies Communication Platform



See for details: Kuni, V., Landwehr, D. Home Made Bio-Electronic Art

Materials Needed

- Arduino microcontroller
- Breadboard
- 100 μF capacitor
- 1 kΩ resistors (×3)
- Jumper wires
- USB cable
- Electrode patches
- AD620 instrumentation amplifier chip



Experiment Setup

1. Preparing the Amplifier Circuit
- Place the AD620 amplifier chip on the breadboard so that its legs bridge the central gap.
- Insert the 100 µF capacitor between pin 4 (GND) and pin 7 (VCC) to stabilize the power supply from the Arduino.
- Place a 1 kΩ resistor between pin 1 and pin 8 to set the gain (amplification factor) to approximately 50.
- Connect pin 7 to the 5V power of the Arduino and pin 4 to GND.

2. Establishing the Reference and Inputs
- Connect pin 5 (reference) to the organism being measured (e.g., plant or mycelium). This sets the amplifier's reference ground.
- Add the two remaining 1 kΩ resistors to pin 5:
- One connects to pin 7 (power),
- The other to pin 4 (ground), forming a voltage divider that stabilizes the reference voltage.

Experiment Setup

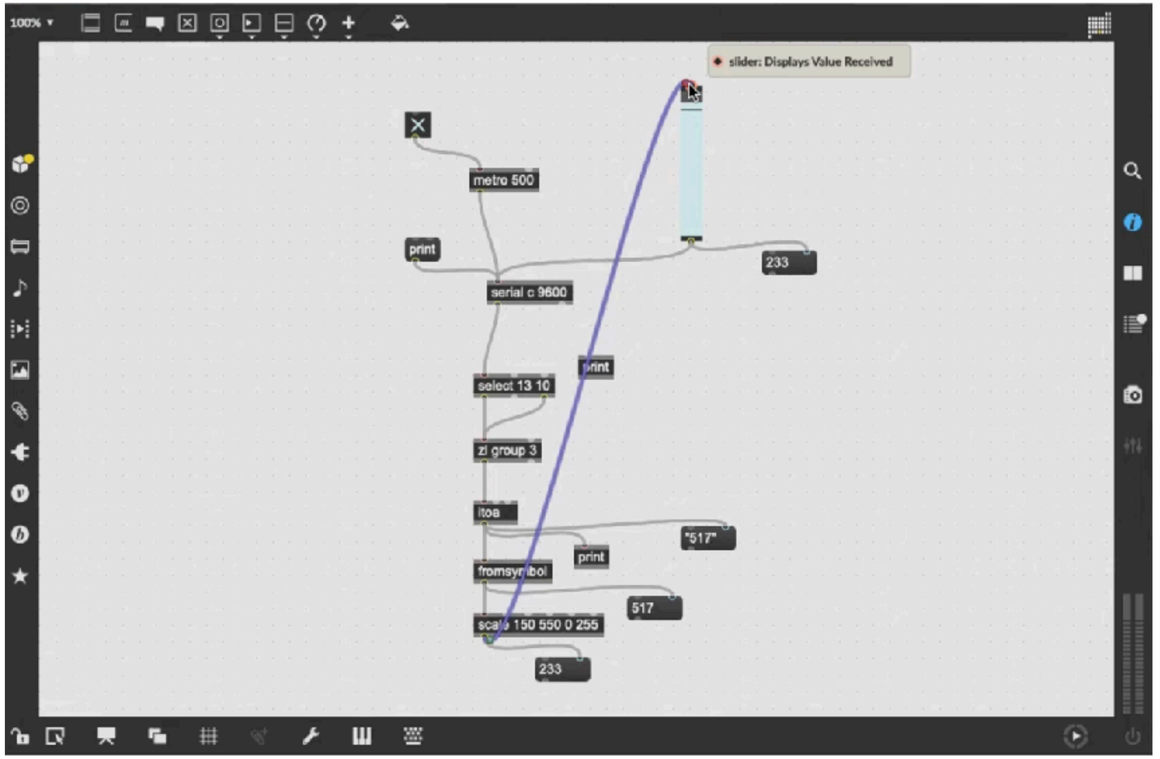
3. Signal Input & Output
- Connect pin 6 (output of the amplifier) to analog input A0 of the Arduino.
- Attach electrode patches to the organism and connect them to pins 2 and 3 of the AD620 chip (the differential input channels).

4. Arduino Connection and Software Setup
- Use the USB cable to connect the Arduino to your computer.
- Open the Arduino IDE, select your board and port under the "Tools" menu.
- Load the analog signal reading sketch:
- Navigate to File > Examples > Basics > AnalogReadSerial.
- Click the Upload button (right-pointing arrow) to upload the sketch to the board.

Further steps

Once you've begun collecting electric potential data from your organism, you can start interpreting and visualizing it using visual programming environments. A quick and accessible entry point is to use platforms like Pure Data, Max/MSP, or TouchDesigner.

If you're new to Max/MSP, a concise tutorial on sensing and working with physical parameters is available here: https://www.uni-weimar.de/kunst-und-gestaltung/wiki/GMU:Max_and_I,_Max_and_Me/Sensing_physical_parameters



Summary

The short intro into the Measurement of Electric Potentials in Plants should have given you an idea of:

- How to track electrochemical signal from a living organism such as plant, human or bacteria
- How to convert this signal into digital signal (For that you use a microcontroller such as Arduino)
- How to convert the digital signal into sound (for that artists often use a visual programing framework such as Max/MSP, Pure Data, or TouchDesigner)