Biodata Sonification

Problem statement

We will use a 555 timer and filters to obtain a clean, amplified output of electric pulses whose frequency and duty cycle depend on the conductivity between the parts of a plant. We will then generate music from the square wave signal, using the properties such as amplitude, duty and frequency to control the music using an Arduino board and a MIDI controller. Finally, we will output the signal as audible sound onto a speaker.

Theory

Any living organism responds to stimuli. Biologically, the organism generates action potentials across its parts that result in the change in conductivity between these parts. Such effects are more pronounced in sensitive plants like *Mimosa pudica*. Our goal is to much such changes in conductivity into melodious music: in short, we will *hear* plants!

Team

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Components

- Electrodes (optional, can be substituted by wires)
- Arduino Uno (Atmega 328)
- Speaker
- MIDI Controller
- 3.5mm Input Jack (optional)
- 555 Timer
- DSO (for debugging)
- LEDs, Resistors, Capacitors, Potentiometers
- Wires
- Breadboard

Description
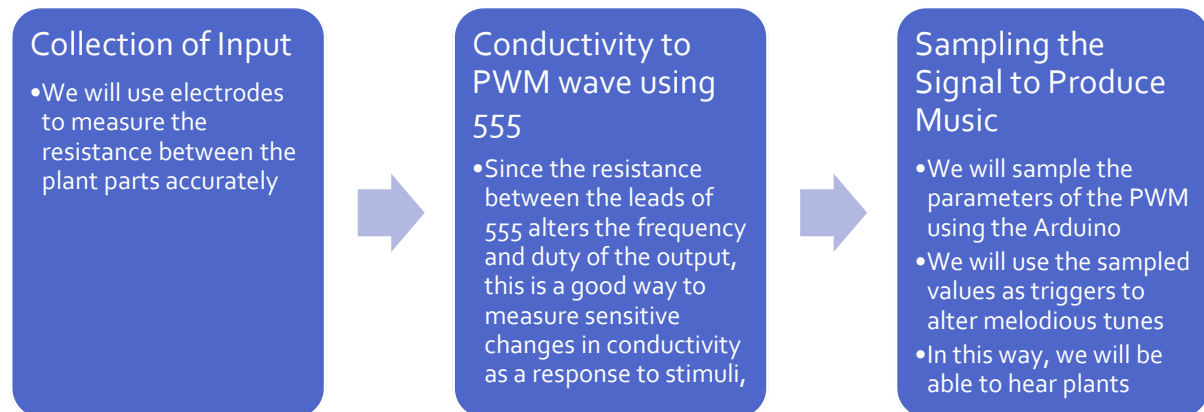
The project can be divided into three parts.
1. **Collection of signal:** We will use a 555 timer to convert the change in conductivity into electric signal in the form of a PWM wave.
2. **Filtration:** We will use a low pass (corner ~ 100kHz) followed by a high pass (corner ~ 5Hz) as a notch filter to clean our amplified input.
3. **Coding signals to sound:** This part involves converting the PWM to melodious music. We will use the Arduino to sample the parameters of the signal output from the 555 and

use the same as triggers on an audio track to produce harmony. The music will change due to change in conductivities. Small changes will manifest in small changes

4. **Real world testing:** The last phase would involve some real-world testing of the instrument we have built. This would involve probing the plants and actually hearing the music from plants. The changes in the music produced in response to stimuli is an interesting area to explore.

Block diagram

A flowchart-like diagram showing key elements of your project. The focus of this diagram is more on a conceptual workflow rather than strict hardware / software boundaries.

Collection of Input
- We will use electrodes to measure the resistance between the plant parts accurately

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Conductivity to PWM wave using 555
- Since the resistance between the leads of 555 alters the frequency and duty of the output, this is a good way to measure sensitive changes in conductivity as a response to stimuli,

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Sampling the Signal to Produce Music
- We will sample the parameters of the PWM using the Arduino
- We will use the sampled values as triggers to alter melodious tunes
- In this way, we will be able to hear plants

Circuit diagram

Will be revealed in the final submission.
(We have tested our circuit and it is working satisfactorily)

Arduino Code

Will be revealed in the final submission.
(We have tested our code and it is working satisfactorily)