Remotely Connected Electric Field Generator

for Particle Separation in a Fluid

Presented by *Team May1612* on 27 April 2016

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Dielectrophoresis (DEP)

1. A dielectric particle in a non uniform electric field experiences a force
2. Different potential fields and frequencies has an effect on the net force
3. First studied in 1950s by Herbert Pohl
4. Recently revived due to the ability to manipulate micro-particles and cells.

Real World Application

1. Potential to separate particles in spinal fluid
2. Act as filter
3. Research in separating cancerous cells from healthy cells
4. Separate platelets from whole blood
5. Separate red and white blood cells
6. Strains of bacteria and viruses

Project Description

1. A system to aid in the research of DEP
2. Allow for quicker setup times
3. Control Voltage and Frequency via the web
    1. 1 to 60 VPP
    2. 10k to 1Mhz
4. Hold output for long time periods
5. Small Form Factor
6. Easy to use
7. Plug and play

Project Structure

1. Raspberry Pi
2. Web Interface
3. Web Server
4. Frequency Control Solution
5. Voltage Control Solution

Initial Implementation

1. Raspberry Pi
    1. Host web server
    2. Remote manipulation of circuit output
    3. Web interface can provide additional functionality
    4. GPIO pins input to circuit
2. Circuit Output
    1. Frequency generated by GPIO pin
    2. GPIO waveform integrated to get sine wave
    3. Sine wave amplified to form output

Intermediate Implementation

1. Raspberry Pi controls Integrated circuit components
2. Minigen Signal Generator
3. SPI communications
4. Produces frequency 10 Khz - 4 Mhz
5. Digital Potentiometers
6. SPI communications
7. Vary resistance to control amplifier
8. Amplifier controls voltage output from circuit

Problems and Setbacks

1. Mosfet Amplifier
2. Digital Potentiometer
3. Resistance drops with AC signal
4. Distorted the sine wave
5. Op Amps
6. Slew Rates
7. Gain Bandwidth
8. Minigen
9. B23 Bug

Digital Potentiometer Amplifier Circuit

1. ïmage"

MOSFET Amplifier

1. picture"
2. information

Problems and Setbacks

1. Lost a group member
2. BJT Switch
3. Control through GPIO pin
4. Current Leaks through when logically off
5. Relay
6. Operating Frequency not sufficient
7. Brandon
8. We have had to make quite a few adjustments from our original plan.
9. This is especially the case with our digital potentiometers.

SSR Circuit Implementation

1. ïmage"

Current Circuit Design

1. "design diagram"

Web Interface

1. Hosted Locally
2. Able to be seen on intranet
3. Controls Voltage and Frequency
4. Provides Additional Functionality

Questions?

1. Dielectrophoresis (DEP)
2. Circuit Design
3. Digital Potentiometer/ Operation Amplifier
4. MOSFET/ Programmable Gain Amplifiers (PGA)
5. Web Interface
6. Design Documents

Work Breakdown

1. Initial Planning
2. Project Website
3. Reports
4. Circuit Design
5. Web Server
6. SOC Communications
7. PCB Design