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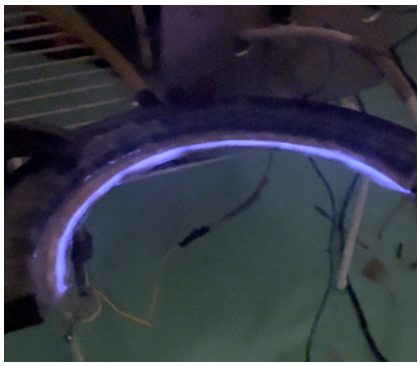
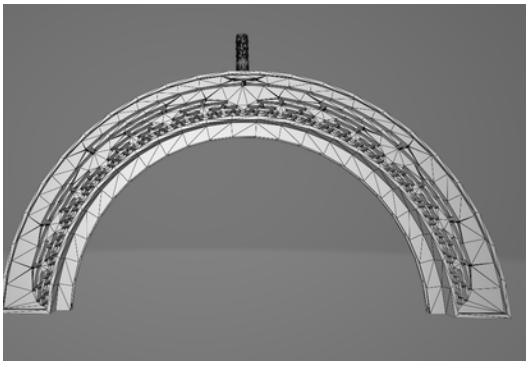
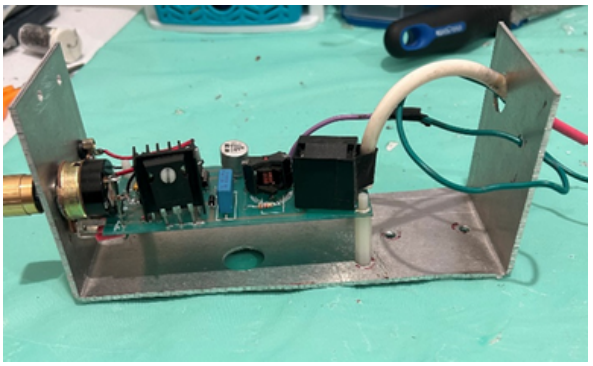
LOW-TEMPERATURE PLASMA FOOD STERILIZER







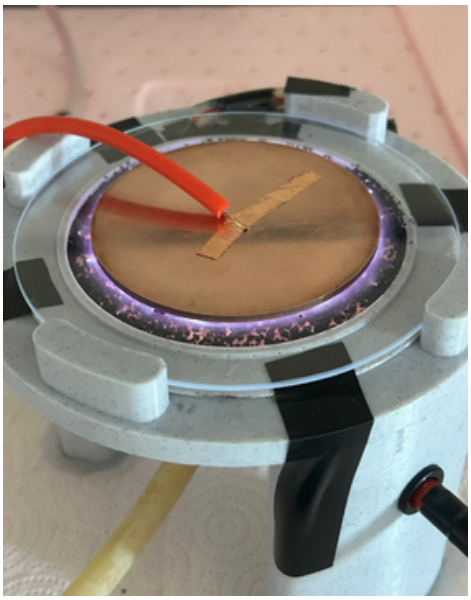
What?

- Plasma generators produce a **tiny volume** of plasma and have a **geometry that hinders** treatment
- Developed plasma sterilizer that can be **molded into any shape** and produce **a large volume o**f plasma

How?

- Used **Fusion 360** to model a gas distributor customizable in shape and **3D-printed** it
- Designed a 555 timer RF pulse-oscillator circuit on **PCB** to drive a flyback transformer and power the device

PLASMA SYSTEM FOR PFAS DEGRADATION - VILLANOVA UNIVERSITY



What?

- **Short-chain PFAS** water pollutants are difficult to degrade because they are **unreachable by plasma** when underwater
- Created a device to degrade short-chain PFAS

How?

- Used activated carbon to **concentrate PFAS on its surface**
- Used **a dielectric barrier discharge** plasma configuration to generate plasma around the carbon
- Used **High-Performance Liquid Chromatography** and **centrifugation** to analyze results

Results

- Degraded short-chain PFAS
- 0.86 µmol fluoride byproduct after 2 µmol short-chain PFAS treated

SPARK-GAP TESLA COIL

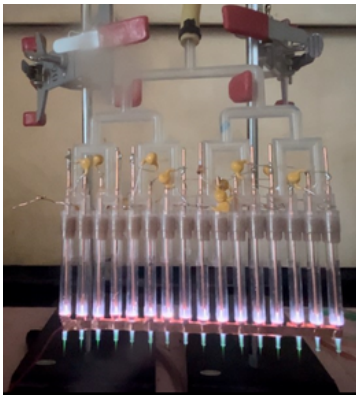
What?

- Created a spark-gap tesla coil

How?

- Used a **signal generator** and **oscilloscope** to match the LC resonance of the coils
- **Soldered** a ZVS circuit

PLASMA JET ARRAY



What?

- Made a plasma jet that branches out into 16 jets

How?

- Modeled the gas distributor in **Fusion 360**
- **Matched impedance** of the transformer secondary inductance with capacitors

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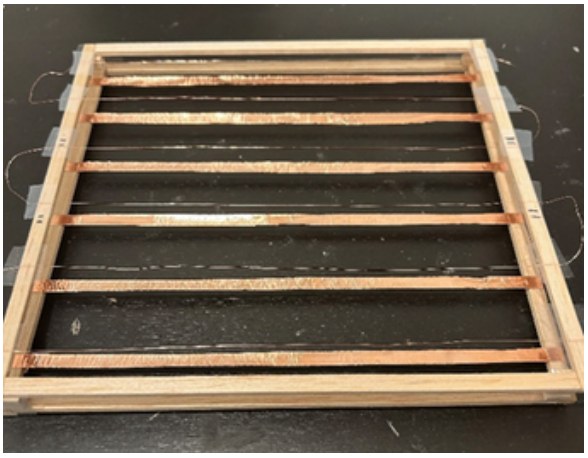
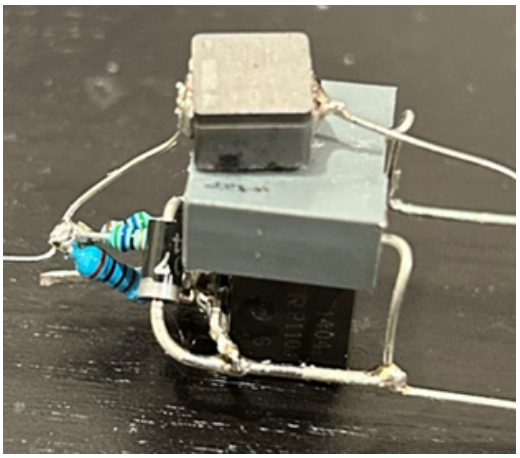
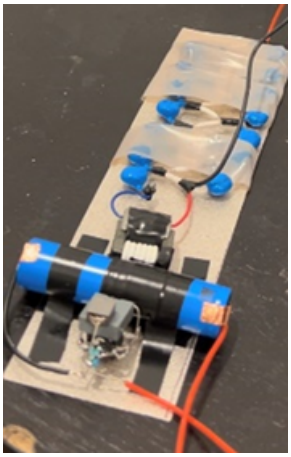
IONIC WIND DRONE

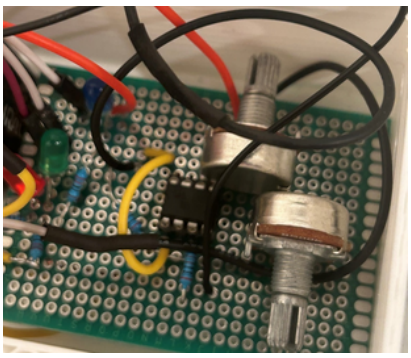
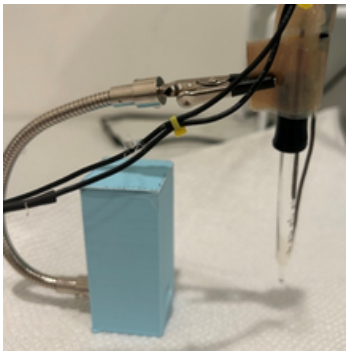
What?

- Used ionic wind to lift a structure

How?

- **Built** a lightweight frame with thin emitter electrodes and smooth collector electrodes
- **Made** a small ZVS driver, **transformer**, and **voltage multiplier** for power supply

CHLORIDE DETECTOR

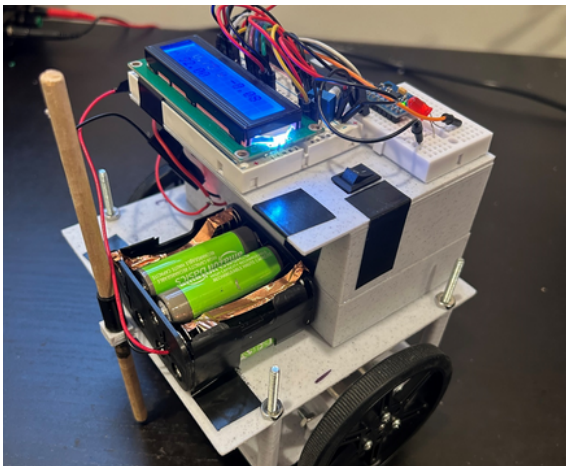
What?

- Made an Ag/AgCl **ORP probe** to accurately measure low chloride concentrations

How?

- Used a **shunt voltage regulator** for a stable voltage reference for the **Arduino**
- Used **op amps** to amplify the signal from the electrodes
- **Calibrated** the detector with a voltage vs. concentration model

MAZE ROBOT



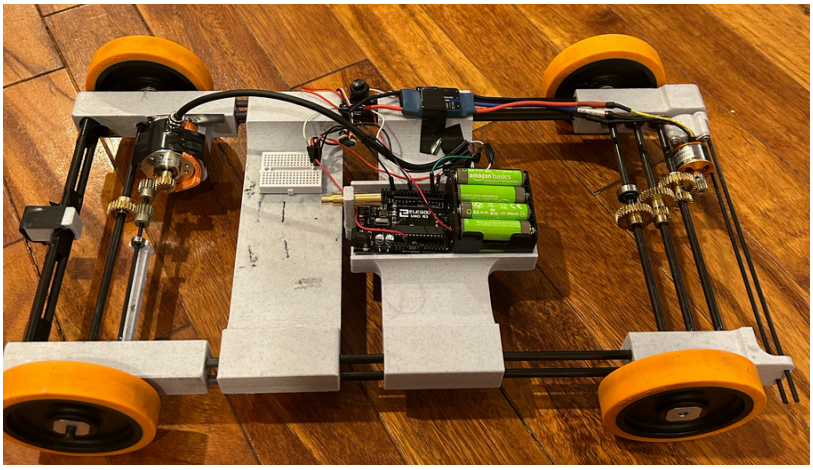
What?

- Made a robot using **Arduino** for a maze competition

How?

- Used **motor encoders, MPU6050**, **real-time control**, and **PID control** for accurate movement and timing

SMALL RACING VEHICLE



What?

- Made a vehicle using **Arduino** for a racing competition

How?

- Used **brushless motors** and ESCs