Pulse Inverted Electrolyzer

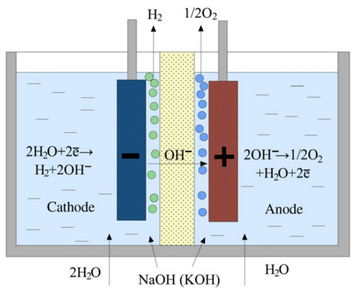
Brennan Angus, Matthew Beausoleil, Jacob Cooper, Wyatt Groves, Austin Jerrolds, Conner Sanders

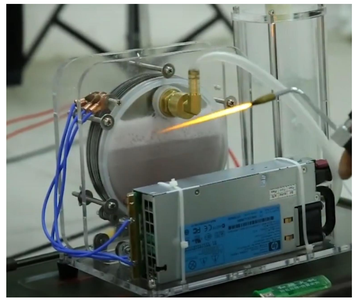
Executive Summary

The goal of the project was to create an electrolysis system and make it as efficient as possible, while also taking standards of safety into consideration. The system should create a constant flame while it is run. The standards to be met required a variety of additions to the basic electrolysis cell, including a water level sensor and an emergency stop button. While the electrolytic cell was pre-made, the overall system needed to be designed around it, with functional and spatial limitations being considered.

What is Electrolysis?

Electrolysis is the process by which an electrical current is passed through a substance to trigger a chemical change. Water electrolysis occurs when a power source is connected to two electrodes which are immersed in water. When a voltage is created across the plates, water in the cell changes into hydrogen and oxygen gas. This results in the highly flammable mixture oxyhydrogen, commonly dubbed “Brown’s gas”.





Predicted vs Real BOM

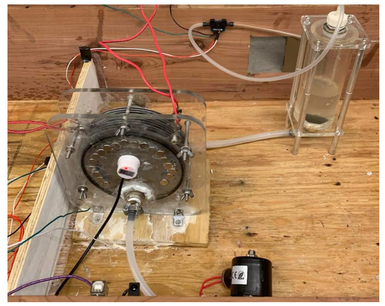
Predicted

Components	Price($)
Electrodes	180
Pulse Generator	90
Mini Compressor	400
Hydrogen Sensor	65
Housing System	80
Gas System	260
Micro-controller	30
Total	925

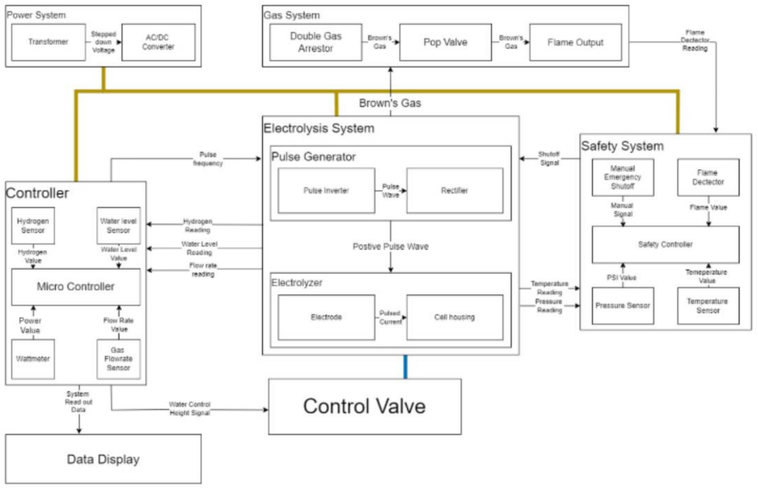
Real

Systems	Price
Controller	155.72
Electrolysis	120.9
Gas	157.42
Power	33.97
Safety	152.64
Total	620.65

Pictured (left to right): Austin Jerrolds, Brennan Angus, Jacob Cooper, Wyatt Groves, Conner Sanders, Matthew Beausoleil



Architecture



Efficiency Boosting

Lye

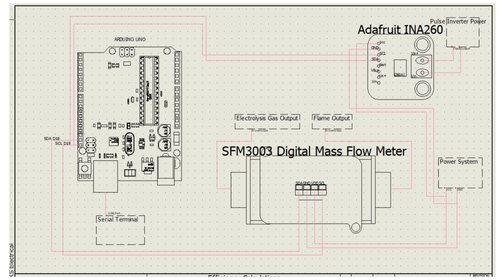
Lye (sodium hydroxide) is used to help boost the chemical splitting of water into hydrogen and oxygen gas.

Pulse Inverter

The pulse inverter is used to generate high-magnitude electrical pulses in order to try to boost the system’s efficiency. The pulses are rectified so that the polarity of the system is unchanging.

Magnets

The magnets are placed onto the electrolysis cell in order to bias the ions’ location in the solution for faster oxyhydrogen generation.



Controller System Schematic

Experimental Results

In experimentation, many constraints were tested and met. Functionality constraints included but were not limited to constant voltage supplies of 5V and 12V, the pulse generator’s output being rectified, and the prevention of water backflow out of the system. Safety constraints included but were not limited to the cell not being reactive with sodium hydroxide, the system having no dangerous exposed wires, and the inclusion of a functional emergency stop button. Constraints of accurate measurement, gas not being produced when there is no flame, and the inclusion of magnets were the only ones not met.

Future Improvements

- Pulse inverter: The pulse inverter running at a higher frequency than what it is currently capable of could result in the cell being sufficiently powered.
- Gas output sensor: The sensor used by the system was ruined by the oxyhydrogen being output. Using a different sensor would allow the output to be measured properly.
- Magnets: The magnets used on the cell didn’t end up having notable effects. Using stronger magnets could help make the electrolysis process more efficient.
- Electrolysis cell: While the cell that was used functioned overall, it had leaking issues that needed to be addressed and it proved to be inconvenient to take apart and work with.