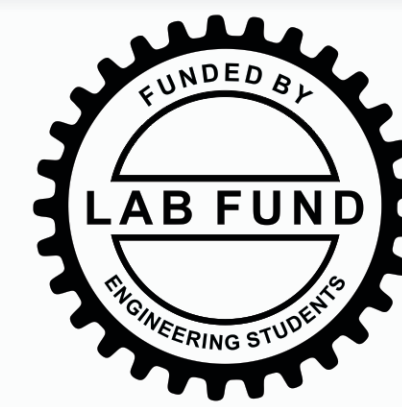


Hydrogen Fuel Cell Performance Optimizer

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Background

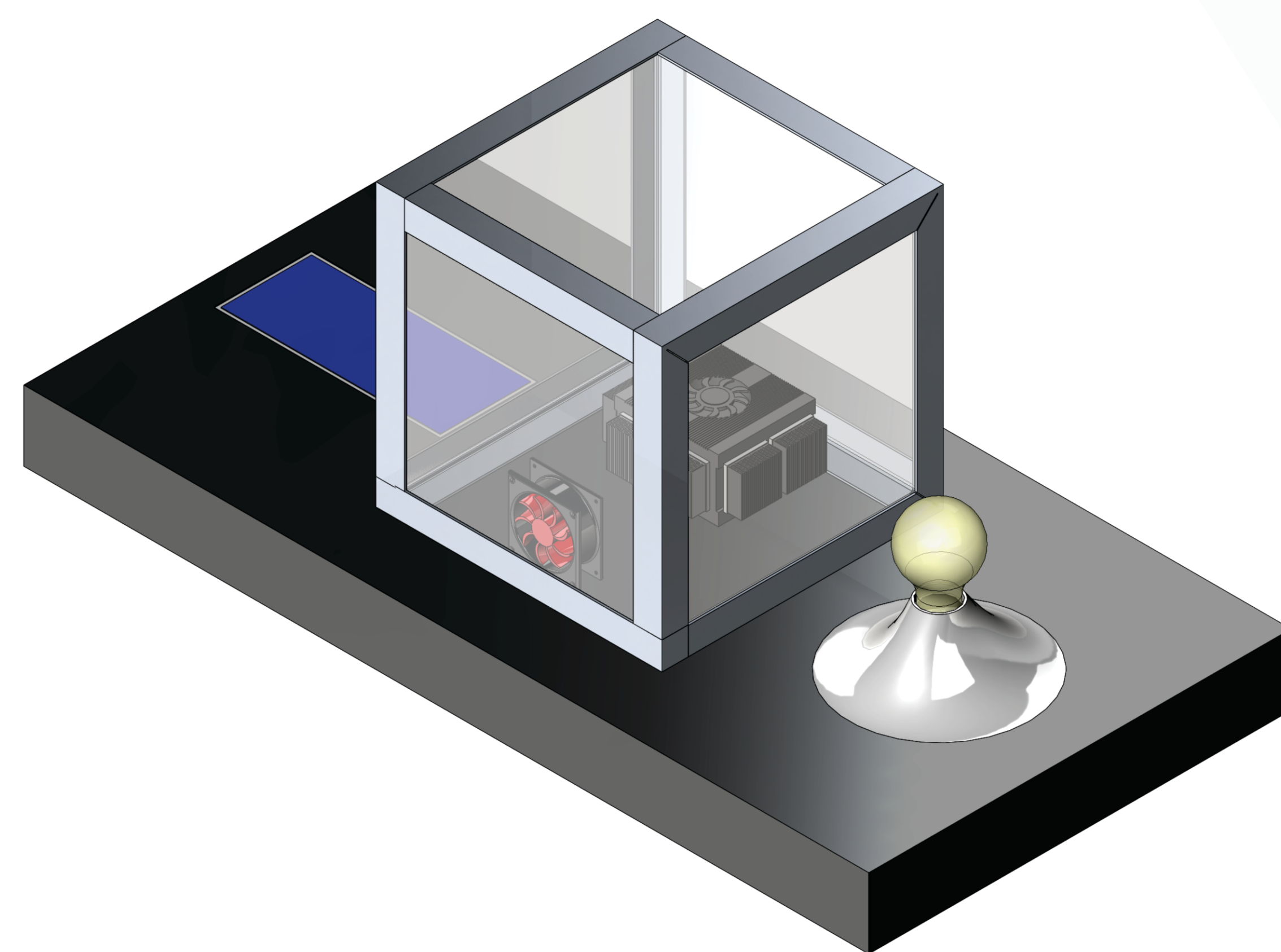
- The development of hydrogen fuel cell technology will help the transportation industry shift away from gas powered vehicles lowering fossil fuel emissions
- The efficiency of a hydrogen fuel cell is proportional to the internal temperature of the cell and improving fuel cell efficiency will increase usability

Design Objectives

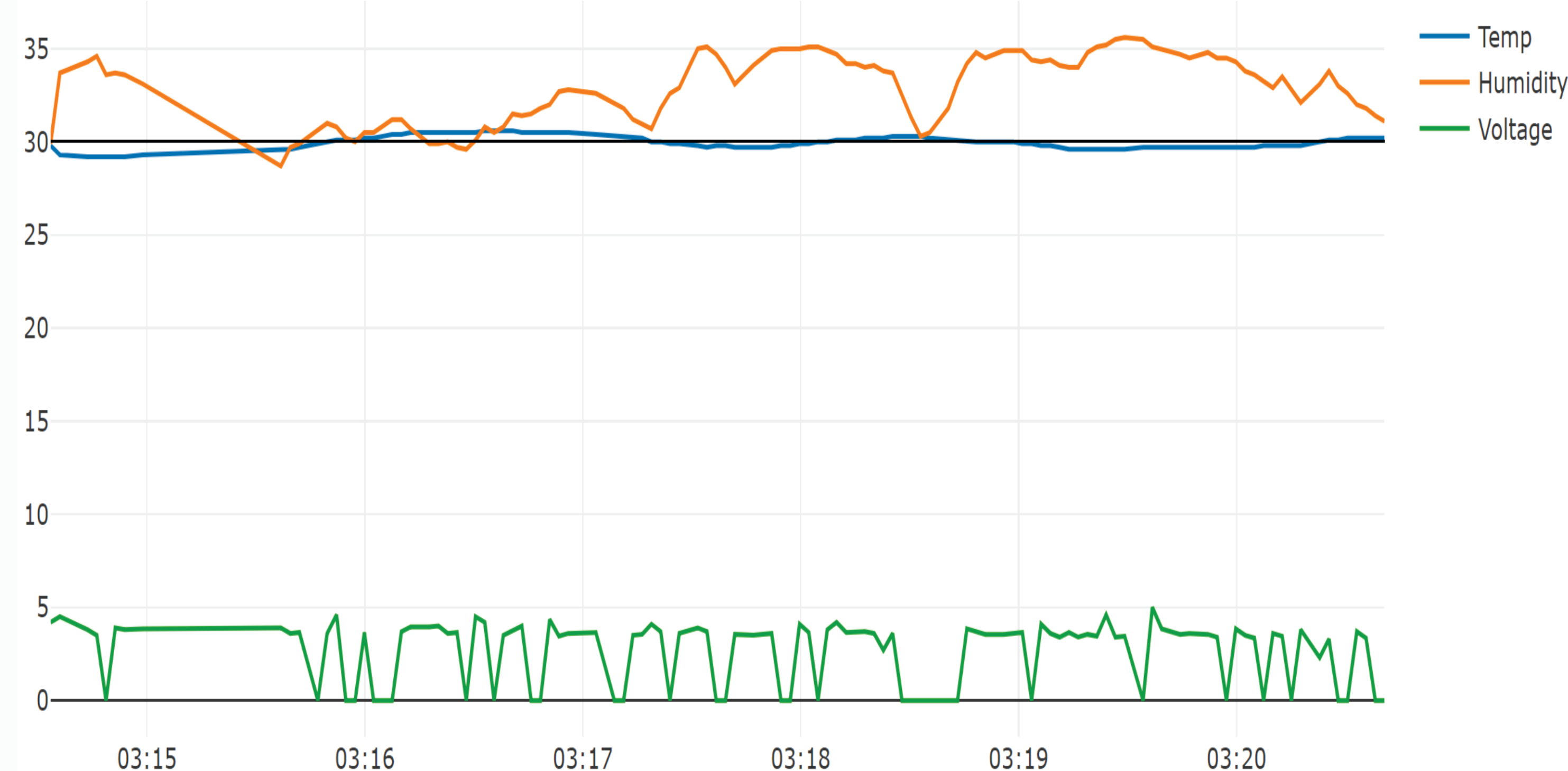
- Design and prototype a system to determine and maintain the optimal operating temperature of a hydrogen fuel cell
- Improve students understanding of how temperature effects the efficiency of a hydrogen fuel cell
- Create an interactive power output display

Proposed Solution

- Removable enclosure to show effects of environmental conditions
- Thermoelectric coolers to help remove excess heat from system
- Heat sink to increase temperature gradient across coolers
- Forced convection fan to remove remaining excess heat
- Temperature and humidity sensor to monitor cell conditions
- Hysteresis controller to ensure temperature is held constant
- LCD screen to display temperature, humidity and power readings
- Lightbulb brightness clearly displaying varying power output
- Black plastic panels are used to create an aesthetic finish
- Raspberry pi is used for data analysis and LCD display
- Python based backend for interfacing sensors with the Raspberry Pi
- Arduino to read temperature data



Performance Analysis



Conclusion

- The proposed solution successfully monitored and controlled the operating temperature of the hydrogen fuel cell and was able to find the optimal operating temperature
- In order to use a larger hydrogen fuel cell, the heat removal system will need to be scaled up and optimized
- The LCD display and lightbulb allowed students to see exactly how the power output varied while the temperature of the fuel cell was regulated
- The system maintained a local database to aid in system control and data visualization

Future recommendations

- Adapt the current system to a real-time system to allow for faster and more accurate data sampling
- Integrate data hosting to allow the creation of an app for easy access to data

