



# Hydrogen-Powered Drone

TEEL, UC Merced

## Using Hydrogen Fuel Cells

### Drone Overview

- Quadcopter or drones are small unmanned aerial vehicles (UAV) that are used in many fields from surveying (construction, agriculture), photography, to hobbies.
- Currently the most popular power source for drones are batteries and while these work great, they are extremely limiting to the flight time of these drones. The average flight time is around 20 minutes to a maximum of around an hour for a battery powered drone. These short flight times are a serious drawback for drones, so the goal of this project is to increase the flight time of a drone.
- It is possible to get longer flight times using a fuel cell with hydrogen as the fuel because of the high energy density of hydrogen. However, fuel cell technology is relatively new so they are much more expensive than batteries. Therefore, we designed a fuel cell and battery hybrid system to power the drone.



### Fuel Cell Overview

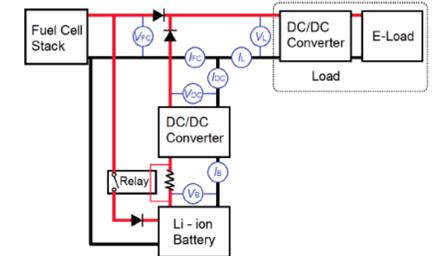
- A hydrogen fuel cell reacts hydrogen and oxygen together to produce electricity, and water is a byproduct. The fuel cell and hydrogen storage tank are shown below:



## Achievements / Results / Outcomes

### Results

- We have tested the fuel cell and determined the necessary amounts of air flow and hydrogen flow.
- We have modified the drone to make it as light as possible so that it can fly for as long as possible.
- So far, we have developed a preliminary design for the hybrid system that will power the drone. It involves various electrical components, such as a DC to DC converter and a voltage sensitive relay.



## Lessons Learned / Intern Experience

### Successful Strategies:

1. Order parts as soon as possible so that there is plenty of time to test and assemble them.
2. Setting clear goals for each week that must be accomplished.
3. Working on the project as a team rather than simply splitting up the work and doing things individually.

### Recommendations for Improvement / Program Expansion:

1. Attach a larger fuel cell to a larger drone – this will open up more possibilities, but it will also cost more.
2. Understand different hydrogen storage mechanisms for extended flights.

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Intern background: I am a third year mechanical engineering major. I hope to have a career in renewable energy, and this project was an excellent opportunity to work on a complex project relating to energy storage

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