Small Satellite and Launch Vehicle for Climate Change Research

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Cubesats are small, lightweight satellites that allow researchers to conduct experiments and collect data from Low Earth Orbit (LEO); however, the costs to launch these satellites oftentimes hold back research from being conducted as even the cheapest methods to send them, as secondary payloads on other launch vehicles, can bring the costs higher than otherwise feasible and thus hold back research. To serve as a proof of concept for a launch vehicle that could launch small satellites into orbit, we developed a model rocket that uses advanced applications of control theory in order to maintain a desired orientation. Using a 9 degrees of freedom inertial measurement unit for gyroscope data, a Kalman filter to improve the accuracy of the sensor readings, and a PID controller, we developed a vehicle that is capable of responding to errors in orientation. Alongside this, we developed a CubeSat system capable of detecting forest fires and measuring air quality through the use of infrared temperature and carbon monoxide sensors. This system serves as a proof of concept of how CubeSats can be utilized for climate change research, helping to monitor both its long-term and short-term impacts. As launch vehicles become smaller, which is necessary to decrease the costs of launching small satellites, external factors such as wind have an increasing impact on the vehicle. This project serves as a proof of concept that advanced control is possible for such small scale vehicles, and could one day be applied to LEO launch vehicles.

Awards Won:

Third Award of $1,000

American Institute of Aeronautics &amp Astronautics: 3rd Prize of $1,000