Remote Piloted Drone for Cenote Water Collection

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Abstract

Due to the difficulties and dangers associated with collecting water and data samples from areas of interest, unmanned aerial vehicles (UAV) have been used to reduce risk and increase efficiency of geological surveillance. This project provides both the design and development process of a high durability, high payload capacity UAV. This drone will operate by combining power control systems, flight control systems, and data and sample collection systems in order to provide users with a modular platform that can operate in a variety of environments and can assist in various forms of geological sampling.

Introduction

Over the past several decades, human development and pollution levels have had an environmental effect on even the most remote areas. One indicator of the ecological health of a specific environment is the quality of water. It can be difficult and dangerous to sample water, especially when cenotes, large chasms in the ground filled with water, are considered. A drone designed for this task must have a high payload capacity, be durable, be able to easily implement modern sensors, and remain modular. Essentially, this drone is a hybrid between agricultural drones or package delivery drones, and nimble hobbyist drones. The combination of these two drone families provides a functional design that will assist in water sampling and data collection for cenotes.

Prototype

Frame and Body: Aluminum arms and a water-resistant box to house electronics.
Power and Flight Control: Batteries and task specific ICs along with an RC control system allows user input to manipulate flight
Sample and Data Collection: Microcontroller and sensor kit along with servo operated PVC container.
Optional Peripherals: Features including GPS and FPV to allow for easier operation.

Results

Based on preliminary simulations, it was determined that roughly 8 minutes of flight time could be achieved by using dual battery operation. Testing primarily involved verification of each of the subsystems. Fully functional flight, collection of water samples and data, and peripheral system operations were achieved. While functional implementation of all systems were not met simultaneously, instructions can be provided to meet the required goal.

Discussion

Significant discussion has been given as to additional design ideas that could be implemented in a second phase of the project. This allows for improved design elements including the ability to adjust the depth of the water collector remotely, rotor guards, and methods to increase flight time.

Conclusions

Based on testing, this drone does provide a reliable tool to assist in the gathering of water samples and data, although this prototype can be further improved upon with the help of an increased budget and better understanding of infield shortcomings.

Acknowledgements

The authors would like to thank Dr. Sachit Butial and German Ibarra for their continued oversight and advice for the design of this drone, Dr. Donald Peterson and the College of Engineering at Northern Illinois University for providing the funds and facilities for development, and lastly, Dr. Melissa Lenczewski and the Department of Geology and Environmental Geosciences for their additional funding.