Celestial-Inertial UAS Navigation in a GPS-negative Environment

Auburn REU on SMART UAVs 2018

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June 17, 2018

Abstract

As technology continues to advance, electronics get cheaper and batteries get smaller. This has led to cheaper and larger drones taking on new and more complex roles beyond their traditional place as either military hardware or hobbyist toy. As drones increase in both size and importance, we have to look more carefully at safety. Most drones, when guided autonomously, depend on our Global Positioning System (GPS) network to function. GPS depends on weak signals and is exceptionally easy to "jam" or render inoperable. We purpose to develop a system which aims to provide a passive and reliable method of Unmanned Aerial System navigation via computer vision monitoring upward star positioning. Utilizing careful calculations of the stars around the observing aircraft(s) to determine precise position, while utilizing inertial dead-reckoning system for correcting the celestial computations.

1 Introduction

Why should we care about UASs?

With the increasing economic viability of UAS technology, they have taken a larger role in in various fields from delivery to search-and-rescue to military applications. This increased reliance has led to less interaction from drone operators, longer missions, and a greater reliance on autonomous systems.

How are they navigated.

Unmanned Aerial Systems are dependent on many advances in high-precision navigation technology, including GPS systems, LIDAR, AI-assisted dead reckoning, and many other proposed solutions. The most common, accurate, and affordable choice is GPS. However, GPS suffers from relatively weak signals and ease of jamming[]. LIDAR suffers from being expensive, bulky, and active rather than passive. The method this paper will explore is called either astronavigation or celestial navigation: determining location using heavenly bodies.

Pro/Con on Celestial Navigation.

Astronavigation is dependent on having an accurate view of some celestial bodies including the sun, the exact time for some point on Earth. Given these and a camera, location can be determined to within one mile or less[]. While this is a relatively wide area, it does offer an observer on the ground to locate the drone by sight when within the radius of home.

What we want to do.

The goal of this paper is to explore the exact

potential of an inertial dead-reckoning navigation system supported by astronavigation.

What is in this paper.

2 Body

3 Conclusion

References Cited

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