

A Low-Cost Vision-Based Unmanned Aerial System for Extremely Low-Light GPS-Denied Navigation and Thermal Imaging

Authors : Chang Liu, John Nash, Stephen D. Prior

Abstract : This paper presents the design and implementation details of a complete unmanned aerial system (UAS) based on commercial-off-the-shelf (COTS) components, focusing on safety, security, search and rescue scenarios in GPS-denied environments. In particular, the aerial platform is capable of semi-autonomously navigating through extremely low-light, GPS-denied indoor environments based on onboard sensors only, including a downward-facing optical flow camera. Besides, an additional low-cost payload camera system is developed to stream both infrared video and visible light video to a ground station in real-time, for the purpose of detecting sign of life and hidden humans. The total cost of the complete system is estimated to be \$1150, and the effectiveness of the system has been tested and validated in practical scenarios.

Keywords : unmanned aerial system, commercial-off-the-shelf, extremely low-light, GPS-denied, optical flow, infrared video

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