Applications for Uncrewed Aircraft Systems at Night to Identify Hazardous Wildlife Species at Airport Environments

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Abstract

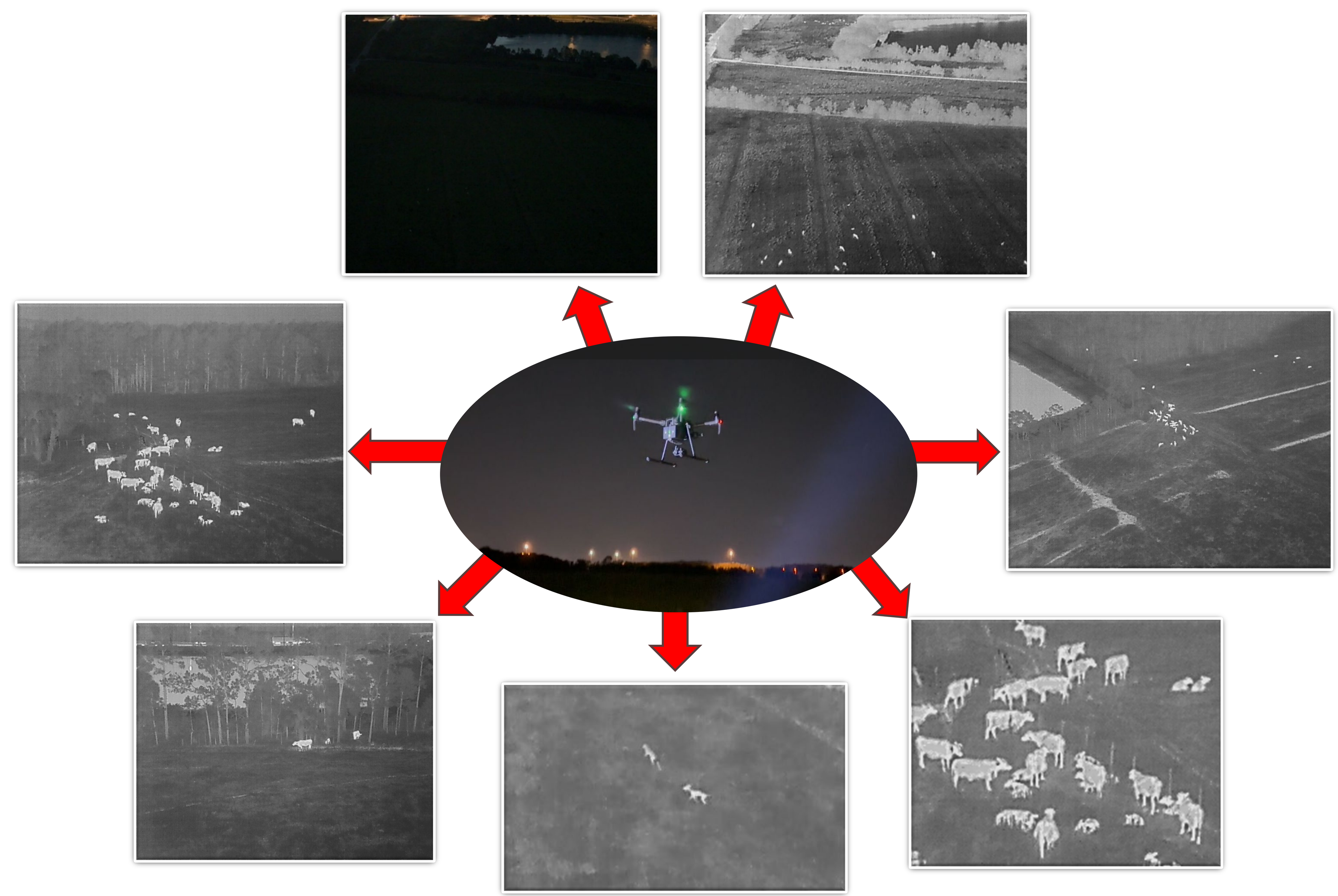
Wildlife strikes are a growing safety and economic concern for the US aviation industry. In this ongoing study, our team has explored the use of uncrewed aircraft systems (UAS) technologies by using thermal sensors to support data collection and analysis during nighttime Wildlife Hazard Assessments (WHAs). Data has been collected between twilight and nightfall in a farmland area that is located approximately two nautical miles south of Daytona Beach International Airport. The research team has developed a Concept of Operations (CONOPs) to address safety risk management concepts and protocols to identify hazards and mitigate the associated risks with the safe operation of UAS in and around the airport environment. The safe application of UAS to streamline the WHA process is anticipated to provide several benefits to the airport operator, including task completion in reduced time, enhanced level of accuracy during the data collection process, reduced risks for the qualified airport wildlife biologist, and cost efficiencies. Most importantly, researchers are expecting to develop benchmark safety protocols that can facilitate the effective integration of UAS into the airport environment.

Introduction

Studies have identified a positive relationship between the body mass of an animal and the likelihood of a damaging strike [4, 8]. Similarly, there is evidence that supports a higher risk of strikes with terrestrial mammals at night [2, 4]. This stands to reason considering most terrestrial animals listed in the FAA's Wildlife Strike Database of the fifty most hazardous wildlife species tend to be crepuscular (most active before sunrise and after sunset) or solely nocturnal. Herein lies an opportunity to enhance current WHA practices during periods of darkness. Through UAS innovation technologies, there is a potential to extend the range, perspective, and penetrate locations previously inaccessible to qualified airport wildlife biologists.

Concept of Operations

The researcher led a small team of undergraduate students to assist with data capture, visual observing, flight operations, and data analysis during the hours of twilight leading into nightfall. This study employed a DJI Matrice 210 with an XT-2 thermal camera to achieve the thermal imaging requirement. The team used a dedicated trailer to house the necessary equipment to ensure optimal research procedures, such as an Automatic Dependent Surveillance – Broadcast (ADS-B) flight box, in concert with ForeFlight to monitor manned air traffic; and two television monitors, one to display ForeFlight information, and the other, connected to the drone's controller via an HDMI cable, to mirror the drone's screen.



Data Collection Methodology

To obtain the best possible outcomes, the test flights first used both automated and manual flight modes. The first mode (automated) was flown at 300 feet AGL to provide a baseline of the area and thermal signatures of resting objects (e.g., presence and location of mammals) by scanning in a grid-like pattern via the "DJI GS Pro" software. The second mode (manual) of flight then shifted to manual operations whereby the pilot-in-command (PIC) observed and loitered over areas of interest at 300, 200, 100, and 50 feet AGL to assess the varying stand-off heights. A mixed method approach was utilized during the analyses of the collected data to identify what, if any, added benefits there were to the methodology of the research project. Quantitative and qualitative analyses helped identify:

1. The workflows and best practices for applying UAS technologies during a WHA at night;
2. Whether UAS thermal imaging was effective in the detection of wildlife during periods of darkness; and
3. Whether UAS thermal imaging was effective in identifying the land uses and habitats at the data collection area that are potentially attracting hazardous wildlife to the airport environment.

Significance of the Study

Historically, ground-based exploration (often with the assistance of binoculars) does not offer a bird's-eye view of wildlife, nor are the locations conducive to reach by vehicle or on foot (e.g., wetlands, marshes) [1]. Furthermore, these assessments fail to capture the nocturnal nature or congregations of large-massed animals that have emerged as more dangerous to aviation. Moreover, traditional WHA conducted at night use trapping and animal marking techniques are highly invasive [3]. Other methods call for night vision equipment that does not adequately penetrate the landscape, or vehicle-mounted spotlights that potentially pose a hazard to aircraft, other vehicles, or airport towers if pointed inappropriately [3]. Hence, the use of UAS technology is a less intrusive means to assist with wildlife surveys, and from an aerial perspective that extends beyond conventional practices.

Safety Risk Management Strategies

The team adopted SRM procedures to help mitigate the possibility of conflicts between manned aircraft operations and UAS during the data collection process, including geofencing, a visual observer (VO) [5, 6, 7], and UAS flights being conducted at or below 300 feet above ground level (AGL). Noteworthy to mention that at least one member of the team stayed inside the trailer during the entire data collection process monitoring the live traffic feed and communicating (e.g., walkie-talkies) with the drone's pilot and the visual observer.

References

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