Night Owl: A Low-Cost Smart Drone System for Defending Peanut Farms from Nighttime Wildlife Intrusion

Investigators

Dr. Taeyeong Choi
Assistant Professor
Department of Information Technology, Kennesaw State University
tchoi3@kennesaw.edu

Dr. Yan Fang
Assistant Professor
Department of Electrical and Computer Engineering, Kennesaw State University
yfang9@kennesaw.edu

Dr. Austin Ford Ramsey
Associate Professor
Department of Agricultural & Applied Economics, University of Georgia
aframsey@uga.edu

Research Goals: This project proposes a robotic solution called "Night Owl"—a low-cost smart drone system designed to autonomously protect peanut crops from wild animals, particularly during "nighttime" when such animals are most active.

Milestones Achieved

Development of Sentinel: As shown in Fig. 1, we built a stationary sentinel system using a CCTV-style chassis equipped with a thermal camera and microcomputers (i.e., NVIDIA Jetson Nano and Arduino). The system is powered by a 60,000 mAh battery pack, enabling continuous operation for over one week without recharging, and is enclosed within a hunter blind for camouflage in the field. An AI-based perception and control framework was implemented to *autonomously* scan a 150° field of view using a rotating thermal camera and trigger video recording when deer are detected using temperature-based features in thermal imagery.

Figure 1. Developed sentinel system.

In-Field Deployment & Data Collection: The sentinel system was deployed at an 11-acre peanut farm in Sycamore, Georgia, where the farmer reported frequent "deer-related" crop damage. The system operated continuously from 8PM to 6AM between October 13 and October 17, 2025. During this period, the sentinel system recorded 67 deer appearance events, where each event may include multiple individual deer. We trained an AI-based deer detector, using a publicly available thermal deer image dataset, and it successfully transferred to real-world field conditions in our recordings. Representative examples are shown in Figure 2.

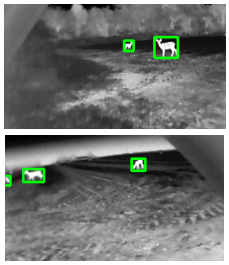

Figure 2. Frames with detected deer.

Drone System Development:

Economic Benefits: We conducted a preliminary assessment of the economic feasibility of the proposed solution, collecting data from the federal crop insurance program on wildlife-related losses in Georgia peanut production. Figure 3 shows that these losses have highly increased in recent years. Given the relatively "low cost" of approximately $2,700 ($1,000 for the sentinel and $1,700 for the drone), the proposed system has the potential to yield substantial economic benefits.

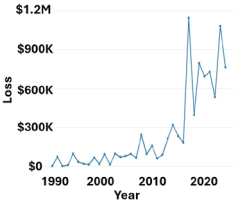

Figure 3. Peanut crop insurance losses due to wildlife in Georgia

Planned Work

Sentinel Refinement: We will enhance the AI-based deer detector to improve detection accuracy and robustness by applying image quality enhancement techniques and expanding training with additional thermal datasets collected under diverse field conditions.

Integration & Deterrence Field Testing: We will integrate the sentinel and drone into a unified autonomous system and evaluate "deterrence" strategies (e.g., flashing lights) through extended nighttime deployments in peanut fields to assess its effectiveness. Both quantitative metrics (e.g., deterrence success rates) and qualitative assessments (e.g., behavioral responses of deer) will be used for evaluation.

Net Benefit Assessment: We will conduct a net benefit analysis that considers system cost, spatial coverage, and operational effectiveness to determine the point at which the economic benefits *exceed* the costs and justify investment in the developed technology.