

Scarecrow-Bot: The Rabbit Hunt

Vertebrate pests such as squirrels, rabbits, raccoons, deer, mice, voles, and birds are an agriculture problem year-round. Managing vertebrate pests requires time, money, and sometimes labor. Challenges are identifying the presence of pests and constantly moving onto the field, when farmers are not on the premises or when it becomes especially undesirable during cold seasons. Currently, farmers use scarecrows, reflective paper, repellent sprays, propane canons, lasers, and ultrasonic devices for vertebrate control separately so animals become desensitized over time. **We propose solving this issue via robotic intervention.**

Our vision for Boiler Gold Rush is a Rabbit Hunt game involving an autonomous Scarecrow-Bot and Virtual Reality (VR) augmented Remote-Control Rabbit (RC-Rabbit). We will design a closed game arena mimicking a Midwestern strawberry farm, with Boiler- and Hoosier-themed obstacles. The Scarecrow-Bot will be equipped with a speaker that dynamically cycles through a range of sounds, in increasing intensity as it approaches the rabbit. A student-player will wirelessly control the RC-Rabbit, wearing a VR headset to view the field through the rabbit's perspective. The student-player's objective is to reach simulated strawberry checkpoints in the field and return to his burrow without being caught by the devious Scarecrow-Bot. The game ends when either Scarecrow-Bot emits its loudest sound or the RC-Rabbit returns safely home. The audience is encouraged to cheer for the success of either human-rabbit or machine-scarecrow team.

This project is proposed by a interdepartmental team of undergraduate and graduate students from the Digital Agriculture Club (DAC) of Purdue and their faculty advisor. Since 2021 we have experimented with digital technologies for food systems and agriculture, participating in hackathons and doing an annual project. We seek to create experiential learning activities that allow us to explore digital agriculture. Our production timeline is as follows.

- **Early Spring 2024, ideation and research:** DAC will host workshops to help the team build robotics and computer vision skills and field trips to agricultural sites to share domain understanding about pest management in strawberries. We will build incremental prototypes of high-risk components such as the computer vision system, sound activator, VR experience.
- **Late Spring to Early Summer 2024, development and integration:** early stage prototyping to implement, integrate, and test the robotic components. We have funding to attend the ASABE Hackathon in July 2024, where we will present our first prototype.
- **Mid to Late Summer 2024, final build and testing:** we will deploy the Scarecrow-Bot at the Purdue Student Farm for minimal-real world testing. Then, we will construct our final game prototype for BGR, including the game experience, and theming the Scarecrow-Bot. We will host a test game during a College of Ag outreach event to assess playability.

Our long-term vision is to develop human-centered and animal-friendly robotic interventions for automated pest-management in real farm-fields, including Purdue's Agricultural Centers. The robot that will be deployed in real farms will be capable of displacing vertebrate pests by non-harmful stimuli. The game can be extended to larger scale entertainment opportunities such as corn mazes and Prophetstown Trail of Scarecrows' exhibit.

Project Budget			
Item	Description	Purpose	Estimated Cost
Rover Chassis	The Lynxmotion A4WD3 Wheeled Rugged Rover Kit	The platform for the scarecrow bot	\$795.95
Sensor/Camera	Logitech - Brio 100 1080p Full-HD Webcam	Using cameras to track objects around the track	\$39.99 × 5
Processing Server	NVIDIA Jetson Orin Nano Developer Kit	Processing video streams and controlling the scarecrow bot	\$499.95
Speaker	Bluetooth, water-resistant.	Act as the stimulus on the scarecrow bot	\$19.99
Communication Gear	ASUS - RT-AX82U AX5400	To communicate between cameras, servers, and scarecrow bot	\$199.95
VR Headset	Meta Quest 2	For a student who controls the rabbit bot	\$349.99
Rabbit bot	BEZGAR HM181 Hobby Grade	A wireless controlled robot as a rabbit	\$69.99
Material for track		To build a track	\$500
Total			\$2635

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