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United States Department of Agriculture
Project Initiation

Project Data for Accession Number 1031030

Project Title

Poultry Caretaker Robot to Improve Animal Well-Being

Project Details

Sponsoring Institution National Institute of Food and Agriculture	**Project Status** COMPLETE
Funding Source NIFA Non Formula	**Grant Year** 2023
Grant No. 2023-39412-40698	**Cumulative Award Amt.** $650,000.00
Proposal No. 2023-03977	**Multistate No.** (N/A)
Project Start Date Sep 01, 2023	**Project End Date** Aug 31, 2025
Program Code [8.3] Animal Production & Protection	

Project Director

Niewohner, S.

Recipient Organization

BIRD'S EYE ROBOTICS, INC.
19994 COUNTY ROAD 19
HERMAN, NEBRASKA 680295128

Performing Department

(N/A)

Non Technical Summary

American chicken farmers struggle to attract and retain the needed labor to operate farms that are expanding in size and scale. Manual labor is currently required to walk up and down the barn to stimulate the flock and check on the birds. Birds Eye Robotics' proposed innovation, the Caretaker Robot, seeks to reduce labor costs associated with checking broiler barns and flock stimulation while improving bird welfare and performance. The Caretaker is a fully autonomous robotic in-barn solution. Phase I successfully developed a proof-of-concept unit to autonomously navigate broiler barns. Phase II technical objectives relate to in-barn localization, indications of mortality occasions, barn route planning, and flock redistribution. Senior personnel will research and develop autonomous robot technologies that incorporate the unique and under researched aspects of large scale commercial broiler barns. These are inherently dark, dusty and difficult to navigate environments. The Birds Eye Robotics vision is to bring the cutting edge of precision ag technology to an often-overlooked industry. Poultry farmers who desire to expand their

operations will now have the capabilities to do so. Commercialization efforts will enable a robotics-as-a-service business model in which the Caretaker is paid for on a per-barn per-year basis. Upon completion of phase II, Birds Eye will deliver units as part of signed purchase orders and commercial agreements with some of the largest poultry integrators in America.

Animal Health Component

Animal Health Component: 100%

Research Effort Categories

Basic	10%
Applied	30%
Developmental	60%

Classification

Knowledge Area (KA)	Subject of Investigation (SOI)	Field of Science (FOS)	Percent
307	3299	2020	100%

Knowledge Area

[307] Animal Management Systems

Subject Of Investigation

[3299] Poultry, general/other

Field Of Science

[2020] Engineering

Keywords

animal welfare, artificial intelligence, automation, machine learning, poultry welfare, robotics

Goals / Objectives

The technical goal of phase II is to develop a commercially viable poultry Caretaker robot to improve animal well-being and reduce labor costs. The poultry Caretaker will autonomously navigate the broiler barn, stimulate the flock, till up caked bedding with its spiked wheels and identify mortality occasions. These deliverables have been requested by industry and a willingness to pay for a robots-as-a-service business model has been demonstrated. The technical objectives build upon the early success of the phase I USDA grant concluding Feb. 2023 and are as follows:1) Integration of reliable localization with navigation, computer vision and obstacle avoidance algorithms previously developed in Phase I2) Development of Mortality Indication and Avoidance System3) Creation of Fundamental Barn Route Planning System4) Testing Spinner RPM for Mobility through Flock and Redistribution of Flock Density

Project Methods

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Each technical objective will include research and development time at the Birds Eye Robotics office as well as in barn testing in coordination with industry partners. For objective onethe research and development team will work to integrate a new and improved reliable localization system based on stereo VSLAM and Lidar. NAV2 will be the primary integration point for the new localization system. NAV2 is a production-grade and high-quality navigation framework trusted by robotics companies around the world. The technical feasibility of this objective is high as NAV2 is a commercially proven and well documented resource in the robotics ecosystem. However, like the technical objectives in Phase I, key considerations must be take into account for this USDA proposal such as dusty barn conditions, changes in barn lighting and dynamic barn layout variances.For objective twoBirds Eye Robotics research and development will build upon the current mortality recognition algorithm to create a commercially ready mortality indication system (MIS). Long term this data collection will be critical in proving the commercial impact (number of dead birds in a barn managed by Caretaker vs human). The current MIS is purely a mock-up to receive industry feedback. This objective is not just front-end software development. Research and development must be done to engineer optimal mortality avoidance as well as indication. Further integration between the mortality recognition algorithm and NAV2 is also necessary.During objective three, related to route planning, senior personnel must now augment route planning to provide optimal bird stimulation and bedding tillage. Engineering principals considered will include operating speed in the barn (see objective four), battery life, charging time and maximum passes per day. Additionally, animal welfare consideration will include route variance within feeder line rows (altering spiked wheel drive path slightly till different areas in a row) and bird behavior in various barn segments.Finally for objective four,the team will identify chickens and their location relative to the robot. From these locations senior personnel will calculate the average distance from the robot the chickens move in various conditions and locations in the barn. ResNet50 bird recognition and measurement algorithms can currently track the speed (cm/s) and distance (cm) at which a bird responds to the spinner. Tests will be repeated at the three RPM settings to understand the relationship between RPM speed and flock distribution. Each RPM rate will also be benchmarked for the battery usage requirement (by use of a multimeter), speed at which it alters the Caretakers time for a pass, and stoppage time (sec.) of the Caretaker. Stoppage time occasionally occurs when the camera vision recognizes the spinner is nudging a live bird and the bird is slowly moving out of the way. The Caretaker is trained to stop prior to moving forward to ensure animal welfare.