Autonomous laser runner cutter

G. Kondo, B. Holt, A. Fischer, and J. Lin

The goal of this project is to produce a low-cost autonomous runner cutting machine that identifies strawberry runners and cuts/wounds them by precision burning using a laser as it moves through the field without disrupting fruit production. The system uses off-the-shelf hardware and focuses specifically on California strawberries. This lets us tune the design and machine-learning training for better performance while keeping overall cost down.

To detect runners, we used an RGBD camera to acquire a 3,500-image dataset and benchmarked leading real-time image segmentation models. These included the YOLO family of models, RF-DETR, Mask R-CNN with PointRend, and RTMDet. YOLOv8 performed best for both speed and detection accuracy. It identifies runner boundaries in real time at 30 frames per second and tracks them across the camera's field of view. The software uses these runner detections to aim a high-power laser at its center and fire a controlled burst at a USDA-validated wavelength and power level shown to stop future runner growth.

A web-based app allows remote control and monitoring from any internet-connected device. The system is also designed to adapt quickly to a new field. As little as one day of imaging is enough to calibrate it to local conditions. Initial field tests successfully demonstrated real-time runner detection and laser cutting under production conditions. Testing is ongoing.

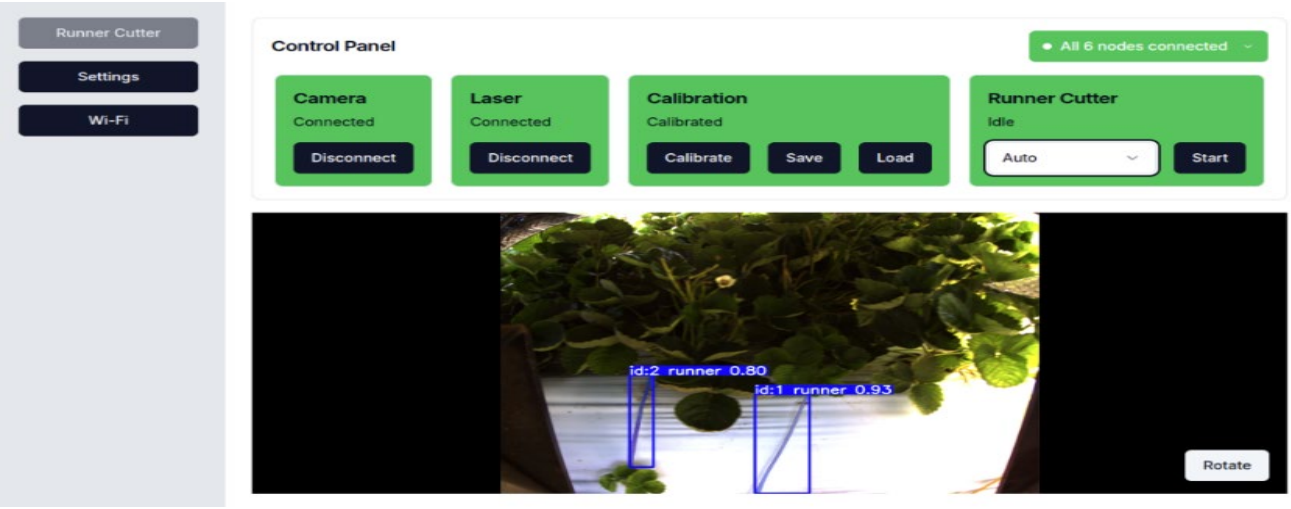


Figure 1. Web-based interface for real-time system control and monitoring.



Figure 2. Laser runner cutter mounted on a Farm-NG Amiga during field testing.