

Koidra Inc. 2022 Station Report



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1. Background

Offices and Labs: Koidra Inc, an AIoT for CEA company based in Seattle, provides end-to-end automation solutions for indoor farms, including integration with climate control systems and data consolidation from multiple sources to deliver autonomous growing for higher crop production efficiency. Our products include:

IoT Suite

- Koidra's IoT Suite is an operating system (OS) for all of your IoT and operational intelligence needs.
 - Unify and visualize data from multiple sources
- Modern and customizable dashboards
- Anytime, anywhere, any device
- Interoperability with other applications
- Advanced alerts and recommendations
- Comparative analytics

Digital Twin

The Digital Twin is a smart simulator that digitizes the specific growing facilities with specific crop. The digital twin uses physics-informed machine learning to compute how climate variables and crop growth variables will interact. This makes the invisible crop growth metrics, such as transpiration and photosynthetic rate, visible for growers to analyze as Smart Sensors.

The Digital Twin enables growers to:

- Gain more data and insight without installing additional hardware
- Visualize how different growing strategies affect predicted crop growth
- Effectively plan labor around an accurate harvest prediction

Ωpera

Ωpera, operators-driven automation platform, provides a flexible and user-friendly web interface for the controllers to define their control strategies in a simple yet powerful way, like writing Excel formulas. Controllers can easily update and improve their control strategies over time and are no longer constrained by the cluttered graphical user interface (often with many windows, menus, and submenus) in legacy SCADA systems.

λutopilot

λutoPilot solution, built on top of our IoT Suite platform and Digital Twin smart sensors, can sense the plant's needs and responses and hence optimizes the inside climate to achieve the plants' full growth and production capacity.

- Continuous crop and climate monitoring from our AI models 24/7
- Scalable and efficient digital workforce that continuously updates and improves over time
- Eliminate growers' tedious climate control tasks, allowing them to focus on the higher-level growing strategies
- Smart digital decision making, which combines the best of AI and Experts' wisdom

2. Accomplishment summaries

Autonomous greenhouse challenge: Koidra led Koala team, in collaboration with Neil Mattson at Cornell University and A.J.Both at Rutgers University, won the autonomous greenhouse challenge at the Netherlands' Wageningen University & Research repeatedly in 2021 and 2022. For the online challenge in 2021, Koala team [outperformed 46 teams from 24](#) countries in growing virtual lettuce using AI and computer vision modeling.

In the 2022 challenge, 5 teams out of 46 teams above competed to autonomously grow a lettuce crop using an artificial intelligence algorithm. During the challenge, the Koidra team used its Ai algorithm to remotely adjust greenhouse parameters such as lighting, ventilation, heating, irrigation, fogging and blackout screens. Various monitors provided feedback on the greenhouse conditions. RGB (red, green, blue) images of the lettuce gave insights into its weight and growth in real time, while thermal images revealed the veggies' rate of water loss through transpiration. [Koala team won the challenge](#) and has become the only AI team to outperform the Dutch reference growers by 27.8% in net improvement.

Autonomous growing pilot in commercial greenhouse: We partnered with Great Lakes Greenhouse, in collaboration with Harrow Research and Development center to receive 2 grants the [Greenhouse Competitiveness and Innovation Initiative grant](#) and [the Independent Electricity System Operator](#) for developing and piloting AI-based autonomous growing technology to remotely grow eggplants and cucumbers in a commercial greenhouse. [Our trial](#) has been started for several months.

3. Impact statements

- Due to the ever-growing world population, the demand for fresh and healthy vegetables is increasing. Autonomous greenhouses can ensure that more people are fed with nutritious products. In addition, these techniques contribute to increasing food safety and a higher production volume of healthy vegetables, using fewer resources such as energy. The Koidra's win at the autonomous greenhouse challenge again has provided concrete proof of concept on leveraging AI in automate climate controls inside greenhouse.
- The concept of using AI to automate the climate control in a greenhouse is relatively new. Koidra has organized workshops and provides public talk to educate people about data-driven growing for better yield and resource efficiency

- Koidra has been working with strategic partners from both private sectors and researchers from academics (e.g., Cornell University, Rutgers University, Ohio State University) to trial and democratize autonomous growing on different crops in different types of commercial greenhouses.

4. **Published written works**

1. A. Miller. 2022. The overlap of edge computing and traditional PLCs.

<https://www.controldesign.com/articles/2022/will-edge-and-cloud-replace-central-control/>

2. K. Tran. 2022. Building Operational Intelligence.

<https://www.automation.com/en-us/articles/may-2022/building-operational-intelligence>

3. K. Tran, Q. Digweed. 2022. How to grow disruptive automation with AIoT.

<https://www.controldesign.com/articles/2022/how-to-grow-disruptive-automation-with-aiot/>

4. K. Tran, J. Chang. 2021. Digital Horticulture: An Essential Step Toward Autonomous Growing.

<https://www.greenhousecanada.com/digital-horticulture-an-essential-step-toward-autonomous-growing/>

5. K. Tran. 2021. A primer on AI and its rise in the greenhouse.

<https://www.greenhousecanada.com/the-rise-of-ai-in-the-greenhouse/>