

Smartfarm Insight - Sensor Data acquisition and visualization for Food Production Facilities

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Emerging Technologies
for the Circular Economy

Background & Scope

The ETCE Lab conducts interdisciplinary research at the intersection of computer science and sustainability. The research focus includes the development and conceptual design of dynamic, adaptive and self-organizing software systems, digital identities as well as digital technologies facilitating the circular economy and circular societies. Previous projects developed and built **Smart Greenhouse & Farmbot**, **Outdoor Growing Setups**, **Gourmet Mushroom Production** and **Vertical Farming Tower**. Those are working as Food Production Facilities for the ETCE and TU Clausthal as well. Our team set up sensors for temperature, humidity and pH-value, as well as cameras, which can provide a live feed and pictures from within the Food Production Facilities. All these sensors collect data which we worked on displaying on the website <https://farminsight.etce.isse.tu-clausthal.de> where all Food Production Facilities and their respective sensors can be viewed and assessed to get a picture of what this Facility is doing. All this is done so we can collect data from the Facilities, such as in which environment the respective plants grow best or to predict, when it is best to water plants or harvest them based on projected temperatures and humidity. Our model of supervision can be applied in a vast array of Food Production Facilities, such as those projects mentioned above or even fields in general farming. In the future this collected data can be used with AI. This can be to predict the best time to plant, water or harvest plants, fruits or crops. Based on the collected data food production facilities can be created which offer perfect environments for the plants growing inside, so farming can be made more efficient.

Results

1. Organizations and User

ETCE

Search FPFs...

Vertical Farming Tower

MushR

+

Organization: ETCE

Status: PUBLIC

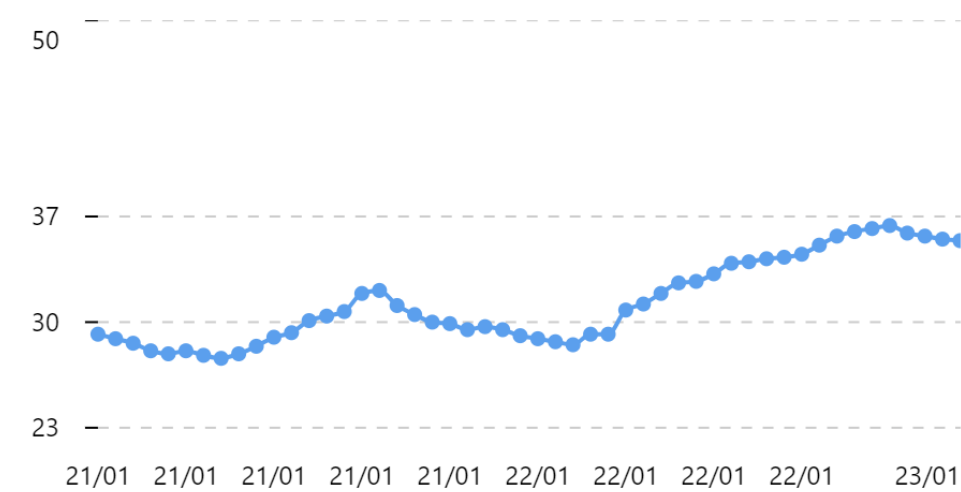
Members

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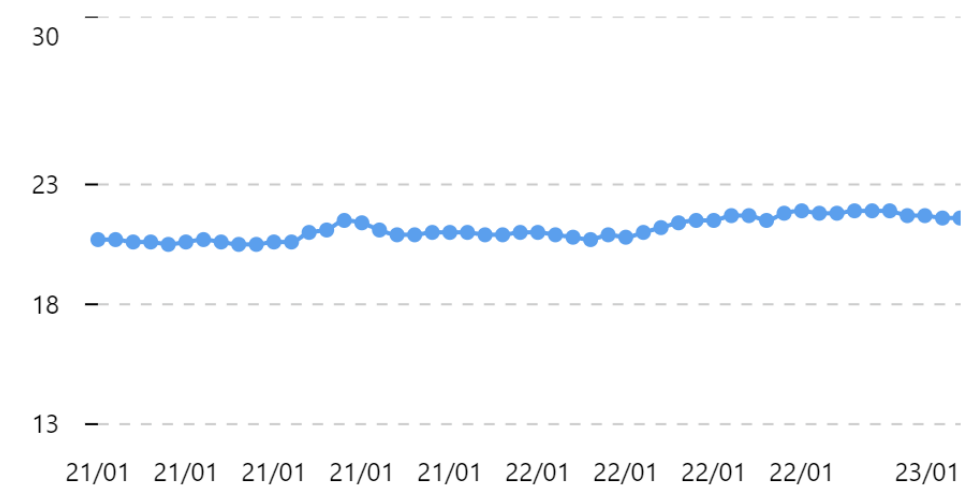
The website is set up so that many organizations can use it. These organizations can create Food Production Facilities which are affiliated with that organization. The organization is in full control regarding who can access and edit their Facilities. That way controlling and monitoring the Facilities is all done by the people of said organization. For all users there is always a navbar visible, where they can access all Food Production Facilities belonging to the organization they are currently viewing.

2. Sensor Data

Humidity



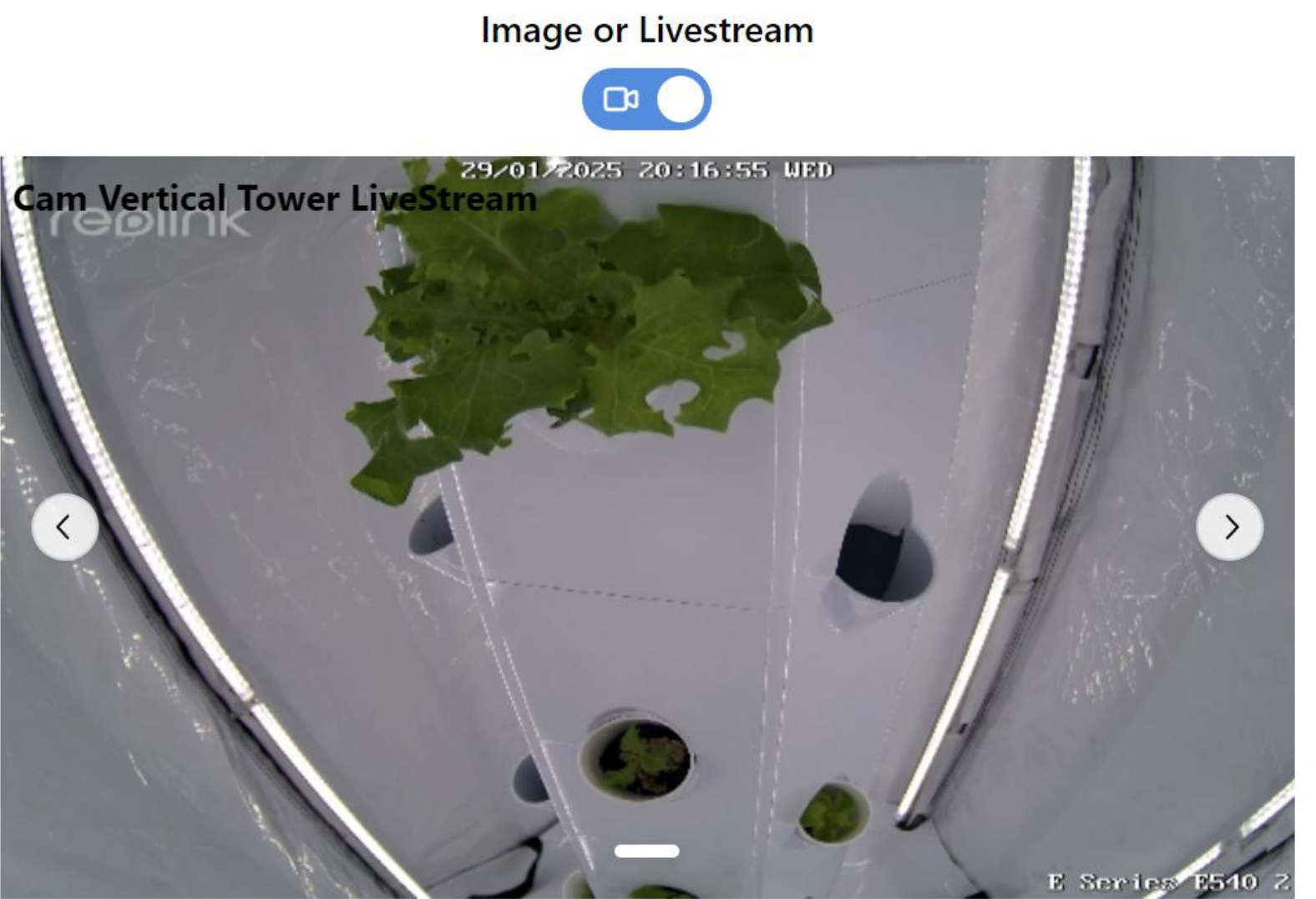
Temperature



The sensors which are installed inside the Food Production Facilities send back data which is then displayed on the website. The graphs update automatically whenever new data is sent from the sensors. The data range is also set automatically depending on the type of sensor and the data that is being sent to the website. When creating a sensor the user can set in which time range the data is displayed and in which interval the sensor measures inside the Facility.

3. Camera Carousel

The camera carousel is a feature where all cameras in a Food Production Facility are displayed. A user can choose whether he wants to see a live feed, which runs on 5 FPS, as to not overload network traffic, or one of the many cameras that can be set up inside it. These are on a carousel so the user is able to switch between different view angles inside the Food Production Facility. There is a switch at the top of the camera window to switch between the live stream and the carousel so the live stream is not running the whole time.



4. Growing Cycles

	Name	Planted on	Total Harvest	Notes
	Tomato	01/01/2025	3.5 kg	
	Lettuce	01/11/2024	1 kg	Iceberg

Growing cycles can be added by the user to keep track of their plants inside their Food Production Facility. They can add the plants with notes and information about the plant itself. There is always a date on which it was planted and the user can add information about how much was harvested at which date to know exactly what happened to their plants and how much they have planted and harvested.

Conclusions

Through this project, we successfully developed and deployed an advanced monitoring and management platform for Food Production Facilities, enabling real-time data visualization and operational insights. By integrating dynamic sensors for temperature, humidity, and pH levels, along with live camera feeds, users can gain a comprehensive view of their growing environments. Additionally, the platform's flexible structure allows different organizations to manage their facilities autonomously, ensuring tailored user access and control. By offering a scalable, data-driven solution that facilitates improved plant growth conditions, we have laid the groundwork for future AI-driven advancements in sustainable farming. This project sets a solid foundation for making food production smarter, more efficient, and adaptable to future challenges in agriculture.