

## **Invitation to participate in the international challenge:**

### **Autonomous greenhouses**

#### *Through AI and sensors, build greenhouses of the future*

The world population is growing and consumers are demanding more fresh and healthy products, such as vegetables and fruits, which are also sustainably produced. Greenhouse production is a very efficient way to produce fresh vegetables and fruits with high contents of vitamins and minerals on a small production area. Ideal for production close to large cities! Production volumes in greenhouses are typically up to 10 times higher than in open field. At the same time, greenhouse production uses much less water compared to open field. Recent research results of WUR have shown that in extremely controlled greenhouses only 5 litres of water are used to produce 1 kg of tomato. The controlled environment enables the reduction of pesticide use to a minimum, leading to the production of safer products without residues.

In the future even more greenhouses might be needed to produce our food. Nowadays skilled growers manage greenhouse climate and crop based on their long-term experience and the so-called “green thumb”. However, it is hard to find enough skilled personnel in many countries worldwide.

Currently, significant advances are being made in automation, information technology and artificial intelligence (AI). Automated information and AI can help the grower to oversee all the information needed and to make better complex decisions.

#### *Could AI be able to outperform the human-operated greenhouse production in the future?*

In 2018, five international teams took part in the first edition of Autonomous Greenhouses. They were challenged to remotely control a greenhouse cucumber production during a 4-month period, while competing with each other and with a group of experienced manual growers. As far as we know, such a worldwide experiment had never been conducted before.



The first edition resulted in a successful benchmark experiment demonstrating that state-of-the-art algorithms can control greenhouse climate and irrigation at a distance, compete with experienced growers and even outperform them in one case.

However, there is still some way to go in this combined field of AI and greenhouse horticulture: ongoing data acquisition for AI training purposes, evaluation of sensors' utility, automated data gathering on crop growing parameters, development of more robust and scalable algorithms able to generate decisions for both climate and crop. This and much more is

needed for the development of an autonomous AI control system able to get closer and closer to an optimal greenhouse production.

**We would like to invite** computer scientists and horticultural experts to form multidisciplinary teams to both challenge themselves as well as the state of the art in human operated greenhouse production in order to make a large step towards the Autonomous Greenhouse.

If the capabilities of an AI driven greenhouse can be demonstrated, it will imply a significant opportunity to drive horticultural productivity while reducing resource use and management complexity. AI might help us live healthier lives and make it possible to produce more vitamin rich food in greenhouses for growing human populations.

***Join our challenge! Bring in your experience, knowledge and passion! Work in a multi-disciplinary team, come in contact with other world-wide experts! Have fun!***

#### **What is the goal?**

The goal of the challenge is to produce a cherry tomato crop within 6 months at a high level of production and a high resource use efficiency. For that, selected teams will get the possibility to operate a greenhouse compartment at the greenhouse facilities of WUR in Bleiswijk, The Netherlands. Teams need to achieve the goal by growing the crop remotely controlled, supported by measured values of greenhouse climate and crop development and also webcam footage.

The teams will have to make choices with respect to the control settings in order to control the crop production and quality growth remotely. They can also add their own sensors/camera's to generate additional information. Each team will be able to extract necessary data from the greenhouse compartment and couple it to their own ICT/models/machine learning algorithms in order to decide on the control settings for the next day/period. They will send the control settings back to the system (the greenhouse climate computer) in order to steer the actuators automatically or send instructions for crop handling in order to reach the goal. WUR will continuously measure performance criteria per compartment and share them with each team and the public.



The final jury will consist of horticulture experts from WUR, an Artificial Intelligence expert from Tencent, and other industry leaders across these fields.

***Show your skills, enjoy a multi-disciplinary collaboration and have fun in an international setting of experts!***

## Who can join?

We are looking for multi-disciplinary teams, combining the following expertise: 1) Artificial Intelligence/Machine learning/Sensor technology 2) Crop physiology/Horticulture/Crop Management/"Green Thumb". Participants can be students, scientists, start-ups and companies. Team have at least 3 members, from which at least one student. We encourage teams from different countries and continents to participate. Good English language skills are required.

## How to join?

In order to participate you will have to:

- Register your team and all individual members via [www.autonomousgreenhouses.com](http://www.autonomousgreenhouses.com).
- Provide an extended abstract with your team's motivation for the challenge, your planned methodology including expected A.I. approach.
- Provide a description of your personal details, background and skills.
- Send a short smartphone video of your team.

All the details for the subscription (and next updates of the challenge) can be found on [www.autonomousgreenhouses.com](http://www.autonomousgreenhouses.com)

All subscribed teams fulfilling the criteria will be invited to the pre-challenge Hackathon beginning of September to present your team, work on your strategy, show your skills and pitch your approach in front of an international jury of experts. The 5 best teams will be selected to participate in the Autonomous Greenhouse growing experiment, which will take place between December 2019– May 2020.

## **Important dates:**

22 May -15 July 2019	Team subscription via <a href="http://www.autonomousgreenhouses.com">www.autonomousgreenhouses.com</a>
22 July 2019	Confirmation of teams
12-13 September 2019	Pre-challenge Hackathon at WUR, The Netherlands
December-May 2020	Challenge Autonomous Greenhouse (growing experiment)
June 2020 (Week 24)	Final Event at WUR, The Netherlands