PRESS RELEASE

First results of the "SAMSON" fruit-growing digitization project at the Federal Government's Digital Summit 2023 in Jena

Sensor box and mobile measuring sticks for the precise collection of tree or area-specific data – the basis for future optimized management of fruit orchards using digitalization and automation

On November 20 and 21, 2023, the Federal Government's Digital Summit will take place in Jena, Germany, with the annual focus topic "Digital Transformation in the Turning Point. Sustainable. Resilient. Future-oriented." In addition to Federal Chancellor Olaf Scholz and the organizing federal ministers Dr. Robert Habeck (Federal Ministry for Economic Affairs and Climate Action, BMWK) and Dr. Volker Wissing (Federal Ministry for Digital and Transport, BMDV), numerous other federal ministers and high-ranking representatives from business, science, and civil society are expected to attend.

On Monday, November 20, 2023 from 10:00 a.m., the topic context "Sustainable digital transformation in agricultural value chains" will focus on four projects from the research funding program of the Federal Ministry of Food and Agriculture (BMEL) "Future farms and future regions", which show how the digital transformation in agriculture and along the subsequent sectors of the agricultural value chain can be driven forward sustainably.

The research project "Smart automation systems and services for fruit growing on the Lower Elbe", or "SAMSON" for short, is one of these four projects, as part of which a new "future farm" is to be created in the Altes Land region in northern Germany.

Project manager and coordinator Benjamin Schulze from the Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM in Stade will present the first R&D results during a speed geeking session on behalf of the SAMSON partners Hamburg University of Applied Sciences HAW, hochschule 21, Buxtehude, and Hamburg University of Technology TU, as well as the Fruit Farmers Association Altes Land e.V. (OVR), and will be available to participants for professional exchange and discussion.

The focus is on a specially developed sensor box that can be mounted on a tractor, as well as mobile measuring sticks for the precise collection of tree- or area-specific data, which provide the basis for the future optimized management of fruit-growing areas with the help of digitalization and automation. In the context of practice-oriented research and development

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work with a focus on apple cultivation, direct professional exchange with fruit farms and local advisory institutions is of particular importance.

Digital and automated solutions for current challenges in fruit growing

The quality and quantity of the apple harvest depend on many factors, such as climate, pruning, the previous year's yield and nutrient availability. Due to the complexity of these interactions, it can be a challenge for growers to optimally manage and cultivate fruit-growing areas – especially in view of the future with further requirements due to climate change and a shortage of skilled workers.

The SAMSON project offers solutions for this. It involves researching and developing intelligent automation systems and services that monitor the entire fruit-growing system and collect seasonal data. These data-based results then support decisions on the future management of fruit-growing areas.

The focus here is on improving the sustainable use of resources in fruit cultivation: seasonal harvest data such as growth, alternance, harvest results, water use, and treatment measures are analyzed. The aim is to derive data-supported individual recommendations through to the treatment of the individual fruit tree, for example in the use of pesticides.

Smart automation systems and services from the SAMSON project can support fruit producers: the entire cultivation area is monitored and cross-seasonal key figures on yield, quality, pest infestation and treatment measures are displayed interactively on mobile devices. In this way, efficient and sustainable cultivation can be achieved.

Sensorbox – the first development

The researchers at the Fraunhofer IFAM in Stade have developed a multi-sensor system, the so-called "sensorbox", for recording data in orchards, which can be mounted on any tractor using the classic three-point mount. Sensors for capturing camera images and precise GPS signals are integrated into this structure. Based on the image data, artificial intelligence (AI) systems are developed to detect pest infestations, for example. The collected information can be assigned to an individual tree using the GPS signals. In addition, various three-dimensional laser scanners (LiDAR) are being investigated in the sensor box, which can help to create a three-dimensional image of the fruit tree.

The sensor box is designed in such a way that it can be taken along during normal work and normal driving speeds in the orchard, where it collects data from the fruit trees in parallel and automatically.

From data collection and systematic data storage via digital twins to practical recommendations for action

The first data sets were already collected in the Altes Land region during the flowering phase in May 2023 using the sensor setup. Since the flowering phase in 2023, a big data volume has already been collected on the fruit-growing trial farm of the Chamber of Agriculture Lower Saxony and another regional practice farm in regular test series to monitor the vegetation phases.

In order to clearly assign the sensor data collected from the sensor box to the respective areas and individual trees, work is ongoing to develop a software solution that can be used in conjunction with a mobile measuring stick to precisely measure the cultivated areas. The fruit-growing experts at the Fruit Farmers Association Altes Land e.V. are testing this solution, which has been specially developed for pome fruit cultivation, in practice and are uncovering further potential applications, such as measuring irrigation and drainage pipes.

The researchers at the University of Applied Sciences HAW Hamburg have also developed an initial data model that ensures the structured storage of all data and information. Comparable to the filing system of a computer or a filing cabinet, the automatically collected data is stored and made available according to a systematic procedure. The resulting databases contain knowledge about the relationships between the data points and offer the potential for the efficient use of algorithms and artificial intelligence (AI) methods. The systematic storage of all cultivation-relevant information forms the backbone of the digital twin, so that prediction models, recommendations for action and automated documentation work can be derived on this basis.

Perspectives

Based on the data collected during the vegetation phases of the 2023 season, the researchers are working on optimizing the sensor box on the one hand and on evaluating the data and intensively training the AI models on the other. Two sensor boxes with different sensor configurations are available for the 2024 season, which will be used continuously on the SAMSON farm of the future and by other interested fruit producers. In addition, participants in the workshops offered in January 2024 in the Altes Land region can learn about the use of precise GPS systems as well as the functionality and practical use not only of mobile measuring sticks but also of the sensor box.

Funding

The German Federal Ministry of Food and Agriculture (BMEL) is funding the research project "Smart automation systems and services for fruit growing in the Lower Elbe region" ("SAMSON"; funding code: 28DE201B21). The project will have a duration of three years and will end in December 2025. On behalf of all project partners, Fraunhofer IFAM would like to thank the Federal Ministry for the funding and the Federal Office for Agriculture and Food (BLE) as project manager for their support.

With support from   Project manager

Federal Ministry   Federal Office
of Food   for Agriculture and Food
and Agriculture

by decision of the
German Bundestag

More information

- https://www.de.digital/DIGITAL/Navigation/EN/Home/home.html
- www.samson-projekt.de
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- https://www.esteburg.de/esteburg/mid_39245.html
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Figure l Caption
The "sensor box" developed by Fraunhofer IFAM in Stade as part of the "SAMSON" project for recording and processing data in orchards can be mounted on any tractor via the three-point mount. This multi-sensor system contains the sensor technology for capturing camera images and precise GPS signals (© TUHH).

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