

PROJECT PROFILE

19016



Miniaturized monitoring sensor systems for plants and agriculture [PLANTAR]



PLANTAR aims to develop cost-efficient, miniaturized, networked, biodegradable monitoring electronics to help tackle one of the world's biggest challenges: producing enough food over 9 billion people while also protecting the environment.

Since the start of the 20th century, technologies such as improved plant breeding, fertilizers and plant protection products (pesticides, herbicides and fungicides) have enabled farming to keep pace with constantly rising demand for food. However, intensive agricultural practices, just barely optimized for high-yield production, are unsustainable. Not only are they damaging to the environment, but they also require large quantities of clean water for irrigation – water that may no longer be available due to climate change. Yet with the global population set to grow from 8 billion in 2025 to 9.6 billion in 2050, the UN Food & Agriculture Organization (FAO) calculates that food production needs to increase by 70% in this period. Solving the dilemma between high-yield intensive agriculture and protecting the environment calls for cross-industry approaches, and digitalization has a key role to play.

New kinds of electronic sensors, actuators, networks and other digital technologies can increase efficiency and improve environmental sustainability in many agricultural applications. Whether in fields, in greenhouses or in the new domains of indoor and urban farming (which now accounts for 20% of global food production), digital technologies have the potential to enable holistic monitoring of production and growing conditions. Sensors can provide timely warnings of plant stress and / or diseases. By measuring factors such as soil moisture, EC and content of nitrogen, ammonia, surface temperature, solar radiation, CO₂ and detecting pests and plant pathogens, digital technologies can help significantly increase yields per cultivated area. And at the same time, they can assist in reducing water, energy, fertilizer and pesticide use.

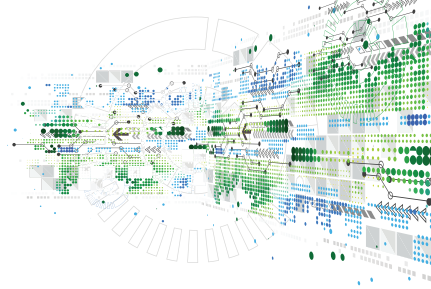
Although some of such sensors and sensor networks already exist, on the one hand, many are too expensive for large-scale use. On the other hand, more cost-effective sensors and measuring systems lack sufficient accuracy for professional applications. Moreover, since they can pollute the soil if left in place, existing sensor systems generate added costs and effort for producers because they have to be removed from the soil after use.

Affordable, highly integrated, biodegradable solutions

To address these issues, the PLANTAR project is focusing on development of affordable, highly integrated, miniaturized sensors and close-mesh sensor networks (including nano-sensors and paper-based microfluidic devices) and application intelligence in three areas: precision farming (field / urban), greenhouse / indoor farming and farm monitoring. In addition, it aims to reduce the environmental impact and 'de-installation' costs of these technologies by ensuring that the sensors are biodegradable, so they can be left in place after their use and simply ploughed back into the soil.

With its ambition to provide for high-volume markets, PLANTAR aims specifically to create low-cost sensors for the detection of pests and plant pathogens (putrefaction), soil moisture, leaf wetness, ammonia, CO₂, electrical conductivity (EC) and nitrate content (NO₃). It will also work on creating highly integrated circuits and interfaces including signal pre-processing and battery management for connected sensor systems. By creating an ultra-low power microcontroller with an integrated transceiver and suitable interfaces that connect to different sensors, the PLANTAR consortium will seek to achieve the highest levels of integration and signal analysis at low power operation. This work will also cover new combinations of interface materials and production technologies to meet the requirement for biodegradability.

Biodegradability is a key challenge within the project. As yet, biodegradable sensor nodes which include all the necessary wireless sensor components (substrate, microcontroller, sensors, antenna, power supply and housing) do not exist. The PLANTAR project will explore how printed electronics could be used to solve this challenge, creating devices that are almost fully biodegradable and have an adequate energy supply and data transmission capability. Its goal is to demonstrate a printed circuit board, antenna, battery, and certain sensors and their housings made of biodegradable materials which can be broken up by ploughing and harrowing and decompose into the soil.



KEY APPLICATION AREAS



Digital Industry

ESSENTIAL CAPABILITIES



Systems and Components:
Architecture, Design & Integration



Process Technology, Equipment,
Materials and Manufacturing for ECS

PARTNERS

Alianza Nanotecnología Diagnóstica ASJ, S.L.
ALPHASIP
Alteria Automation SL
COGNICASE MANAGEMENT CONSULTING S.L.
Evalan BV
Fraunhofer ENAS
Freudenberg Industrie Siebdruck GmbH,
HANSENHOF_electronic Entwicklung Fa. Steffen Schmieder
Infineon Technologies AG
Kurt-Schwabe-Institut für Mess- und Sensortechnik Meinsberg e.V.
Munisense BV
Rockwool B.V.
Stichting IMEC Nederland
Stichting Wageningen Research

COUNTRIES INVOLVED



Germany



The Netherlands



Spain

PROJECT LEADER

Ms. Ulrike Glock
Infineon Technologies AG

www.project-hades.eu

KEY PROJECT DATES

01 November 2020 - 31 October 2023

Expertise across the value chain

The PLANtAR consortium brings together partners from across the entire value chain. These include highly experienced technology and component providers as well as leading suppliers in agricultural applications and infrastructure who have direct contact with end-users. The extensive mix of industrial partners features a high number of SMEs and start-ups with know-how in sensors and other relevant technologies. Several research institutes with expertise and excellent market access are also involved. With this breadth of knowledge and resources in agriculture and semiconductor and sensor technologies, the consortium will strengthen knowledge transfer and cut development time and costs leading to a faster time-to-market.

Growing market opportunities

By minimizing risks and speeding development of new sensor technologies and communication networks, PLANtAR's collaborative approach will deliver competitive offerings to the environmental sensor market – at both component and solution level. It will allow European companies to maintain or achieve market leadership positions and enable end-users to install low-cost sensor networks or expand existing ones.

The opportunities are considerable. The market for IoT sensors in the smart farming segment is expected to rise from one million sensor systems in 2016 to 9.5 million in 2025¹. In precision farming, the market for hardware and software was worth 2.3 billion Euros in 2014 and is expected to grow worldwide with a CAGR of 12% through 2020, with an even higher growth rate in Europe². Demand for eco-friendly nano-sensors is likely to create a highly lucrative market (already worth 642 million USD in 2020). The greenhouse sector is also digitalizing rapidly and is predicted to double to 1.3 billion USD worldwide in the next 6 years³. Meanwhile, the market for printed electronics (primarily biodegradable) is expected to grow to a value of 30 billion USD in the next ten years.

Given the global need for sustainable, high-yield agriculture and the size of the markets, PLANtAR is a key project for Europe. It will ensure that Europe retains essential scientific research and strengthen European industry's ability to supply components for these vital new agricultural applications.

¹ IHS Markit Report 2018, Industrial Sensors in IoT: Review of key use cases and quantification of demand

² <https://fticomunications.com/2016/11/europes-opportunity-digital-agriculture/>

³ "Smart Greenhouse Market (Hydroponic, Non-hydroponic) by Technology (HVAC, LED Grow Light, Communication Technology, Irrigation System, Material Handling, Valves & Pumps, Control System, and Others): Global Industry Perspective, Comprehensive Analysis, and Forecast, 2016 – 2022" report

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Penta (E! 9911), is a EUREKA Cluster whose purpose is to catalyse research, development and innovation in areas of micro and nanoelectronics enabled systems and applications.

