

Electronic

Systems



Technologies for Environmentally Friendly and Low-Cost Sensors for Soil and Plant Monitoring

Fast Facts

- Scalable printing technologies for low-cost sensor components such as:
 - Printed batteries
 - Printed antennas
 - Conductors
 - Carrier and housing components
- Construction of sensor components and sensor systems using biodegradable and inert materials such as:
 - Cellulose
 - Wood
 - PHA (Polyhydroxyalkanoates)
 - MnO_2 and Zn
- Demonstration of an almost biodegradable wireless sensor system for monitoring of plants and agricultural fields

General Description

Fraunhofer ENAS is working in the field of technologies for environmentally friendly and low-cost sensors for smart farming applications.

Manufacturing is mainly based on scalable printing technologies on organic substrates. Biodegradable and inert materials like cellulose, wood, PHA, MnO_2 , Zn, Ag, Al, Si, Al_2O_3 are used for the printing of batteries, thin-film antennas, conductors, and housing and carrier components. Beeswax, linseed oil, and natural latex are used to seal the components against humidity and other environmental influences. Technologies for avoiding plastic components in the encapsulation of electronic ICs are currently under development.

In future, these technologies will form the basis for completely biodegradable or inert electronic sensor systems. They will help avoid electronic waste and enable applications where it is too difficult or too expensive to recover the systems at the end of their useful life.

Technologies and Services

- Feasibility studies and technology consulting
- Consulting during the development phase
 - Circuit
 - Simulation
 - Layout
 - Design and engineering optimization
- Process and product development
- Process services and prototyping
- Testing, qualification, and reliability
- Training, technology transfer, licensing
- Publicly funded R&D projects



Printed components: printed battery (top) and printed antenna (bottom).

Demonstrator

The demonstrator shows an almost biodegradable and low-cost wireless soil sensor system for agriculture. It measures the soil moisture (soil tension) of the surrounding medium as well as the ambient and soil temperature. Furthermore, sensors for the soil nitrate content and leaf wetness can be integrated.

Suggested Applications

- Monitoring of ornamental trees and nursery stock (soil moisture, soil temperature)
- Control of Phytophthora (leaf wetness and ambient temperature)
- Optimization of crop production (soil moisture, nitrate content, soil temperature)
- General environmental monitoring to protect nature and drinking water (nitrate content for needs-based fertilization and greenhouse gas reduction)



Soil moisture sensor made of biodegradable and inert material.



Environmentally friendly and low-cost monitoring system on agricultural test field.

In cooperation with



Fraunhofer ENAS is part of
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 All information contained
 in this datasheet is prelimi-
 nary and subject to change.
 Furthermore, the described
 system is not a commercial
 product.