APIMONDIA SCANDINAVIA 2025
SWEDEN | DENMARK | NORWAY

PP-213 [Beekeeping Technology and Quality]

Apisense

AGH

UNIWERSYTET PRZYRODNICZY w Lublinie

APISENSE: AI-ENHANCED SENSORS FOR DETECTING BEE PHEROMONES AND VOCS TO MONITOR COLONY HEALTH AND PREDICT VARROA, NOSEMA, AND FOULBROOD INFESTATIONS

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BACKGROUND

Bee Disease Detection Methods

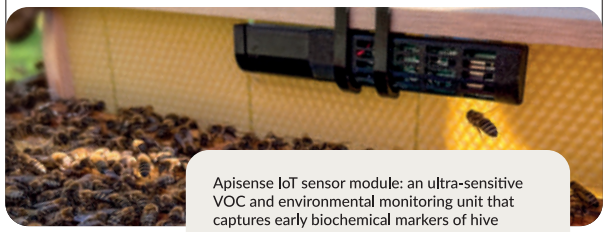
Early detection of diseases is crucial for protecting bee colonies, yet current methods in most cases enable to identify the disease once it is advanced.

Method	Scalability	Accuracy	Non-invasive	Status
Visual inspection	x	x	x	Widely used
In-vitro test	x	√	x	Commercial
Scent-detecting dogs	x	√	√	Limited use
Vaccine	√	x	√	Emerging
Bacteriphagae therapy	?	?	√	Experimental

APISENSE SOLUTION

In-hive Sensor

Apisense delivers the first AI-powered, non-invasive bee disease prediction system, combining ultra-sensitive IoT sensors with satellite data to enable early identification of AFB, EFB, Varroa, and Nosema



Apisense IoT sensor module: an ultra-sensitive VOC and environmental monitoring unit that captures early biochemical markers of hive diseases with ppb-level precision — enabling non-invasive, real-time diagnostics.

EFFICIENCY

Disease detection

Current system's efficiency for various bee disease detection:

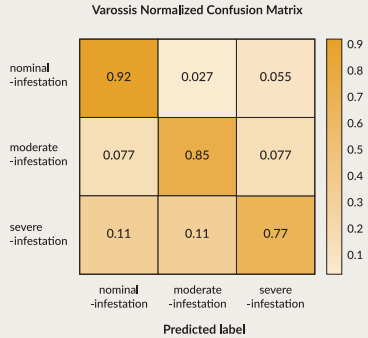
- **American Foulbrood: 97%**
- **Nosemosis: 87%**
- **Varrosis: 84%**

The system maintains high accuracy with low error probability.

Early Identification Accuracy

>90%

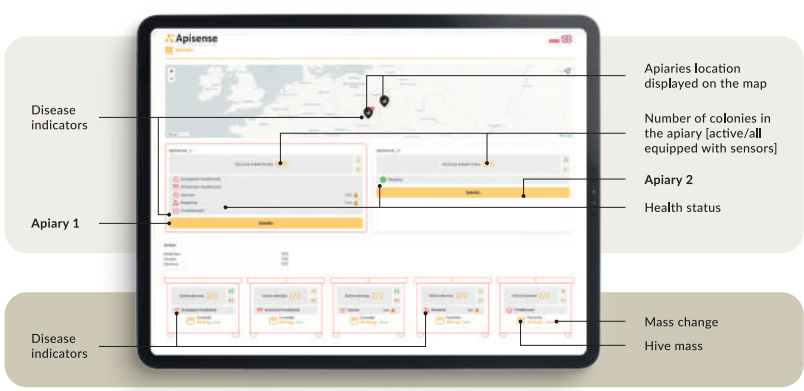
Powered ba AI anomaly detection on multimodal time-series data



Disease spreading prediction

Sufficient sensor coverage allows the system to integrate on-site measurements with satellite data to predict disease spread direction.
Want to learn more? See our talk on Saturday, 27th Sept, at 9:45 in HALL A2.

APISENSE MOBILE APP



METHODOLOGY

Academic trial experiments: 2024

Preliminary validation of sensor and AI model for bee disease detection
Number of tested colonies: 70

European validation studies: 2025

Cross-European validation under different beekeeping conditions.
Number of tested colonies >200

Global validation studies: 2026 (planned)

Efficiency validation across various climate conditions worldwide
Aimed number of tested colonies: 2000

JOIN THE COMMUNITY

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Apisense: AI-Enhanced Sensors for Detecting Bee Pheromones and VOCs to Monitor Colony Health and Predict Varroa, Nosema, and Foulbrood Infestations

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Bee pheromones are crucial for colony communication, conveying information about health, environmental changes, and threats. Numerous research aims to assess colony condition based on in-hive air composition. However, precise disease identification remains challenging due to limited data availability.

In collaboration with Polish beekeepers and scientists, Apisense has developed an innovative solution that transforms bee pheromone signals into actionable insights for accurate colony health assessments. The Apisense device, equipped with an advanced volatile organic compounds (VOCs) sensor, is easily installed inside a hive where it monitors air composition continuously. AI-driven algorithms analyze the collected data and generate alerts about potential diseases. These insights are accessible to a beekeeper via a user-friendly web or smartphone application.

Currently, Apisense focuses on detecting three of the most serious bee diseases identified by the World Organisation for Animal Health: Varroosis (Varroa destructor), Nosemosis (Nosema spp.), and American and European Foulbrood (Paenibacillus larvae, Melissococcus plutonius). Conducted tests confirm the Apisense software's F-1 score effectiveness achieving over 86% accuracy in detecting Varroa and 88% accuracy for Nosema detection, with a false-positive rate of 11% and a false-negative rate of 14%. The most promising results were obtained for foulbrood detection, with accuracy reaching 98%.

With its ease of use and accessibility, Apisense supports both novice and experienced beekeepers. By providing early disease detection and real-time bee colony status monitoring it enables more efficient, data-driven beekeeping, and supports beekeepers to respond promptly. This 24/7 automated monitoring system reduces the need for manual inspections, improving hive management efficiency. The developed solution is the subject of a patent application, additionally highlighting its innovative approach to in-hive air composition monitoring and disease detection.