جامعة
حمد بن خليفة
HAMAD BIN KHALIFA
UNIVERSITY
عضو في مؤسسة قطر
Member of Qatar Foundation

HBKU Flagship Research Grant Program 3rd Cycle– Project Highlight

Project Title: Integrated Aerial-Ground Intelligent Sensing and AI Platform for Resource-Efficient and Sustainable Agriculture in Qatar's Arid Climate

Research Team:

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External Collaborations / Partnerships

Dr. Dominique Martinez;   LORIA, CNRS, France

Executive Summary

This project addresses the challenge of sustainable food production in Qatar's arid climate by developing an integrated air-and-ground sensing system for greenhouse automation. The proposed platform merges printed flexible ground sensors, an aerial robotic system, and AI-based environmental analytics to enable real-time monitoring and intelligent microclimate control. Aerial data collected through a cable-driven parallel robot will be combined with in-soil and ambient sensing data to generate precise, adaptive decisions on irrigation, ventilation, and crop management. The system is designed for low cost, modularity, and scalability, making it ideal for deployment in controlled environment agriculture (CEA) facilities.

The multidisciplinary team brings together expertise in sensors, AI, robotics, and environmental science across HBKU entities (CSE, QEERI, QCRI) and international collaborators. The solution will be validated in collaboration with QEERI using their commercial greenhouse infrastructure. The project supports HBKU's Flagship Research Area of Sustainable and Resilient Arid Cities, contributing to national priorities in food security, water efficiency, and technology-driven sustainability.

Expected Outcome

The project will deliver a validated prototype of an intelligent greenhouse sensing and control platform. Outcomes include: an integrated multi-sensor array, aerial surveillance robot, AI control algorithms, and deployment in a commercial greenhouse.

Flagship Area, keywords, tags: Smart agriculture, Printed sensors, AI in greenhouses, Aerial robotics, arid climate technologies, Precision farming, Sustainability, Microclimate control
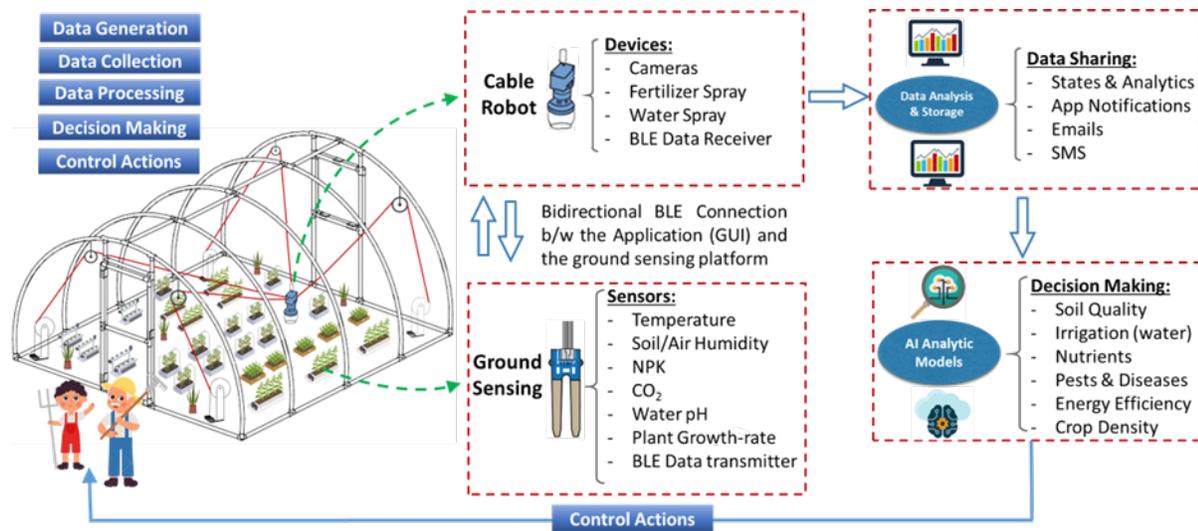

Figure: Schematic diagram of the data-driven control system for smart greenhouses equipped with ground sensors and aerial robot.