Guru Gobind Singh Indraprastha University

University School of Information, Communication and Technology (USICT)

Sector 16C, Dwarka, New Delhi 110078

Report on DST Agricultural Research Project: IoT-Based Crop Monitoring, Diseased Leaf Image Collection and AI-Based Disease Prediction

Project period: August 2019 to September 2023

1. Background

The University School of Information, Communication and Technology (USICT), Guru Gobind Singh Indraprastha University, Delhi, carried out a research project funded by the Department of Science and Technology (DST) that applied the Internet of Things (IoT) and machine learning to agriculture. Under this project, the research team raised crop trials at ICAR-IARI, New Delhi, recorded field conditions with IoT sensors, collected images of healthy and diseased leaves, and used these data to develop computer models for plant disease prediction. The project was completed in September 2023.

2. Project

Project	Funding agency	Investigators	Sanction, duration and funds
Application of Internet of Things (IoT) in Agriculture Sector (Reference No. T-139)	Department of Science and Technology (DST), Government of India, under the Interdisciplinary Cyber Physical Systems (ICPS) Programme	Prof. Amit Prakash Singh (PI) Prof. Anuradha Chug (Co-PI)	Commenced: 1 August 2019 Completed: 30 September 2023 Total fund granted: Rs 60 lakh

3. Crop trials, sensor monitoring and image data collection

Period	Place	Work carried out
December 2019 onwards	ICAR-IARI, New Delhi	Tomato plants raised in pots for disease study
February 2020	ICAR-IARI, New Delhi	Disease inoculation of tomato plants
February–May 2021	ICAR-IARI, New Delhi (greenhouse)	Crop trial with IoT sensors; healthy and diseased leaf images collected

Partner institute: ICAR-Indian Agricultural Research Institute (IARI), New Delhi.

4. Work carried out

- **Crop trials and image collection:** tomato plants were raised in pots at ICAR-IARI and inoculated with disease, and healthy and diseased leaves were photographed at different stages.
- **IoT field sensors:** sensor nodes placed with the crop recorded temperature, humidity, leaf wetness and soil moisture, so that weather conditions that favour disease could be linked to when the disease appeared.
- **Disease prediction models:** the image and sensor data were used to develop machine learning models for plant disease prediction and severity assessment.

5. Outcomes

The project produced tomato leaf image and sensor datasets collected at ICAR-IARI, machine learning models for plant disease prediction and severity assessment, and a series of research publications. The www.plantiot-ipu.in web portal was developed to share the sensor set-up process and the collected image and environmental data.

6. Contribution to the Sustainable Development Goals

The work is aligned with the following goals. These describe the intended direction of the research rather than measured impacts.

SDG and target	How the work contributes
SDG 2: Zero Hunger (2.4)	Sensor and image data with disease prediction models support timely disease management, which can help reduce crop losses.
SDG 9: Industry, Innovation and Infrastructure (9.5)	The project built research capacity in IoT-based crop monitoring and machine learning for agriculture.
SDG 12: Responsible Consumption and Production (12.4)	Predicting disease from field conditions can support well-timed spraying and help avoid unnecessary use of crop protection chemicals.
SDG 13: Climate Action (13.1)	Linking temperature, humidity and leaf wetness to disease helps in understanding how changing weather affects crop disease.
SDG 17: Partnerships for the Goals (17.17)	The work was carried out jointly by GGSIPU and ICAR-IARI, and the data are shared openly through the project web portal.

7. Photographs



Figure 1. Tomato plants raised in pots at ICAR-IARI, New Delhi, December 2019.



Figure 2. Disease inoculation of tomato plants at ICAR-IARI, New Delhi, February 2020.



Figure 3. Tomato pots in the greenhouse at ICAR-IARI, New Delhi, March 2021.



Figure 4. Testing a solar-powered IoT sensor node with a potted plant.



Figure 5. IoT sensor nodes prepared for testing and installation.



Figure 6. Project team training on and testing the IoT sensors.



Figure 1 IoT Data Loggers for collecting sensors data in field

Prof. Amit Prakash Singh, Principal Investigator
Prof. Anuradha Chug, Co-Principal Investigator
Prof. Udayan Ghose, Dean, USICT
Guru Gobind Singh Indraprastha University, Sector 16C, Dwarka, New Delhi 110078