AI-Driven Smart Horticulture for Climate Sensitive Plant using Soil Analysis and Image Processing: A Tropical Perspective
Project Meeting and Site Visit at Prek Leap National Institute of Agriculture (NIA), Khmer Modern Farming and Huy Yun Farm and Report/Minutes Form

I. Organizer:

Name:	Dr. Phon Sovatna
Position:	Project Member
Institution:	Prek Leap National Institute of Agriculture (NIA)

II. Participants

No.	Name	Organization
1.	H.E Chhun Tory (President)	NIA, Cambodia
2.	Dr. Phon Sovatna	NIA, Cambodia
3.	Mr. Long Touch	NIA, Cambodia
4.	Mrs. Ath Sophat	NIA, Cambodia
5.	Mr. Ket Mesa	NIA, Cambodia
6.	Mr. Var Vannak	NIA, Cambodia
7.	Mr. Mr. Phum Sombo	NIA, Cambodia
8.	Mr. Tho Pisey	NIA, Cambodia
9.	Mr. Yun Sophat	NIA, Cambodia
10.	Asst. Prof. Dr. Khanthanou Luangxaysana	NUOL, Laos
11.	Mr. Phutsavanh Thongphanh	NUOL, Laos
12.	Assoc. Prof. Dr. Lim Tiong Hoo	UTB, Brunei
13.	Hj Ismit bin Hj Mohamad	UTB, Brunei
14.	Dr. Lee It Ee	MMU, Malaysia
15.	Dr. Olivia Tan Swee Leng	MMU, Malaysia

III. Introduction

The project titled “AI-Driven Smart Horticulture for Climate Sensitive Plant using Soil Analysis and Image Processing: A Tropical Perspective” is implemented under the ASEAN IVO framework through collaborative research among four partner institutions: Multimedia University (MMU), Malaysia; Universiti Teknologi Brunei (UTB), Brunei Darussalam; National University of Laos (NUOL), Lao PDR; and Prek Leap National Institute of Agriculture (NIA), Cambodia.

The project aims to integrate artificial intelligence, soil analysis, environmental sensing, and image processing technologies to enhance climate-resilient horticulture production in tropical environments. Through joint research design, technology development, system integration, and field validation across participating countries,

the collaboration promotes regional knowledge exchange, technical harmonization, and innovation in digital agriculture.

The Cambodia project meeting and site visit represent a key collaborative milestone, enabling all four institutions to jointly review progress, validate field-level implementation, and strengthen inter-institutional coordination under the ASEAN IVO platform.

3.1. Overall Objective

To strengthen regional collaboration and project coordination among MMU, UTB, NUOL, and NIA through joint meetings and field-based evaluation of AI-driven digital agriculture systems implemented under tropical conditions in Cambodia.

Specific Objectives

To jointly review and evaluate integrated project outputs across the four collaborating institutions

The joint visit provides a platform for project members from Malaysia, Brunei Darussalam, Lao PDR, and Cambodia to collectively assess research outputs, system integration, and technical progress. By observing implemented automation and AI systems in real production environments, the team will align methodologies, validate performance, and identify future improvements and replication opportunities.

To assess the application of AI-driven digital camera systems and automated environmental control for greenhouse potato production at NIA

The visit to NIA focuses on evaluating AI-integrated digital camera technologies, automated irrigation and fertigation systems, and environmental sensor networks applied to greenhouse-based potato production. The objective is to assess technical effectiveness, resource optimization, and decision-support capabilities under tropical greenhouse conditions.

To examine environmental sensor networks and digital automation systems for modern crop production at Khmer Modern Farming

Participants will observe real-time environmental monitoring and automated control systems supporting commercial crop production. The objective is to evaluate system contribution to production stability, crop performance, and adaptive farm management, while drawing lessons for regional application across partner institutions.

To evaluate the implementation and scalability of online automation systems for crop production and organic fertilizer processing at Huy Yun Agriculture Co., Ltd.

The visit aims to review integrated automation systems across crop production and organic fertilizer processing. The objective is to assess system usability, operational sustainability, and scalability potential for small- and medium-scale agricultural enterprises, contributing to future collaborative development among the four institutions.

3.2 Program and iteration

Date: 3-6 February 2026

Venue:

(1) Project Meeting and Sharing Session at Prek Leap National Institute of Agriculture (NIA)

(2) Site visit and Meeting at Khmer Modern Farming

(3) Site Visit and Meeting at Huy Yun Agriculture Co., Ltd.

Agenda:

Project Members arrive at Phnom Penh Capital on 3 February 2026 (Tuesday).

Day 1: 04 February 2026 (Wednesday)
Project Review Meeting and Sharing Session at NIA

08:30 AM	Arrival of IVO Project Team at NIA
09:00 AM	Welcome remarks by the President of NIA
09:15 AM	Introduction of Faculty of Technology and Agricultural Engineering by Dean of Faculty
10.00 AM	Coffee break and networking
10:30 AM	Sharing session on Digital Agriculture by Department of Information Technology and Digital Agriculture
11:30 AM	Visit AIoT Lab and Discussion
12:00 PM	Lunch break
13:00 PM	Visit to Khmer Modern Farming
14:30 PM	Coffee break
15:00 PM	Discussion with Owner of Khmer Modern Farming
17:00 PM	End of Day 1

Day 2: 05 February 2026 (Thursday)
Site Visit to Huy Yun Farm

08:30 AM	Travel to Huy Yun Farm
10:30 AM	Coffee Break
10:45 AM	Visiting and Discussion on Huy Yun Farm including Crop Production
11:45 AM	Come back to NIA for wrap-up and discussion meetings
13:00 PM	Lunch Break
15.00 PM	Project Update and Discussion
16:30 PM	Coffee Break
17:30 PM	End of Program

IV. Results

From 3 to 6 February 2026, the project teams from Multimedia University (Malaysia), Universiti Teknologi Brunei (Brunei Darussalam), and the National University of Laos (Lao PDR) conducted the official visit to Cambodia under the ASEAN IVO project framework. The visit was hosted by Prek Leap National Institute of Agriculture (NIA).

Upon the arrival of the international delegates on 3 February 2026, we, NIA, organized and coordinated all reception, accommodation, and logistical arrangements. Hotel reservations were arranged to provide suitable comfort and proximity to meeting venues, while transportation was also coordinated for institutional sessions, and field visits to partner farms. Meeting facilities at NIA were prepared with the necessary technical equipment to support presentations, demonstrations of IoT and AI technologies, and interactive technical discussions among participants.

Throughout the duration of the visit, we also arranged catering services, including meals and refreshments during official sessions and site activities.

The smooth coordination of accommodation, transportation, meeting facilities, and hospitality services created a conducive environment for effective knowledge exchange and technical engagement. As a result, the visit from 3 to 6 February 2026 progressed efficiently and supported the achievement of meaningful outcomes for all four collaborating institutions.

4.1 Day 1

4 February 2026 | Prek Leap National Institute of Agriculture (NIA), Cambodia

On 4 February 2026, the project review meeting and technical activities were conducted at NIA, Cambodia. The participating teams from Multimedia University (Malaysia), Universiti Teknologi Brunei (Brunei Darussalam), and the National University of Laos (Lao PDR) attended as scheduled.

4.1.1 Field Practical Visit to NIA

Upon arrival at NIA, the delegation was welcomed **by H.E. Chhun Tory, President of NIA**. During the campus visit, the President introduced several of NIA's applied agricultural systems, including food processing lab, fish-raising, prawn production, and aquaponic systems that integrate aquatic and vegetable production. The visit provided practical insight into how sustainable farming systems are implemented at NIA and how digital technologies can complement integrated agricultural practices.

Figure 1: Visit to Aquaponic System

4.1.2 Sharing Session by Project Team

The team then continued with a comprehensive project presentation delivered to lecturers, students, and project members. The presentation outlined the objectives and collaborative framework of the ASEAN IVO project among the four partner institutions. Updates were provided on the greenhouse system for vanilla cultivation, cooling system innovation for crop production under high-temperature conditions in Brunei, AI-based crop disease and pest detection technologies at NIA, and the construction of a new greenhouse facility by the Laos team.

Particular emphasis was placed on the development and integration of the Automation of Things (AoT) system, which combines IoT-based environmental monitoring with AI-driven analytics to support climate-sensitive horticulture production.

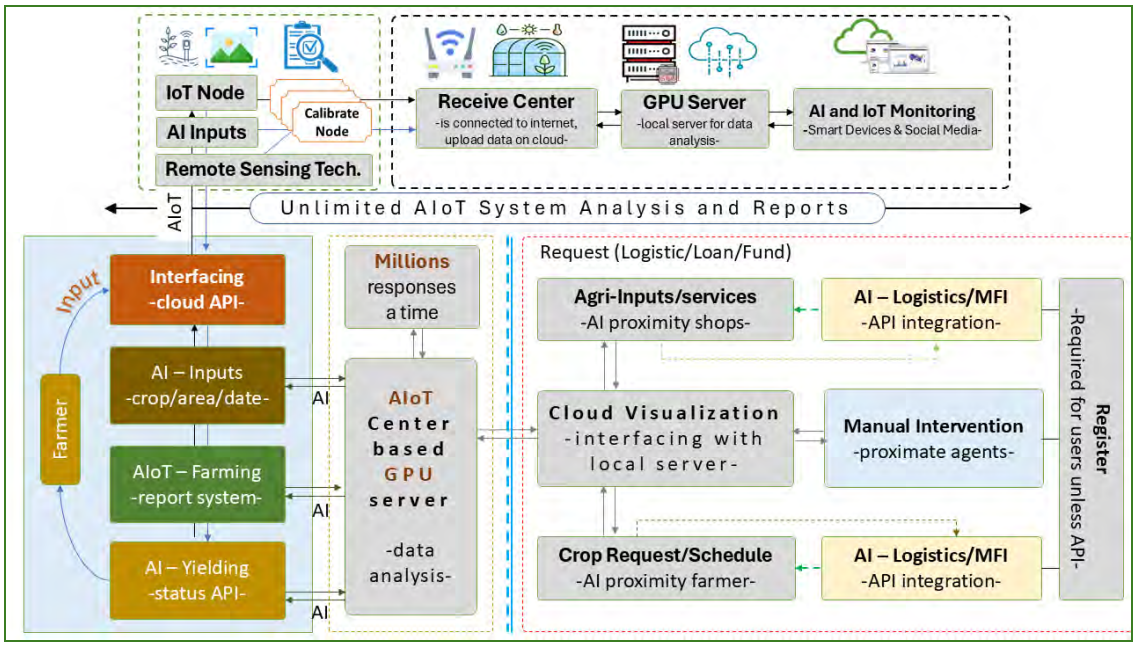


Figure 2: Overall AIoT System Architecture – showing sensor nodes, microcontroller, communication module, gateway/server, dashboard, and smartphone interface

The team demonstrated how environmental parameters such as temperature, humidity, soil moisture, and light intensity are collected through distributed sensor nodes and transmitted to a centralized monitoring platform for real-time visualization and analysis. The integration between hardware components, communication infrastructure, and user-interface dashboards was explained to illustrate the complete data flow process, from sensor data acquisition to remote monitoring and decision-making support.

Figure 3: sharing session for lecturers and students in NIA

The presentation further introduced the AI-based crop disease and pest detection system developed at NIA. The AI model processes digital camera inputs through image preprocessing and machine-learning algorithms to identify disease symptoms and generate diagnostic outputs for early intervention and precision management.

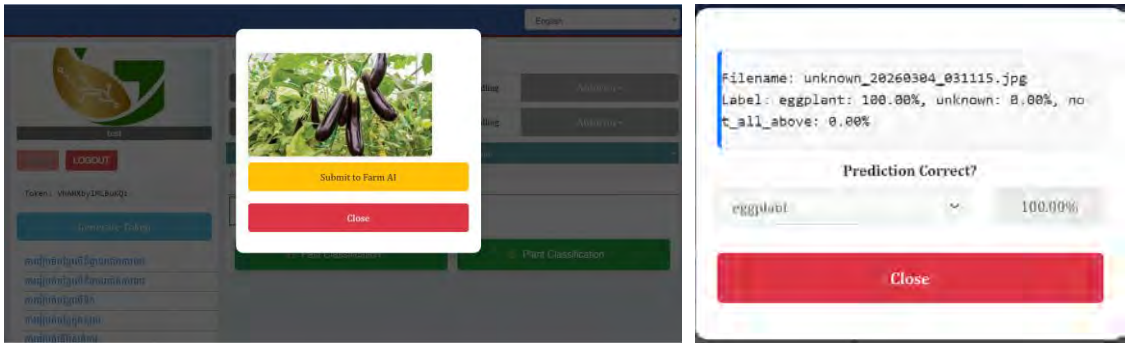


Figure 4: AI-Based Crop Disease Detection Framework – showing camera input, image preprocessing, model inference, and decision output

The session created an engaging platform for knowledge sharing and academic exchange. Lecturers and students from the Faculty of Technology and Agricultural Engineering showed strong interest in the technological approaches presented, particularly the integration of IoT sensors, artificial intelligence, and automated environmental control systems for greenhouse management. Several participants raised questions regarding the practical application of AI models for disease detection, data collection processes from field sensors, and the potential for scaling these technologies to support Cambodian farmers.

Students expressed enthusiasm about the opportunity to observe how research activities are translated into real-world agricultural solutions, noting that the project provides valuable learning experiences that connect classroom knowledge with practical innovation. Lecturers also highlighted the importance of international collaboration within the ASEAN IVO framework, emphasizing that such partnerships strengthen research capacity, promote technology transfer, and create opportunities for joint development of smart agriculture systems in the region.

In addition, both lecturers and students expressed particular interest in the

development of vanilla cultivation at NIA. Participants noted that vanilla has recently gained increasing attention as a high-value crop with emerging market demand in Cambodia and the region. They were eager to learn more about the planned vanilla greenhouse system, including cultivation techniques, environmental control requirements, and potential commercialization opportunities. The discussion reflected a shared interest in exploring vanilla farming as a promising research and business opportunity that could contribute to value-added agricultural production and new income streams for farmers in Cambodia.

4.1.3 Practical Visit to AIoT Lab

The delegation then visited the laboratory of the Faculty of Technology and Agricultural Engineering at NIA to observe the ongoing development of IoT sensor systems and AI integration. Demonstrations were provided on sensor prototyping, calibration procedures, embedded system programming, communication module configuration, and AI model training activities. The laboratory visit illustrated the complete technical workflow from hardware assembly and circuit design to data acquisition, processing, and algorithm deployment.

Figure 5: Laboratory Development of IoT Sensors and AI Model Training Activities

The visiting team expressed appreciation for the technical progress achieved and encouraged further acceleration of system installation within greenhouse facilities to enable real-time monitoring and field validation. It was highlighted that students and contracted technical staff have been actively involved in the design, development, testing, and refinement of these systems, strengthening institutional capacity and providing valuable hands-on research experience.

4.1.4 Visit Khmer Modern Farming

Following the laboratory visit, the delegation proceeded to **Khmer Modern Farming**, a local agricultural enterprise that applies modern greenhouse production practices. The visit aimed to provide project partners, and lecturers with practical exposure to commercial greenhouse operations and innovative cultivation techniques implemented in Cambodia.

During the visit, the farm management introduced the overall greenhouse production system, including crop cultivation methods, irrigation infrastructure, and

environmental management practices used to maintain stable growing conditions. The delegation observed how greenhouse structures are designed to improve crop productivity, reduce climate-related risks, and enable year-round horticultural production under controlled environments.

Particular attention was given to the economic potential of greenhouse farming. According to the farm operator, a well-managed greenhouse unit has the capacity to generate at least USD 10,000 in annual revenue, depending on crop type and management practices (possible for the current cropping – tomato, chili and leafy crops). Due to the demonstrated profitability and structured production model, The Agricultural and Rural Development Bank (ARDB), financial institution, has made an agreement (MoU) with the owner to provide bank loans without requiring traditional collateral, allowing farmers to access financing based on the projected performance of greenhouse operations.

The farm operator further explained that the company already maintains contractual arrangements with farmers for the installation and operation of more than 200 greenhouse units. Under this model, farmers manage greenhouse production while receiving technical guidance, production inputs, and market linkage support from the company. During the discussion, the farm operator expressed strong interest in integrating the smart IoT–Automation of Things (AoT) monitoring and automation system developed by the project into these existing greenhouse units. The adoption of intelligent monitoring systems, automated irrigation control, and data-driven crop management could significantly improve production efficiency, environmental management, and decision-making across the greenhouse network.

The visit also stimulated discussions among the delegation regarding the potential role of digital agriculture technologies, including IoT-based environmental monitoring, remote irrigation control, and AI-assisted crop management, in supporting commercial greenhouse operations. Lecturers expressed strong interest in observing how research-based technologies could be applied in real production environments, highlighting the importance of collaboration between research institutions and commercial farms to test and scale smart agriculture solutions in Cambodia.

Figure 6: Visit to Khmer Modern Farming Greenhouse

4.2 Day 2

4.2.1 Visit to Huy Hun Farm and Wrap-Up Meeting

On the second day, the delegation visited Huy Hun Farm to observe greenhouse crop production and farm management practices. The farm team briefly introduced their cultivation system, irrigation infrastructure, and greenhouse operations used for horticultural production.

During the visit, the delegation observed the irrigation infrastructure currently used in the greenhouse. As illustrated in Figure below, the farm utilizes a conventional pump-based irrigation system, where farmers manually switch the pump on and off to regulate water supply to the greenhouse beds through a network of PVC pipelines.

Figure 7: Visit to Huy Yun Farm - Conventional Tool Vs Modern Tool

This observation prompted discussions on how smart irrigation technologies could improve farm management. By integrating IoT-based irrigation control systems, water pumps could be connected to microcontrollers and communication modules that enable remote operation via smartphones or computer dashboards. Such systems would allow real-time monitoring and automated irrigation scheduling, improving water efficiency and reducing labor requirements.

4.2.2 Wrap-up and Discussion Meetings

Following the farm visit, the delegation held a wrap-up meeting and project overview session. During this meeting, **Dr. Phon Sovatna** summarized the key activities conducted during the two-day program and reflected on the technical exchanges, laboratory demonstrations, and field observations.

The discussion highlighted the importance of strengthening collaboration among partner institutions and continuing the development and deployment of IoT and AI technologies for smart greenhouse agriculture. Facilitated by **Dr. Lee It Ee**, Project Leader, the team emphasized that future collaboration should extend beyond research activities by actively involving farmers and commercial farms as key partners in testing and validating the technologies.

It was agreed that the project should follow a Research–Development–Deployment

(RDD) model, where technological innovations are first developed and tested in research laboratories, further refined through pilot development, and ultimately deployed in real farming environments. By involving farmers directly in the deployment stage, the smart agriculture technologies, including IoT-based environmental monitoring, automated irrigation systems, and AI-assisted crop management, can be evaluated under real production conditions and improved based on practical feedback.

Team members reaffirmed their commitment to advancing joint research, technology development, and capacity building under the ASEAN IVO project while promoting stronger collaboration between research institutions, technology developers, and farmers. This approach is expected to accelerate the adoption of smart agriculture solutions and support climate-resilient and technology-driven agricultural development in the region.

Figure 8: Wrap-Up Meeting and Project Overview Session

V. Conclusion

The two-day visit provided a valuable platform for knowledge exchange, technical discussion, and collaboration among the partner institutions involved in the ASEAN IVO project. Through the project presentation, laboratory visit, and field observations, the delegation gained a comprehensive understanding of the current progress in developing smart agriculture technologies, including IoT-based environmental monitoring, the Automation of Things (AoT) system, and AI-based crop disease and pest detection.

The visits to Khmer Modern Farming and Huy Hun Farm offered practical insights into commercial greenhouse operations and demonstrated the strong potential for integrating digital agriculture technologies into real farming environments. The discussion on greenhouse business models, which can generate significant annual income and operate under structured contracts with farmers, highlighted the opportunities for scaling smart agriculture solutions across a broader network of greenhouse producers.

Team members recognized the importance of strengthening collaboration among research institutions, technology developers, and farmers to ensure that technological innovations move beyond laboratory development toward practical field application. The project partners agreed that future activities should follow a Research–Development–Deployment (RDD) approach, where technologies are

developed and tested through research, refined through pilot development, and deployed in real farming environments with active participation from farmers.

Overall, the visit reinforced the shared commitment of all partners to advancing smart agriculture through collaborative research, technology development, and capacity building. By linking academic innovation with real agricultural practices, the ASEAN IVO project is expected to contribute to the promotion of climate-resilient, technology-driven, and economically sustainable agriculture in the region.

VI. Galleries

Laboratory visits – including food processing, crop production and aquaculture systems and Capus tour

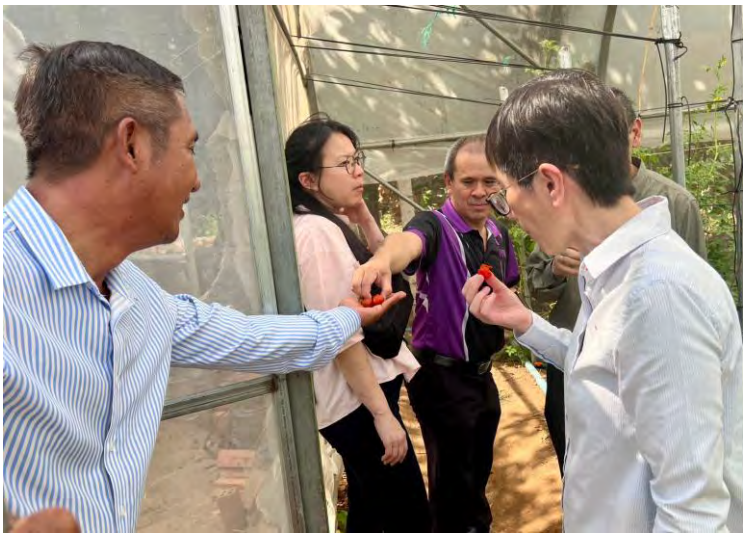



Sharing Session with Lecturers and Students



Farm Visit to the local farming, producing tomato, chili and other leafy crops which highly added value








Project Wrap-up and Conclusion Meeting



__End of Report__