Project Title: **Agricultural IoT based on Edge computing**

Background: ASIAN countries have a large share of agriculture in their economies, so ICT for food is the totally right approach as part of the IVO project's goals. The overall aim of this project is to develop an IoT-based framework with intelligent computing and implementation for an indoor smart farm.

Targets: This project aims to build an agricultural IoT framework based on edge computing, with a focus on solving existing challenges for agricultural IoT systems for both academic and practical aspects at the network edge.

1. New intelligent edge computing solutions for data collection and local response control in smart farming.
2. A security framework based on authentication, data preservation, and encryption, suitable for smart IoT applications such as smart farming.
3. An automatic agricultural system for indoor smart farms with the involvement of robot arms and drones.

Speaker: Dr. Hoang Trong Minh

Project Title: **Agricultural IoT based on Edge computing**

Project Members:

PTIT, VIETNAM: Dr. Hoang Trong Minh (project leader),Assoc. Prof. Hoang Dang Hai, Dr. Pham Anh Thu, MSc. Nguyen Thanh Tra.

VNU, VIETNAM: Assoc. Prof. Nguyen Linh Trung, Assoc. Prof. Nguyen Viet Ha, Dr. Dinh Tran Hiep, Dr. Tran Thi Thuy Quynh, Dr. Pham Minh Trien, Dr. Nguyen Le Khanh, Dr. Chu Duc Ha, Msc. Quach Cong Hoang, Dr. Ngo Khac Hoang.

UTM, MALAYSIA: Prof. Norliza Mohd Noor, Dr. Norulhusna Ahmad, Dr. Hazilah Mad Kaidi.

NECTEC, THAILAND: Dr. Chalee Vorakulpipat, Dr. Montida Pattaranantakul, Dr. Soontorn Sirapaisan.

NICT, JAPAN: Dr. Takeshi Takahashi.

Project Duration: 04/2022-03/2024

Project Budget: 82.000 USD

Project Activities

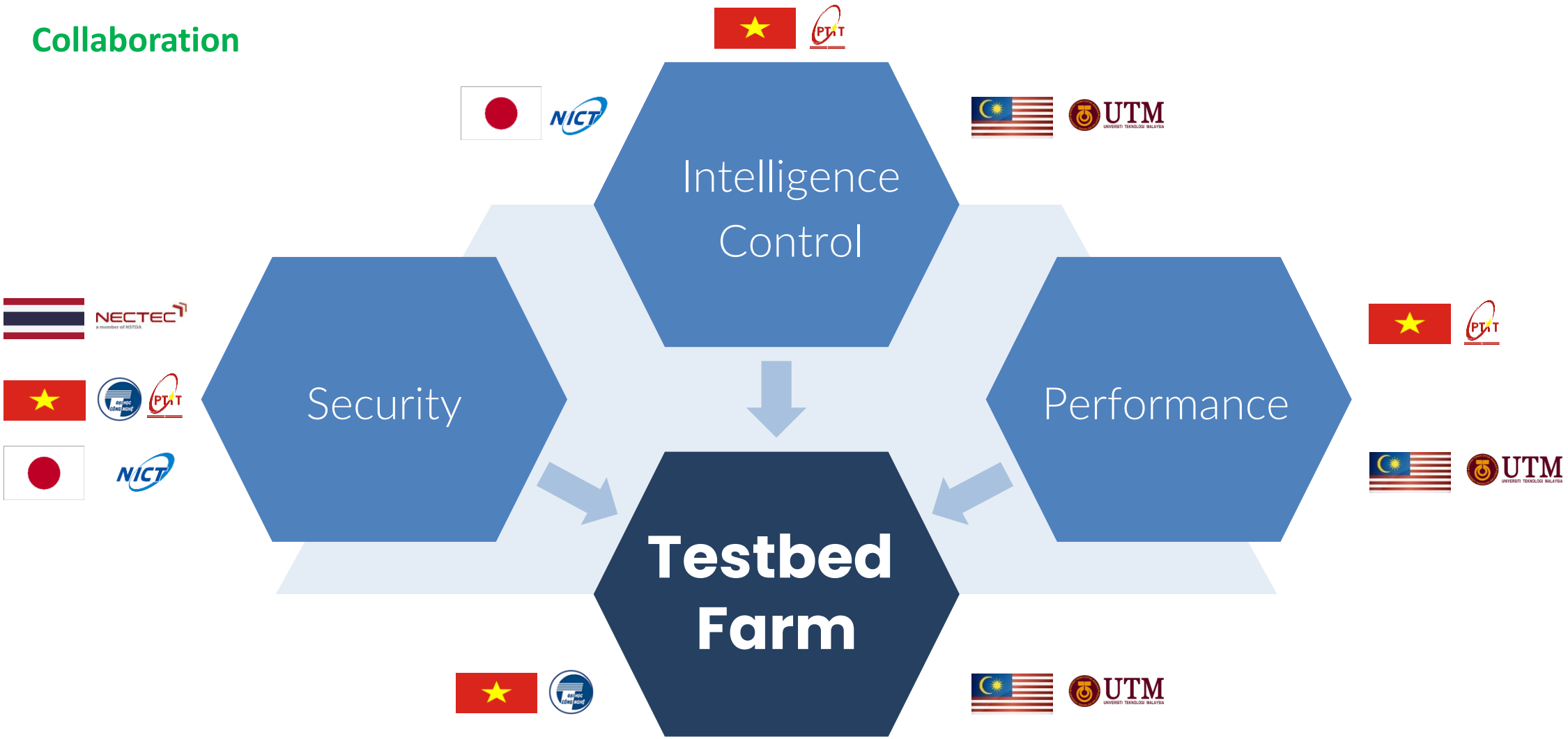
Work package No1		Work package No2		Work package No3	
Design an IoT monitoring system with drones and edge computing capabilities	Develop and optimize edge computing solutions to the system	Design the security framework	Develop the security solutions	Develop the fertilizing and watering systems	Develop the pollinating system and the plant disease predictor.

Work Package	Tasks	Year 1	Year 2	Responsibility				
				PTIT	VNU-UET	UTM	NECTEC	NICT
WP1	Task 1.1	x		②	①			
	Task 1.2		x	①	②	③	③	
WP2	Task 2.1	x		①	②	③	②	②
	Task 2.2		x	①	②	③	②	②
WP3	Task 3.1	x		③	②	①		
	Task 3.2		x	②	①	②		

① = responsible ② = supportive ③ = exploited

Project Activities

Collaboration



Project Activities

Kickoff Meeting

Date: 20 May 2022 – Hybrid Meeting
Venue: PTIT Hanoi Campus
Participants:

- Invited talk of Dr. Hiroshi Emoto, Secretariat of ASEAN-IVO
- Research members
- Other participants of PTIT/VNU-UET

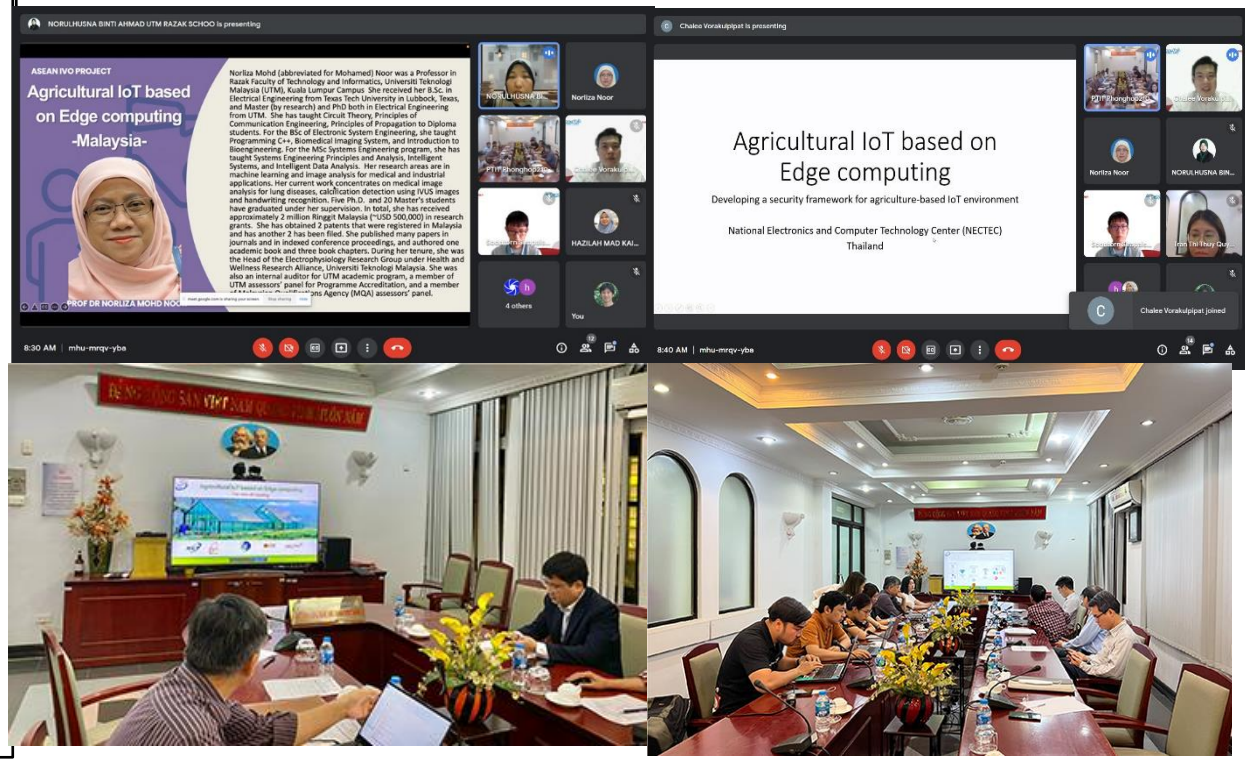
Content:

- Project leader provide the team with background information about the project's requirements, experience and roles
- Research group introduction and discussion on the assigned work packages and project plan
- Review the proposal and focus on solutions to adapt the valuated comments from SC and receive more detailed guidelines from IVO SC
- Other procedures and information
- Discussion on collaboration methods

The link for the event:

https://portal.ptit.edu.vn/eng/posts-and-telecommunications-institute-of-technology-launch-the-research-project-agricultural-iot-system-based-on-edge-computing-under-asean-ivo-program/

Some pictures at the kickoff meeting:



Academic Event

Date: 7-8 October 2022 – Hybrid meeting
Venue: Quang Ninh Province, Vietnam
Participants:

- Invited speakers: Dr. Hiroshi Emoto and representatives from PTIT, VNU-UET, NECTEC, UTM
- Online/Offline participants from Project Team

Content:

- Project members presented research results achieved from the initiation of the project, with the following topics: *(1) Modern IoT security issues; (2) Cyberattack detection in IoT networks; (3) Remote Monitoring Fertigation System; (4) Leveraging SDN/NFV based security monitoring system for IoT environments; (5) Greenhouse Tomato Production: Technologies and Challenges; (6) Precision Agriculture With Drone Technology and Major insect-pests of Solanaceous crop*
- Offer more perspectives and progress of implementing the project
- Prepare the draft of CRDA and the signing procedure
- Discuss equipment list for R&D and the purposes of using them among sides

The link for the event:
https://portal.ptit.edu.vn/eng/academic-event-on-key-issues-on-agriculture-iot-systems-of-asean-ivo-project-agricultural-iot-based-on-edge-computing-hosted-by-ptit/

Some pictures at the meeting:

Project Activities

Academic Event: NICT Visiting (insert pictures)

Date: 30 May 2023
Venue: PTIT Hanoi Campus, Vietnam
Participants:

- NICT: Dr. Hiroshi Emoto, Mr. Yamaguchi Norifumi, Ms. KOJIMOTO Makiko
- PTIT: Assos. Prof. Hoang Dang Hai, Dr. Vu Huu Tien – Vice dean of Multimedia Faculty, Dr. Do Trung Anh – Vice Head of S&T Management and International Cooperation, Dr. Hoang Trong Minh and other PTIT's project members.
- VNU: Dr. Nguyen Minh Trien

Content: information exchange, discuss about promotion of ongoing ASEAN IVO project, and check the equipments

Project Activities

IVO member changes:
Adding two new members:
VNU: Hung Duy Pham,
NECTEC: Kajornsak Piyoungkorn
Total: 23 members

CRDA Signing:
Waiting for the NICT's review and confirmation regarding the draft of CRDA???

Name	Institution
Hai Dang Hoang	Posts and Telecommunications Institute of Technology, Vietnam
Thu Anh Pham	Posts and Telecommunications Institute of Technology, Vietnam
Tra Thanh Nguyen	Posts and Telecommunications Institute of Technology, Vietnam
Giang Huong Thi Tran	Posts and Telecommunications Institute of Technology, Vietnam
Hiep Dinh Tran	University of Engineering and Technology Vietnam, Vietnam
Quynh Thi Thuy Tran	University of Engineering and Technology Vietnam, Vietnam
Trien Minh Pham	University of Engineering and Technology Vietnam, Vietnam
Hoang Cong Quach	University of Engineering and Technology Vietnam, Vietnam
Hoang Khac Ngo	University of Engineering and Technology Vietnam, Vietnam
Trung Linh Nguyen	University of Engineering and Technology Vietnam, Vietnam
Ha Viet Nguyen	University of Engineering and Technology Vietnam, Vietnam
Khanh Le Nguyen	University of Engineering and Technology Vietnam, Vietnam
Ha Duc Chu	University of Engineering and Technology Vietnam, Vietnam
Duong Manh Phung	University of Engineering and Technology Vietnam, Vietnam
Hung Duy Pham	University of Engineering and Technology Vietnam, Vietnam
Takeshi Takahashi	National Institute of Information and Communications Technology, Japan
Chalee Vorakulpipat	National Electronics and Computer Technology Center, Thailand
Montida Pattaranantaku	National Electronics and Computer Technology Center, Thailand
Soontorn Sirapaisan	National Electronics and Computer Technology Center, Thailand
Kajornsak Piyoungkorn	National Electronics and Computer Technology Center, Thailand
Norulhusna Ahmad	Universiti Teknologi Malaysia, Malaysia
Norliza Mohd Noor	Universiti Teknologi Malaysia, Malaysia
Hazilah Mad Kaidi	Universiti Teknologi Malaysia, Malaysia

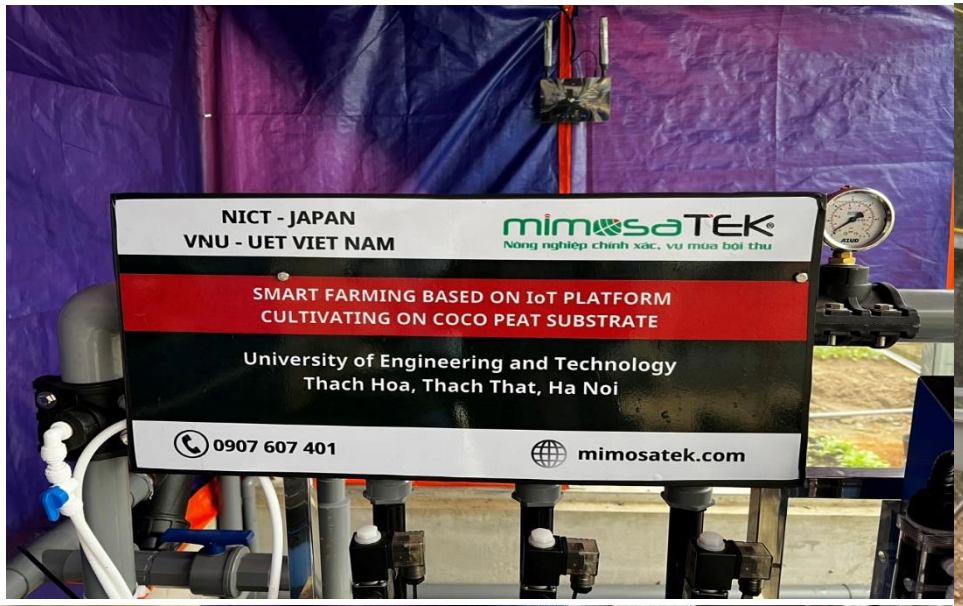
R&D results: (Max. 3 slides)

1. Scientific and technological
   - Figured out the main challenges of 6 packets of the project's aim.
   - Security issues: Distributed learning, SDN/NFV security
   - Disease detection: Image processing, lightweight ML/AI models.
2. Application (or system) development
   - Outline the main components of the greenhouse and the agricultural IoT system
   - List the needed devices for the agricultural IoT system
3. Experiments including field testing

Not yet

R&D results: (Max. 3 slides)

1. Equipment installations (Insert pictures) Vietnam side



List of purchased equipments

Equipment for PTIT and VNU-UET, Vietnam (1st year)
MimosaTech (Smart Fertilizer dosing machine 3 channels + Farming infrastructure on substrate)
Hoang Long Computer (Workstations - 2 sets)
Equipment for UTM, Malaysia
IoT Fertilization System, rental and installation
Plant Disease Detection system using drones
Equipment for PTIT and VNU-UET, Vietnam (2nd year)
® 2 AI & 5G Development Drone - Sentinel 2.4/5ghz WiFi
Sentinel VOXL 2 Battery Pack (2 sets)
Spektrum DX6e Transmitter
Waterproof and Shock Resistant Drone Case with Wheels
Laptops (2 sets)

Scientific Contribution:

Presentations at International Conferences:

No:	Paper title:	Author names	Affiliation	Conference name:	The date of the conference	The venue of the conference
1	Agricultural IoT based on Edge computing	Chalee Vorakulpipat, Ekkachan Rattanalerdnusorn, Sasakorn Pichetjamroen	NECTEC	(ICCAIS 2022)	21-24 November 2022	Hanoi, Vietnam
2	A novel DNN-based IDS System Combined with an LR-GA Method to Detect Attacks	Trong-Minh Hoang, Thanh-Tra Nguyen, Hong-Duc Nguyen, Duc-Thuan Luong and Van-Son Nguyen	PTIT	The Intelligent Systems Conference (IntelliSys) 2023	7-8 September 2023	Amsterdam, The Netherlands
3	Safeguarding Devices and Edge Computing: A Responsive Anti-Scam Approach	Chalee Vorakulpipat, Montida Pattaranantakul, Soontorn Sirapaisan, Soontaree Songserm	NECTEC	CyberSciTech 2023	14-17 November 2023	Abu Dhabi, UAE

Scientific Contribution:

Please fill in the following table if your members gave presentations at an international conference or published papers in scientific journals.

Published Journal Papers:

No:	Paper title:	Author names	Affiliation	Journal name:	The publisher of the Journal	The volume number and Pages
		(all authors)	(full names of institutions)	(full name of the Journal)	(full name of the publisher)	(e.g. Vol. xx, No. yy, pp. zzz)

(please list all papers by your team.)

Note: The scientific contribution (international conferences and journal papers) and societal impact can be summarized into one or two slides, if you don't have a great number of them.

Societal Impact

- The project will contribute to the technical proficiency of research in IoT monitoring for smart agriculture in Vietnam, edge computing in Malaysia and Thailand, and security in Vietnam and Malaysia.
- For Vietnam the project results will be fast transferred to agricultural practice due to the involvement of the prospective end-user (Faculty of Agriculture Technology at VNU-UET) and its industry/practice-related collaborators (CDTAE, VIDA, Mimosa Tex).
- For Malaysia, the agriculture collaborators will implement the project (ZKSB Agriculture Sdn. Bhd, Eco Schematic Enterprise) as a technology transfer to the farmers in helping them to increase the yield with more advanced and systematic farming methods. The implementation of the proposed IoT system can also highly reduce the dependent labor-intensive farming method.
- More broadly, the research results are expected to provide foundations for further research in building future massive IoT systems for smart agriculture, directly contributing to the creation of society's benefits of the ASEAN region and particularly of Vietnam, Malaysia, Thailand, as set out by the ASEAN ICT master plan.

Conclusion: Current state

1. Scientific and technological
   - Recognize the main problems that needed academicals collaboration
   - Focus on ML models applied to the agricultural
   - Develop a framework for the agricultural IoT system (Conference paper)
2. Application (or system) development
   - Outline the main components of the greenhouse and the agricultural IoT system
   - List the needed devices for the agricultural IoT system
3. Experiments including field testing

Not yet

Conclusion: Future work

1. Scientific and technological
   - Recognize the main problems that needed academicals collaboration
   - Proposes ML models applied to the performance and security of edge computing aspects.
   - Develop a security framework for the agricultural IoT system
2. Application (or system) development
   - Build the agricultural IoT system on the Vietnam and Malaysia sides.
   - Embed algorithms/models of IDS-based ML to the edge devices.
3. Experiments, including field testing

   Propose a disease detection Model and apply it to the accurate data.

Organize The workshop in Malaysia in Jan 2024.

Summary of conclusions:

1. Involve researchers into their collaborative work packages to achieve the project goal
2. Prepare the draft of the CRDA and signing procedure among sides and
3. Propose the equipment list and purchase plan according to the project progress
4. Implement technical discussions for the tasks in the project.
5. Plan for the next stages