Course Outline

Annual International Training Course

Theme: Climate Change and Environmental Issues

1. **Course Title:** Good Air Quality with PM 2.5 sensors and IoT

2. **Duration:** 3 Weeks (1-19 May 2023)

3. **Background:**

Thailand International Cooperation Agency (TICA)

TICA is a national focal point for Thailand's international development cooperation. It was established in 2 0 0 4 to realize Thailand's aspiration to be a contributor of development cooperation. Believing that global challenges are best addressed by international cooperation and global partnership, TICA continues to work closely together with its development partners to realize the global development agenda through various capacity-building and human resources development programmes. In response to the recent changes in the global landscape of development cooperation, TICA has strengthened its partnerships to harness the synergy of South-South and Triangular Cooperation to tackle global development challenges, including expediting the implementation of Sustainable Development Goals (SDGs). It also continues to realign our focuses in order to deliver Thailand's commitment as a global reliable partner.

Since 1991, TICA, in collaboration with educational institutions in Thailand, has offered short-term training courses under its Annual International Training Course (AITC) programme. The number of courses offered each year varies between 25 to 35 courses for 20-35 participants per course. AITC not only fosters good and friendly relations which Thailand has already enjoyed with recipient countries across regions, but also helps Thailand to reach out to those countries with which we desire to engage more closely. The courses offered by TICA in 2023-2025 are categorized into 5 themes: Sufficiency Economy Philosophy (SEP), food security, climate change and environmental issues, public health and BCG Model related.

Organization/Institution

School of Science, Walailak University

Walailak University is a residential university equipped with modern educational facilities, services and accommodation for students and staff, located against a beautiful backdrop of mountain scenery in Nakhon Si Thammarat Province, Thailand. The University has a total area of 3,600 acres, making it the largest campus of any university in Thailand. Established in 1999, the School of Science at Walailak University is one of the leading institutes in science in southern Thailand. The faculty focuses on producing a number of qualified researchers to serve industrial needs. It currently consists of five departments namely, Biology, Physics, Chemistry, Mathematics and Statistics, and Marine Science Departments. This training course will be conducted by Center of Excellence for Ecoinformatics and School of Science, Walailak University.

Course background

Outdoor air pollution is a major environmental health problem affecting everyone in low-, middle-, and high-income countries. Ambient (outdoor) air pollution in both cities and rural areas was estimated to cause 4.2 million premature deaths worldwide per year in 2016; this mortality is due to exposure to small particulate matter of 2.5 microns or less in diameter (PM2.5), which causes cardiovascular and respiratory disease, and cancers. People living in low- and middle-income countries disproportionately experience the burden of outdoor air pollution with 91% (of the 4.2 million premature deaths) occurring in low- and middle-income countries, and the greatest burden in the WHO South-East Asia and Western Pacific regions. The latest burden estimates reflect the very significant role air pollution plays in cardiovascular illness and death. More and more, evidence demonstrating the linkages between ambient air pollution and the cardiovascular disease risk is becoming available, including studies from highly polluted areas.

WHO estimates that in 2016, some 58% of outdoor air pollution-related premature deaths were due to ischaemic heart disease and strokes, while 18% of deaths were due to chronic obstructive pulmonary disease and acute lower respiratory infections respectively, and 6% of deaths were due to lung cancer. Some deaths may be attributed to more than one risk factor at the same time. For example, both smoking and ambient air pollution affect lung cancer. Some lung cancer deaths could have been averted by improving ambient air quality, or by reducing tobacco smoking. Outdoor air pollution is carcinogenic to humans, with the PM2.5 of air pollution most closely associated with increased cancer incidence, especially lung cancer (WHO,

2013). Addressing all risk factors for non-communicable diseases – including air pollution – is key to protecting public health. Most sources of outdoor air pollution are well beyond the control of individuals and demands concerted action by local, national and regional level policy-makers working in sectors like transport, energy, waste management, urban planning, and agriculture.

High concentrations of PM2.5 increase mortality and have health impacts even at very low concentrations – indeed no threshold has been identified below which no damage to health is observed. Air pollution takes an estimated seven million lives globally in the next year, while costing the world's economy nearly 225 billion USD. In Southeast Asia, Jakarta and Hanoi are Southeast Asia's two most polluted cities. With Beijing's air quality getting better, Jakarta risks overtaking China's famously polluted capital soon. Climate change is making the effects of air pollution worse by changing atmospheric conditions and amplifying forest fires. The key driver of climate change, burning fossil fuels, is also the main driver of air pollution, globally. Therefore, tackling climate change will also greatly improve our air quality. National governments can help tackle the effects of air pollution by providing adequate monitoring and reporting infrastructure.

Under the Center of Excellence for Ecoinformatics, School of Science, Walailak University, we have more than 10 years of experience on sensor technology, and IoT. We are experts on utilized air quality index data for PM 2.5 control and prevention. Online learning module on Good Air Quality with PM 2.5 sensors and IoT will create awareness, provide knowledge and management skills, disseminate and replicate best practices on PM 2.5 control and mitigation approaches for reducing health risk areas and improve the quality of living in SEAMEO country members.

4. Objectives

The program is designed to

4.1 To strengthen the air quality training programmes to be responsive to the air pollution, climate change challenges and sustainable development

4.2. To build critical survillences who will promote/practice of good air quality and PM 2.5 using sensors and IoT in developing countries.

4.3 To monitor trends in the distribution, spread and environmental risk factors of PM 2.5 over time and geographically.

5. Course Contents

Online training workshop will be held during 1-19 May 2023.

Participants are required to have a computer or iPad or smart phone with internet connect to be able to attend this online training workshop. All online material and classroom assignments will be posted on the google classroom.

5.1   Course Outline

Date/Period/Topic	Time (Thailand time)	Content	Lecture (hrs)	Practices (hrs)
Day 1:				
Monday 1 May 2023, 1-4.30 pm (Lecture 3.5 hrs)	12.00-1.00 pm	Registration		
	1.00-1.30 pm	Opening Ceremony with Special talk by Prof. Dr. Sombat Thamrongthanyawong, the President of Walailak University on "Air Quality, Air Pollution and Possible Actions" Group Photo Orientation	0.5	
	1.30-4.30	Getting to know each other : Participants present their country reports on the air quality and PM 2.5 level in their country	3	
Day 2:				
Tuesday 2 May 2023, 1-4.30 pm (Lecture 3.5 hrs)	1.00-2.30 pm	Global air pollution and trends	1.5	
	2.30-4.30 pm	Sources of emission and exposure	2	
Day 3:				
Wednesday 3 May 2023, 1-4.30 pm (Lecture 3.5 hrs)	1.00-2.30 pm	Disease and economic burden	1.5	
	2.30-4.30 pm	Inequalities, vulnerable and susceptible group of air pollution	2	
Day 4:				
Thursday 4 May 2023, 1-4.30 pm (Lecture 3.5 hrs)	1.00-2.30 pm	Air pollutants: PM2.5, PM10	1.5	
	2.30-4.30 pm	Air pollutants: ozone	2	

Day 5:				
Friday 5 May 2023, 1-4.30 pm (Lecture 3.5 hrs)	1.00-2.30 pm	Air pollutants: nitrogen dioxide, sulfur dioxide, Air pollutants: carbon monoxide	1.5	
	2.30-4.30 pm	Air pollutants: black carbon/elemental carbon, Air pollutants: ultrafine particles	2	
Day 6:				
Monday 8 May 2023, 1-4.30 pm (Lecture 3.5 hrs)	1.00-2.30 pm	Sufficient Economy Philosophy (SEP) and its conceptual framework.	1.5	
	2.30-4.30 pm	Application of SEP in mosquito control as a community-based participation	2	
Day 7:				
Tuesday 9 May 2023, 1-4.30 pm (Lecture 3.5 hrs)	1.00-2.30 pm	Air pollutants: sand and dust storms	1.5	
	2.30-4.30 pm	IoT and Internet Connectivity	2	
Day 8:				
Wednesday 9 May 2023, 1-4.30 pm (Lecture 3.5 hrs)	1.00-2.30 pm	Basic cloud computing	1.5	
	2.30-4.30 pm	Air temperature, Relative humidity sensors and IoT	2	
Day 9:				
Thursday 10 May 2023, 1-4.30 pm (Lecture 3.5 hrs)	1.00-2.30 pm	PM 2.5 sensors and IoT	1.5	
	2.30-4.30 pm	CO sensors and IoT	2	
Day 10:				
Friday 11 May 2023, 1-4.30 pm (Workshop 3.5 hrs)	1.00-2.30 pm	Gather sensor data with IoT		1.5
	2.30-4.30 pm	Visualize your IoT data		2
Day 11:				
Monday 14 May 2023, 1-4.30 pm (Lecture 3.5 hrs)	1.00-2.30 pm	Tools and approaches to raise air pollution awareness	1.5	
	2.30-4.30 pm	Risk communication	2	
Day 12:				
Tuesday 15 May 2023, 1-4.30 pm (Lecture 3.5 hrs)	1.00-2.30 pm	Methods for health risk assessment for air pollution	1.5	
	2.30-4.30 pm	Role of the health sector	2	

Day 13:					
Wednesday 16 May 2023, 1-4.30 pm (Lecture 3.5 hrs)	1.00-2.30 pm	Capacity development for air quality management	1.5	
	2.30-4.30 pm	Multistakeholder cooperation	2	
Day 14:					
Thursday 17 May 2023, 1-4.30 pm (Lecture 1.5 hrs) (Workshop 2 hrs)	1.00-2.30 pm	How to write a good project proposal.	1.5	
	2.30-4.30 pm	Participants write a project proposal on air quality management in your country.		2
Day 15:					
Thursday 17 May 2023, 1-4.30 pm (Lecture 1.5 hrs) (Workshop 2 hrs)	1.00-2.30 pm	Participants present air quality management project. Each participant will have 15 min oral presentation with 15 min for questions and answers.	1.5	
	2.30-3.00 pm	Workshop Reflection and knowledge sharing		0.5
	3.00-3.30 pm	Post-test and evaluation		0.5
	3.30-4.30 pm	Certificate, Closing ceremony and Farewell Party at Walailak Park		1

5.2   Practices

The course contains lectures, exercises, study visits and group work. Oral and written presentation of a project is included.

5.4 Advance Assignments

5.4.1 Country Report

5.4.1.1 Participants are required to submit a country report together with an Application Form and present a country report during the workshop.

5.4.1.2 Country report should include these followings

Topics: general information of the country, historical background of the climate-smart agriculture of the country, existing laws and regulations concerning the climate-smart agriculture, existing problems in the applicants' section, future program/project on the climate-smart agriculture, and expectation for the training course.

Materials: statistical data/data/figures are required where it is applicable.

Length: 3-5 A4 pages, Times News Roman font 12 points, single space

Dateline: submit a country report form together with an Application Form 2 months before the workshop starts.

Country Report Form: see appendix A

5.4.2 Reading Assignment

Cambridge University (2013). Climate Change: Action, Trends and Implications for Business.

Climate-Smart Agriculture Manual for Zimbabwe. (2017). Climate Technology Centre and Network, Denmark.

IISD, UNITAR & UNEP. (2009). IEA Training Material:Vulnerability and Climate Change Impact Assessment for Adaptation.

IPCC. (2013). Climate Change 2013. The Physical Science Basis -Summary for Policymakers.

OECD. (2009): Guidance on Integrating Climate Change Adaptation into Development Co-operation.

UNEP. (2009). Climate Change Science Compendium

UNEP. (2009). Climate in Peril, a Popular Guide to the Latest IPCC Report.

UNEP & UNDP. (2011). Mainstreaming Climate Change Adaptation into Development Planning: A Guide for Practitioners.UNFCCC. CGE Climate Change Training Materials.

UNFCCC. (2008). Compendium on Methods and Tools to Evaluate Impacts of, and Vulnerability and Adaptation to, Climate Change.

UNFCCC. (2006). UNFCCC Handbook.

UNFCCC & UNEP. (2002). Climate Change Information Kit.

World Bank Report. (2012). Turn Down the Heat.

World Meteorological Organization. (2012). Greenhouse Gas Bulletins.

5.4.3 Project Assignment

Day	Project Assignment
14	**Writing on a project assignment** Participants write a project proposal on the knowledge of climate-smart agriculture from the workshop and show how to implementation climate-smart

	agriculture in your country. Date: Day 14 of the workshop. Documents: will be provided and can be downloaded in the google drive.
15	**Project assignment presentation** Participants present climate-smart agriculture project in their country. Date: Day 15 of the workshop. Each participant will have 15 min oral presentation with 15 min for questions and answers. Closing ceremony

6. **Participants' Criteria**

Applicants must fulfill the following requirements:

- Be nominated by their respective governments
- Education:
- Language: proficiency in English (speaking, reading and writing)

Walailak University is expected to have a various and flexible participants from all developing countries around the globe who are interested in training on public health. The course provides clear, concise and up-to-date information for anybody interested in obtaining a general understanding about good air quality and PM 2.5 with sensors and IoT. The course should be of particular interest to the following audiences: Public health officers, Civil servants in national ministries, provincial departments and local authorities; Environmental managers in private sector and civil society organizations; Faculty, researchers and students; farmers and Interested citizens.

7. **Attendance and Evaluation**

Participants who complete the training will receive a certificate based on

- Real-time class attendance (not less than 80%)
- Interactive class participation
- Presentation and report

- Evaluation

The type of assessment to be used will involve continuous both formative and summative assessments. The Assessment tools include some of the following: projects, assignments, theoretical exams, practicals field trials, using the science laboratory and computer labs, field attachment and participatory assessment e.g. presentation to stakeholders farmers /students.

8. Venue:

Online training

9. Expected Results:

The workshop should enable trainees to:

1. Demonstrate an in-depth understanding of good air quality and PM 2.5 sensors and IoT
2. Promote technical skills for an improving community participation and mobilization for sustained air quality monitoring.
3. Conduct cutting edge good air quality and PM 2.5 campaign and/or activities in their countries
4. Promote social innovations and practices for good air quality and PM 2.5 campaign campaign in their countries

10. Organization/Institution:

Implementing Agency:

School of Science, Walailak University

222 Thasala, Nakhon Si Thammarat 80161 Thailand

Tel: +66-075-672005-6, Fax: +66-075-672004

Contact Person

(1) Assoc. Prof. Dr. Krisanadej Jaroensutasinee (Sensors and Smart Agriculture expert)

School of Science, Walailak University, email: krisanadej@gmail.com

(2) Assoc. Prof. Dr. Mullica Jaroensutasinee (Data Analysis expert)

School of Science, Walailak University, email: mullica.jn@gmail.com

Collorborative Organization

1. School of Science, Walailak University
2. SEAMEO STEM Ed center

11. Expenditure/Funding

Thailand International Cooperation Agency (TICA)

Government Complex, Building B (South Zone), 8th Floor,

Chaengwattana Rd., laksi District, Bangkok 10210 THAILAND.

Website: www.tica.thaigov.net

Email: aitc@mfa.go.th

Schedule for the Training Programme:

Course Schedule "Good Air Quality with PM 2.5 sensors and IoT"

1 – 17 May 2023

Date/Period/ Topic	Time (Thailand time)	Content	Lecture (hrs)	Practices (hrs)	Speaker		Note
Day 1:							
	12.00-1.00 pm	Registration					
	1.00-1.30 pm	Opening Ceremony with Special talk by Prof. Dr. Sombat Thamrongthanyawong, the President of Walailak University on "Air Quality, Air Pollution and Possible Actions" Group Photo Orientation	0.5		Prof. Dr. Sombat		
	1.30-4.30	Getting to know each other : Participants present their country reports on the air quality and PM 2.5 level in their country	3		Assoc. Prof. Dr. Mullica		
Day 2:							
	1.00-2.30 pm	Global air pollution and trends	1.5		Assoc. Prof. Dr. Mullica		
	2.30-4.30 pm	Sources of emission and exposure	2		Assoc. Prof. Dr. Mullica		
Day 3:							
	1.00-2.30 pm	Disease and economic burden	1.5		Assoc. Prof. Dr. Mullica		
	2.30-4.30 pm	Inequalities, vulnerable and susceptible group of air pollution	2		Assoc. Prof. Dr. Mullica		
Day 4:							
	1.00-2.30 pm	Air pollutants: PM2.5, PM10	1.5		Asst. Prof. Dr. Rungruang		
	2.30-4.30 pm	Air pollutants: ozone	2		Asst. Prof. Dr. Rungruang		
Day 5:							
	1.00-2.30 pm	Air pollutants: nitrogen dioxide, sulfur dioxide, Air pollutants: carbon monoxide	1.5		Asst. Prof. Dr. Rungruang		

	2.30-4.30 pm	Air pollutants: black carbon/elemental carbon, Air pollutants: ultrafine particles	2		Asst. Prof. Dr. Rungruang		
Day 6:							
	1.00-2.30 pm	Sufficient Economy Philosophy (SEP) and its conceptual framework.	1.5		Assoc. Prof. Dr. Krisanadej		
	2.30-4.30 pm	Application of SEP in mosquito control as a community-based participation	2		Assoc. Prof. Dr. Krisanadej		
Day 7:							
	1.00-2.30 pm	Air pollutants: sand and dust storms	1.5		Assoc. Prof. Dr. Krisanadej		
	2.30-4.30 pm	IoT and Internet Connectivity	2		Assoc. Prof. Dr. Krisanadej		
Day 8:							
	1.00-2.30 pm	Basic cloud computing	1.5		Assoc. Prof. Dr. Krisanadej		
	2.30-4.30 pm	Air temperature, Relative humidity sensors and IoT	2		Assoc. Prof. Dr. Krisanadej		
Day 9:							
	1.00-2.30 pm	PM 2.5 sensors and IoT	1.5		Assoc. Prof. Dr. Krisanadej		
	2.30-4.30 pm	CO sensors and IoT	2		Assoc. Prof. Dr. Krisanadej		
Day 10:							
	1.00-2.30 pm	Gather sensor data with IoT		1.5	Assoc. Prof. Dr. Krisanadej		
	2.30-4.30 pm	Visualize your IoT data		2	Assoc. Prof. Dr. Krisanadej		
Day 11:							
	1.00-2.30 pm	Tools and approaches to raise air pollution awareness	1.5		Assoc. Prof. Dr.Krisanadej		
	2.30-4.30 pm	Risk communication	2		Assoc. Prof. Dr. Krisanadej		
Day 12:							
	1.00-2.30 pm	Methods for health risk assessment for air pollution	1.5		Asst. Prof. Dr. Rungruang		
	2.30-4.30 pm	Role of the health sector	2		Asst. Prof. Dr. Rungruang		

Day 13:							
	1.00-2.30 pm	Capacity development for air quality management	1.5		Assoc. Prof. Dr. Mullica		
	2.30-4.30 pm	Multistakeholder cooperation	2		Assoc. Prof. Dr. Mullica		
Day 14:							
	1.00-2.30 pm	How to write a good project proposal.	1.5		Assoc. Prof. Dr. Mullica		
	2.30-4.30 pm	Participants write a project proposal on air quality management in your country.		2	Assoc. Prof. Dr. Mullica		
Day 15:							
	1.00-2.30 pm	Participants present air quality management project. Each participant will have 15 min oral presentation with 15 min for questions and answers.	1.5		Assoc. Prof. Dr. Mullica		
	2.30-3.00 pm	Workshop Reflection and knowledge sharing		0.5	Assoc. Prof. Dr. Mullica		
	3.00-3.30 pm	Post-test and evaluation		0.5	Assoc. Prof. Dr. Mullica		
	3.30-4.30 pm	Certificate, Closing ceremony and Farewell Party at Walailak Park		1	Assoc. Prof. Dr. Mullica		
			45	7.5			
		Total	52.5				

Appendix A: Country Report Form

Country report should be submitted together with the Application Form in complying the following items.

I. Introduction

    1. Name of the Training Course:...

    2. Name of applicant: ....

    Home Address: ....

    Phone No. (Home & Office): ....

    Fax: ....Email: ....

    3. Name of Country: ....

    4. Name of Organization: ....

    5. Main Tasks of the Organization & Organization Chart

    6. Applications' Position: Roles and Responsibilities

II. General Information of the country (1-2 pages of A4 size paper):

III. Historical Background of the Subject Related to the Training Course (within 1 page of A4 size paper)

IV. Existing Laws and Regulations concerning the subject (if any)

V. Existing Problems in the Applicants' section (1-2 pages of A4 size paper)

    1. Current problems and/or constraints you are facing (please describe concrete details).

    2. Obstacles in the process of solving those problems.

    3. Countermeasures of questions for those problems or any idea which you would like to study or solve through the course.

VI. Future Program/Project on the Related Subject

    1. What is the future policy/program/or project concerning with the subject.

    2. How the training course is related with those future.

VII. Expectations for the Training Course (up to 1 page of A4 size paper)

    1. Main interest subject areas or topics in this training course and reasons why you pick up them.

    2. How do you expect to apply the knowledge and skills received from this training course after you return to your home country.

    3. Other matters you are expecting for this course (if any) (Basically this training program is fixed and cannot be changed upon your request).