FOSTE
SCIENCE TECHNOLOGY & ENGINEERING

International Symposium on Frontier of Science, Technology and Engineering 2018 (FOSTE 2018)

19th – 22nd November 2018
Northern Science Park,
Chiang Mai, Thailand

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Introduction

The International Symposium on Frontier of Science, Technology and Engineering (FOSTE) brings together, through 2½ day meetings, a selected group of emerging science, technology and engineering leaders from the industries, academia and government labs to discuss pioneering technical work and leading edge research in various fields. The goal of the meetings is to introduce these outstanding scientists and engineers (ages 30-45) to each other, and through this interaction facilitate collaboration in science, technology and engineering, the transfer of new techniques and approaches across the fields, and establishment of contacts among the next generation of science, technology and engineering leaders.

The symposium covers four topics that vary from year to year. The 2018 topics will cover Smart Mobility, Climate Change & Mitigation, Smart Water Resource Management and IoT & Big Data. Following each talk, there is a substantial time devoted to discussion. In addition, breakout sessions, poster sessions, and other events offer ample opportunity for informal exchanges among the participants. There is also an alumni program that supports continuing contact among the participants. Attendees will find the programs useful and unique in their ability to bring together a diverse group for the purpose of exchanging information about science, technology and engineering developments and challenges across disciplines.

What to Expect at FOSTE

The purpose of the Frontier of Science, Technology and Engineering (FOSTE) symposium is ***to create useful interactions across disciplines*** among outstanding scientists and engineers under age 45. Here are some helpful hints to ensure you get the most out of the symposium.

- **Check out the participant list.** Bring an ample supply of business cards and prepare to meet as many new friends as possible.
- **Leave your laptop at the hotel during the symposium.** If you are working during the breaks, you miss opportunities to develop new contacts. If you are working during the session, you not only miss a great talk and ideas from interesting fellow scientists and engineers but you also distract the speaker and other attendees.
- **Participate fully** in the poster or breakout sessions.
- **Don't miss a session.** Though tempting to skip out on a session outside your field, you never know what you may learn that will be applicable to your own research.
- **Attend the evening events.** The reception and dinners provide informal time to meet attendees and continue conversations started earlier, plus the food is good.
- And to help you pack, dress code is **business casual**. You can leave your suits at home.

Participation in FOSTE programs are by invitation only. **Please be aware that guests are not included at meals or events**.

Agenda

November 19, 2018		Locations
07.30 PM	Registration and Welcome Party at the Mellowship Restaurant	Ibis Styles Hotel
November 20, 2018		
07.10 AM	Transfer from Ibis Styles Hotel to Northern Science Park	Meet at the Lobby
08.00 AM	Registration	Reception Hall
08.30 AM	**Welcome Remarks** By Assoc. Prof. Dr. Sakarindr Bhumiratana President, Thai Academy of Science and Technology	Exhibition Hall
	Opening Remarks By Assoc. Prof. Rome Chiranukrom Vice President, Chiang Mai University	
08.40 AM	**STeP At A Glance** By Assist. Prof. Dr. Choncharoen Sawangrat Assistant Director, Science and Technology Park	
09.00 AM	**Orientation to FOSTE** By Dr. Yutaka Kuwahara Vice Chair, Japanese Steering Committee Assoc. Prof. Dr. Paritud Bhandhubanyong Chair, Thai Academic Committee	
09.15 AM	**Group Photo of All Participants**	
09.25 AM	**1st Topic: Smart Mobility** 4 speakers (10 mins talk + 20mins Q&A / speaker) Title: SMART MOBILITY: Advanced Driver Assistance Systems towards Autonomous Driving Technology **Assist. Prof. Dr. Nuksit Noomwongs** Chulalongkorn University, Thailand Title: Inter-Airplane Mesh Networking **Prof. Dr. Ichiroh Kanaya** University of Nagasaki, Japan Title: Future Mobility and Urban Development **Assoc. Prof. Dr. Pawinee Iamtrakul** Thammasat University, Thailand Title: Applying Hybrid System Optimization Method to Air Traffic Management **Dr. Daichi Toratani** Electronic Navigation Research Institute, Japan	

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November 20, 2018		
11.25 AM	**Coffee Talk**	**Hallway Behind Auditorium**
11.35 AM	**2nd Topic: Climate Change & Mitigation** 2 speakers (10 mins talk + 20mins Q&A / speaker) Title: Monitoring and Modelling of Air pollution in Chiang Mai Province **Assoc. Prof. Dr. Sate Sampattagul** Chiang Mai University, Thailand Title: Activities for Sustainable Energy in North Japan Area **Prof. Dr. Kenji Itaka** Hirosaki University, Japan	
12.35 PM	**Lunch**	**Private Food Hall**
01.30 PM	**2nd Topic: Climate Change & Mitigation** 2 speakers (10 mins talk + 20mins Q&A / speaker) Title: Climate Change Impacts and Mitigation Potentials in Thailand's Agriculture with Policy Update **Assoc. Prof. Dr. Witsanu Attavanich** Kasetsart University, Thailand Title: CC and LCA in Transport **Dr. Yuki Kudoh** National Institute of Advanced Industrial Science and Technology, Japan	**Exhibition Hall**
02.30 PM	**Flash Poster Presentations** : 1-min oral presentation by each participant	**Exhibition Hall**
04.00 PM	**Coffee Talk**	**Hallway Behind Auditorium**
04.20 PM	**Poster Session I:** Topic of Smart Mobility and Smart Water Resource Management	
05.20 PM	**Poster Session II:** Topic of Climate Change & Mitigation and IoT & Big Data	
06.20 PM	**Khantoke Dinner**	**Chiang Mai Cultural Center** (~ 30 mins from the venue)

November 21, 2018		
07.40 AM	Transfer from Ibis Styles Hotel to Northern Science Park	Meet at the Lobby
08.30 AM	Registration	Reception Hall
09.00 AM	**3rd Topic: Smart Water Resource Management** 2 speakers (10 mins talk + 20mins Q&A / speaker) Title: From Practical to Future Research Issues on Water Resources Management **Mr. Adisorn Champathong** Royal Irrigation Department, Thailand Title: Prevention of Lake Hachiro's water Pollution with GNSS Auto-steer Rice Transplanter **Dr. Yoshisada Nagasaka** National Agriculture and Food Research Organization, Japan	Exhibition Hall
10.00 AM	Coffee Break	Hallway Behind Auditorium
10.20 AM	**3rd Topic: Smart Water Resource Management** 2 speakers (10 mins talk + 20mins Q&A / speaker) Title: Smart Water Management and Disaster Operation **Dr. Surajate Boonya-aroonnet** Hydro and Agro Informatics Institute, Thailand Title: Labor-saving Management for the Resumption of Farming in Disaster Area: Using IoT Prototyping Kit **Dr. Yoshimichi Yamashita** National Agriculture and Food Research Organization, Japan	Exhibition Hall
11.20 AM	Lunch	Private Food Hall
12.20 PM	Excursion: "The Art and Culture of Chiang Mai"	1. Maesa Elephant Camp (~ 60 mins from the venue) 2. Wat Pra That Doi Suthep (~ 60 mins from the venue)

November 22, 2018		
07.40 AM	Transfer from Ibis Styles Hotel to Northern Science Park	Meet at the Lobby
08.30 AM	Registration	Reception Hall
09.00 AM	**4th Topic: IoT & Big Data** 2 speakers (10 mins talk + 20 mins Q&A / speaker) Title: AI-Based Logging System for ALICE O2 Facilities **Dr. Phond Phunchongharn** King Mongkut's University of Technology Thonburi, Thailand Title: Knowledge Sharing and Integration with AI Computers **Prof. Dr. Yoshikazu Nakajima** Tokyo Medical and Dental University, Japan	Exhibition Hall
10.00 AM	Coffee Break	Hallway Behind Auditorium
10.20 AM	**4th Topic: IoT & Big Data** 2 speakers (10 mins talk + 20 mins Q&A / speaker) Title: Research Challenges in LoRaWAN **Assoc. Prof. Dr. Rardchawadee Silapunt** King Mongkut's University of Technology Thonburi, Thailand Title: Internet of Toys (IoT) **Assist. Prof. Dr. Keiko Yamamoto** Kyoto Institute of Technology, Japan and **Prof. Dr. Ichiroh Kanaya** University of Nagasaki, Japan	Exhibition Hall
11.20 AM	Wrap-up Session and Closing Ceremony	
12.30 AM	Lunch	Private Food Hall

ibis Styles Chiang Mai Hotel (~ 45 mins to the venue)

Summary

Thai oral presentations

Future Mobility and Urban Development

Asst. Prof. Dr. Pawinee Iamtrakul
Thammasat University, Thailand

The "future mobility and urban development" is about to allow the interaction between land use and transportation in more systematic approach. By incorporating "smart mobility" to ensure quality of smart planning, "users" as the target groups of the system and the "key informants" of the city has become significant role to be considered and ensure for "improving quality of life" on the basis of service of transportation.

The multilayers of analysis must be performed by considered;

- end users;
- infrastructure;
- vehicles.

This is in order to exeat "smart mobility" to explore for suitable solution for our society which will finally bring benefits in several terms of;

- promote local to global economy;
- enhance the quality of environment for all sources; (air, water, noise)
- sustain living environment for all groups of people;
- help for safety and security environment for urban environment;
- facilitate people to freely mobile to their desire destination.

Finally, "smart mobility" can be starting point of "Thai society" to employ data for establish society solution. However, it must be incorporated with city's vision and comprehensive planning to ensure social and environmental benefit to bring about "prosperity" to the whole society in more digitalizing approach and enable for monitoring and evaluation in efficient and equitable solution.

SMART MOBILITY: Advanced Driver Assistance Systems towards Autonomous Driving Technology

Asst. Prof. Dr. Nuksit Noomwongs
Chulalongkorn University, Thailand

1. There are three big issues in mobility
   - Safety
   - Traffic congestion/ Assessment to mass transit
   - Energy/ Environment

2. Road safety is very important. There are three factors concern to road safety, human/ car/ road, human is one major factor. Advanced Driver assistance System (ADAS) is an ACTIVE Safety system helping driver to control a car in same condition human cannot control. Examples of ADAS are Adaptive Cruise Control (ACC), Lane Keeping Assistant (LKA), Automated Emergency Breaking (AEB), etc.

3. Autonomous vehicle was developed based on ADAS. We can classified it into level 0-5.
   - Level 0: No system.
   - Level 1: There is at least 1 ADAS in a car.
   - Level 2: Many ADASs work together to take control the car in situation that driver loose concentration/ drowsing, etc. Therefore the car can prevent from accident.
   - Level 3: Car can be automate driven in some area that the traffic is not complicate. The road has to be satisfied to use with level 3. Driver has to take control when needed.
   - Level 4,5: Car has very high automation. It can be used anywhere level 4 still need human in a car while level 5 does not need. To allow level 3 up autonomous car to be used in public road, rules and regulation, social acceptance, mutual technology, business model must be developed to support.

Monitoring and Modelling of Air pollution in Chiang Mai Province

Assoc. Prof. Dr. Sate Sampattagul
Chiang Mai University, Thailand

1. The air pollution is a crisis disaster in Northern Thailand which affects to environmental, climate change, human health, socioeconomy aspect.
2. This study has developed the small sensor system for monitoring the PM 2.5, PM 10 concentrations by using A polarization-sensitive laser-light-scattering method and intelligent network systems for haze database.
3. We were reporting the haze data through an intelligent network system based on the website in order to be accessed the information of haze and air pollution situation more quickly and comprehensively.
4. Mostly air pollution in Northern Thailand was issued from open biomass burning in the area. Moreover, the trans-boundary pollution from neighboring countries, such as Myanmar, China, Laos and Indonesia is also important. These findings could be used to lead guidelines in the best practices of air pollution policy for the North of Thailand during the dry season to preventing or decreasing the cause of air pollution for sustainable sort out the air pollution problem and climate mitigation for the future.

<u>Important Messages</u>

- Global warming is real
- GW has contributing to tremendous climate change effects
- There are still the way out to relief and stop the crisis, LCA, CF, WF, Ecological Footprint.
- Many studies real clearly evidence that some gov policies will not fit well with sustainable future and we need to give them the strong voice and the right direction.
- There is nothing to loose now to fight against with GW and CC troubles, just do it today, do it now for yourselves and your children's children, for our beautiful planet that we have only the same one

Climate Change Impacts and Mitigation Potentials in Thailand's Agriculture with Policy Update

Assoc. Prof. Dr. Witsanu Attavanich
Kasetsart University, Thailand

Thailand's Intended Nationally Determined Contribution (INDC) currently defines a mitigation target of 20% against business as usual (BAU), while the ambition can be further increased to 25%. So far, the economy wide INDC target includes major sectors such as energy, transport, industry and waste while agricultural sector does not be included. Therefore, this study aims to close the gaps in the current INDC by analyzing the mitigation potential in the agricultural sector.

There are several steps to obtain the future estimated GHG emission reduction under mitigation options. We firstly collected the primary and secondary data from official sources and experts. The collected data are then used as the input in the econometric model. Thirdly, we obtained the estimated coefficients from the previous step to quantify the Business as Usual (BAU) scenarios of crop/livestock activities and corresponding GHG emissions from 2005-2030 under changes in climate and socio-economic conditions. We selected the BAU under IPCC RCP6.0 with moderate fertility rate of population growth as a baseline for comparison. Finally, we added in the application of each mitigation option mainly captured by the change in the cost of production and levels of adoption rates to observe changes in crop/livestock activities and hence the corresponding changes in GHG emissions. Several criteria were used to select the mitigation options including: 1) Technical mitigation potential; 2) Effect on total emission reduction; 3) Investment costs; 4) Co-benefit; 5) Ease of implementation; 6) Timescale of implementation; and 7) Creditability of option base on literature. According to the criteria and several rounds of meetings with experts, five out of 26 mitigation options were selected for this study.

Here we find that, for the option 1 (Applying alternative wetting and drying; AWD), the corresponding national GHG emissions of out-of-season rice can be reduced up to 12.70, 24.80 and 34.60 percent from the BAU in 2030 under low, medium, and high adoption scenarios, respectively. For the option 2 (Reducing field burning of crop residues), the national GHG emissions of all crops are projected to decrease 22.22, 44.28, and 66.47 percent from the BAU in 2030 under low, medium, and high adoption scenarios, respectively. For the option 3 (Application of site-specific nutrient management; SSNM)), this study revealed that total national GHG emissions of all crops are projected to slightly increase 0.14, 0.58, and 0.99 percent from the BAU in 2030 under low, medium, and high adoption scenarios, respectively. For the option 4 (Improve feed quality for livestock), this study discovered that the GHG emissions generated from option 1 are estimated to drop 0.83, 1.05, and 1.28 percent from the BAU in 2030 under low, moderate, and high adoption scenarios, respectively. For the option 5 (Anaerobic digester replacing uncovered anaerobic lagoon), we revealed that the national GHG emissions can be reduced up to 5.78, 7.83, and 9.88 percent from the BAU in 2030 under low, medium, and high adoption scenarios, respectively. Several policy recommendations can be extracted from the current study and will be discussed during the conference.

From Practical to Future Research Issues on Water Resources Management

Mr. Adisorn Champathong
Royal Irrigation Department, Thailand

The presentation aims to link practical to future research issues on water resources management. According to IPCC AR5 Report, climate impacts on Asian countries are categorized into three issues: flood, heat, and drought. Responding to the key risks, Climate Action (Goal 13) of the UN Sustainable Development Goals (SDGs) was established in order to take urgent action to combat climate change and its impacts.

Several adaptation issues, for example, exposure reduction via structural and non-structural measures, or even effective land-use planning, were proposed in the IPCC Report. However, there are still obstacles due to relevant factors. To achieve the goals, the researches corresponding to local conditions could be expanded to tackle the future risks.

Smart Water Management and Disaster Operation

Dr. Surajate Boonya-aroonnet
Hydro and Agro Informatics Institute, Thailand

Hydro and Agro Informatics Institute (HAII) has been working on research and development of the ICT to improve the water resources management in Thailand. HAII's core technologies range from data warehousing, data integration and management, high performance computing, mathematical modeling, data visualization and analytics. Since 2011 severe floods in Thailand, National Hydroinformatics and Climate Data Center (NHC) was established to unify the hydro-meteorological observations and other data related to water monitoring, forecasting and management in order to provide an online data access and central DSS for flood monitoring and forecasts. Currently, the NHC continuously collects 390 data items from 35 Thai agencies and provide a real-time data access so that the "smart water management and operations" especially for flood and drought disasters can be any water operation centers in Thailand.

Research Challenges in LoRaWAN

Assoc. Prof. Dr. Rardchawadee Silapunt
King Mongkut's University of Technology Thonburi, Thailand

The Lower Power Wide Area Network (LPWAN) is a type of wireless network that has been adopted extensively for IoT applications that do not require high data rate transmission. One of the most widely used LPWAN technologies is the Long Range Wide Area Network (LoRaWAN). LoRaWAN uses the specific form or signal modulation known as Chirp Spread Spectrum, making the signal robust to the interference, thus providing a larger coverage area.
In this talk, research challenges in LoRaWAN will be presented. My research group is focusing on improving the scalability and capacity of the LoRaWAN. First, we adapt and apply the CSMA (Channel Sensing Multiple Access) technique to manage the traffic of LoRA channels and second, we develop an algorithm to automatically allocate the spreading factor to end devices based on information of the receive signal strength indicator (RSSI), which offers more flexibility compared to the traditional LoRaWAN protocol.

Our group is also working on delivering IoT solutions using LoRaWAN. Examples include car tracking and dairy cow's estrus detection.

AI-Based Logging System for ALICE O2 Facilities

Dr. Phond Phunchongharn
King Mongkut's University of Technology Thonburi, Thailand

CERN also known as The European Organization of Nuclear Research is a European organization that conducts research on particle physics to study the composition of matters in the universe. The experiments are using a particle accelerator to make particles colliding near the speed of light. This process allows physicists to understand particle interaction and insights into the basic principles of nature. CERN has four main particle detectors that will capture and record the effects of these collisions. ALICE (A Large Ion Collider Experiment) is a powerful particle detector on the Large Hadron Collider (LHC). It is designed to study the physics of interaction with high energy density substances, called plasma quark-gluon. O2 is the computing facility support team for ALICE experiments. O2 facilities have approximately 2000 nodes which is working all the time. Currently, there is no any logging system in ALICE O2. As a result, O2 operational team cannot provide preventive maintenance for the system effectively. We have, therefore, proposed an AI-based logging system for O2 facilities. The proposed system must provide the following functions: i) to collect, process, store and visualize the relevant information of the vast amounts of system logs that will be generated by the O2 hosts and services ii) to detect abnormal situations and alarm to the subsystem experts iii) to analyze the survival period of the cluster and recommend the pre-maintenance in order to reduce the cost and time of maintenance iv) to advance analyze the data within the domain of data analytics. Our team will take an ownership of the AI-based logging system in the full stack of software engineering activities from collecting the requirement from CERN, designing, implementing to maintaining the system for 3 years in the first phase. The main output of this project is the AI-based logging system, which has high potential for commercialization. This project does not only improving knowledge and skill of our researchers and students but also giving Thai people an opportunity to be recognized in the world-class research organization.

Japanese oral presentations

Inter-Airplane Mesh Networking

Prof. Dr. Ichiro Kanaya
University of Nagasaki, Japan

1. Flying Airplane is the only practical choice for long-distance travel (e.g. Thailand – Japan) for many decades.
2. Over 6,000 airplanes are flying simultaneously in the world.
3. Air Traffic Management is highly important for safety of air travel in such a traffic jam.
4. Location of flying airplanes are collected by radars and second-surveillance radar (SSR) of airports, however, control towers and airplane pilots are community by voice.
5. We'll need digital communication method between ground to airplane, and, airplane to airplane.
6. It is hard to install new radio device on surface of airplane.
7. So, let's use existing hardware (SSR) and build the ad-hoc mesh network for inter-airplane communication.
8. Computer Simulation said the proposal was okay.
9. Future work: take advantage of structure of flying routes.

Applying Hybrid System Optimization Method to Air Traffic Management

Dr. Daichi Toratani
Electronic Navigation Research Institute, Japan

The topic of this presentation was the optimization method for the hybrid system which includes both continuous and discrete systems. In the real world, there are various kinds of hybrid system, but the hybrid system optimization problem is one of the most difficult for the optimization techniques problem to solve. One of the promising approaches to solve the hybrid system optimization is the Mixed Integer Linear Programming (MILP). The MILP is a kind of Linear Programming which can treat both linear and integer variables, namely continuous and discrete variables. This presentation shown one example for applying the MILP to an optimization problem, merging optimization problem. The merging optimization optimizes the trajectory and sequence for arrival aircraft simultaneously while maintaining sufficient separation. The optimization result can reduce the total flight cost of the arrival aircraft than the radar data.

Activities for Sustainable Energy in North Japan Area

Prof. Dr. Kenji Itaka
Hirosaki University, Japan

The topic of his talk was snow trouble on the solar power generation. He installed the test solar panel arrays with tilted angles, 10, 20, 30 degrees. The difference between the backside temperature and air temperature suggests the difference of covered or uncovered snow on the panel. The load cells installed at the legs pf test solar panel arrays show sharp jumps caused by snow drops. The drops were consistent of the temperature differences.

The discussion for his talk was as follows:

- How to avoid the damage of solar panels
- Is it possible to generate the electric power with snow?
- The optimization for the legs of panel arrays for the snow drops and wind-proof.

CC and LCA in Transport

Dr. Yuki Kudoh
National Institute of Advanced Industrial Science and Technology, Japan

1. Presented the relationship between transport CO_2 and life cycle stages of vehicles.
2. Introduced the concept of “Well to Wheel”, an LCA variation for estimating the environmental emissions associated with vehicle use.
3. Pointed out the importance of the importance of identifying the “Right Vehicle” considering the energy supply structure and the needs for using vehicle in a certain counting or region from Well to Wheel perspective.

Prevention of Lake Hachiro's water Pollution with GNSS Auto-steer Rice Transplanter

Dr. Yoshisada Nagasaka
National Agriculture and Food Research Organization, Japan

To reduce nutrient runoff from paddy field, we use RTKG GNSS auto steering system for puddled field water. Comparing with human operation, auto-steer has enough accuracy and it can reduce the nutrient runoff.

Labor-saving Management for the Resumption of Farming in Disaster Area: Using IoT Prototyping Kit

Dr. Yoshimichi Yamashita
National Agriculture and Food Research Organization, Japan

Seven years has passed since Fukushima Daiichi nuclear disaster. Farmers have started farming in coastal and mountainous area. In the disaster area, most of them cultivate wet rice or glow flower in greenhouse in large scale paddy fields. Now, they commute their crop field. In addition, some of the farmers are not ready to start farming their crop field now. Farming corporation has to farming whole crop field in local area. The crop fields are big and “distant” from each other. These days, rice farming corporation in other area of Japan worries same thing because they are expanding their crop field. Therefore, we developed a self-made remote monitoring system using IoT prototyping kit for rice farmers. In order to manage the water pool for raising rice seedings, it is cheap enough for farmers and sends a message to farmer’s smartphone in any interval or when the temperature of the green house rises high or low. It worked well during growing period in the real scale.

Knowledge sharing and integration with AI computers

Prof. Dr. Yoshikazu Nakajima
Tokyo Medical and Dental University, Japan

Artificial intelligence (AI) is spreading its application area rapidly this decade. It might be getting an infrastructure of knowledge sharing, processing and analysis. It almost accompanies with big-data condition thanking to storing-hardware improvement, internet data collection and internet-of-things (IoT) by data sharing sensors. Present trend of AIs started from with deep learning. Most the methods address to capture likelihood or frequently-appeared patterns of the collected data. Due to the incapacity of data connection autonomy in present AIs, some researchers predicted that deductive inference, which can connect knowledges one another, will be a next key of AI breakthrough. Automatic connection of knowledge flanges is desired and would show exceeding of present AI capacity.

We propose an autonomously networking method of weak AI computers, i.e. simple AIs. It presents a method of data and processor identification and the inference to combine AIs. A prototype system was implemented with 256 raspberry-pi computers. Some computers worked as data providers, some were data form converters, some were for linearly or non-linearly computation and the others were for deep-learning classification. All computers identified the roles of itself and the others. They chatted one another, connected autonomously, sent and received data, and processed. They performed various shapes of data processing adequately. Experimental results avoided combinatorial explosion and showed successful performance on medical data processing. It showed the feasibility towards deductive inference in datamatics.

Internet of Toys (IoT)

Asst. Prof. Dr. Keiko Yamamoto and Prof. Dr. Ichiroh Kanaya
Kyoto Institute of Technology and University of Nagasaki, Japan

Internet of things era has come. Everything is to be connected digitally. Key technologies of IoT are: low power and high-performance processors (e.g. ARM), long-life battery (e.g. LiPo), and low-energy network (e.g. Bluetooth Low Energy, LoRA, SIGFOX). From factory to society, Japan is a rapidly aging country, and factory-class efficiency is required everywhere. Taking care of children is exception. There have been wearable devices like smart phones, smart watches, etc. that can monitor accidents. However, kids don't like such wearable devices. We are media artists, so we design a system including toys that can monitor children's activity and connect it to the Internet. It's the Internet of Toys (IoT). Sensors inside the IoTs obtain children's activity data. And using deep learning, features extraction and classification are executed with the data. Based on the result of the deep learning, parents and nursery teachers can get the notification when the children face danger, check the unusual behavior and change of their children's emotion and so on. Additionally, people apart from the children can play with them thorough the Internet. 2011 March, the huge wave attacked to Miyagi prefecture in Japan. Many children who lost one of their parents or both of them. They lost their family, they also lost their memorable material. One of the serial problem is that they lost BOSHI-TECHO at that time. It means they lost their growth record. BOSHI-TECHO is a mother and child health handbook originated in Japan and Now BOSHI-TECHO has widely spread in some Asian and African countries. It contains the information for mothers, and the recording space for their children's physical and medical information. If the children lost their parents or BOSHI-TECHO, they couldn't know their own history of growth. In 2016, new version of BOSHI-TECHO for twelve years record is published in Japan. But these information are still recorded by hand writing by mothers or nursery teachers and it is physical handbook, so if other people (including children themselves) want to check it, they need to ask their parents. Now we are developing digital portfolio system like this. In the future, all of these dada are gathered automatically without any help of parents and nursery teachers, and the system can show each information against each people optimally, to solve problems surrounding children.

Each Topics

Smart Mobility

Dr. Pramual Suteecharuwat

Topic leader

(Presented by: Dr. I-soon Raungratanaamporn)

We can see the various kinds or approaches and efforts that applied to achieving smart mobility from all speakers in many levels (from air to ground) and many field (e.g., urban planning, air traffic communication, safety and smart driving). Many approaches, ideas, concepts and experiments had shown to audience for having some image towards smart mobility challenges. All of presenters trying to convey message to us like "If we would like to achieve a SMART mobility way; what kinds of ideas, things or applications that we need to do and develop to achieve to that goals?". Therefore, integrating concepts and ideas not only from engineers, but from other sectors like governments, end-users, people, communities should be involved as well.

Towards future mobilities issues such as society technology acceptance and readiness, smart mobility mindset creations, safety guaranteed in operation, new technology developments, communication signalling improvements, or integration approaches of analyses and experimental design through simulation, all above issues should be more discussed in order to step further to achieve in the Specific, Measurable, Achievable, Reliable, and Timely (SMART) ways in the future.

The atmosphere in this event is good and friendly. Tactical communication throughout the society seems important to convey technically message to society in simple ways. Flash presentation is quite excited for me because we are rarely to complete or pitching the audiences to interest to our work or research within one minute, which is challenging the presenters so much.

Towards the area of improvement for the next FOSTE, I think it should be good if.....

- The topic should be clearer and more structured: it should be revealing some linkage among each presenter in each session, because the major topic of discussion are broads and wide.
- Do live broadcast via Facebook to widespread to other viewers, which would stimulate another partner or someone who are interest in this even could join.
- Other participants from other field such as social science, could be invited to join in the next FOSTE symposium in order to share some ideas in accordance to the topic of presentation.

Climate Change & Mitigation

Dr. Sate Sampattagul

Topic leader

Life Cycle Assessment (LCA) implication & policy

1. LCA Supporting for National Policy and Implementation: Dr. Jitti Mungkalasiri
   - The 20-year national strategies (2017-2036) & The 12th national economic and social development plan (2017-2021) ⟶ promotions of sustainable consumption and production
   - For the consumption side ⟶ Green public procurement (GPP)
   - While the production side ⟶ Eco-efficient (EE) performance of state enterprise
2. Climate Change (CC) Policy Implications from Consequential LCA Applications: Gainers and Losers in a World with Constrained Materials: Asst. Prof. Dr. Trakarn Prapaspongsa
   - Application of consequential LCA could present risk of unfair LCA results, sub-optimization and unaccounted consequences which could support policy development and decision making towards sustainability
3. Nexus Assessment Approach for Integrated Policy Making on Food, Fuel and CC: Asst. Prof. Dr. Thapat Silalertruksa
   - The study applied the nexus approach to optimize the synergies and manage the trade-offs between resources (among land, water, energy and CC) of the supply chain
   - This integrated approach could help in support decision making of Land-Water-Energy management

Application of LCT towards....

Sustainable food system

1. Environmental Assessment of Rubber and Oil Palm Products: Climate Change Effects and Mitigation Options: Assoc. Prof. Dr. Charongpun Musikavong
   - CC effects on crop yield (CC causes fluctuated rainfall distribution, this affects rainfed farming in Thailand)
   - Several LCA implication on determining envi impacts of rubber and oil palm industry; water footprint, water scarcity, ecological footprint, GHG emission

2. CC and sustainability assessment of food system and consumption (Maize): Dr. Nongnuch Poolsawad
   - One was to promote sustainability in food production by assessing environmental sustainability in agriculture, focusing on maize production. The assessment was done based on SAFA framework (developed by FAO) ⟶ possible to identify stresses of maize production on various environmental themes (e.g. air/water/land/material)
   - Another was to promote sustainable consumption through food waste quantification application. ⟶ raising awareness and behavior change

<u>Sustainable Petroleum and Petrochemical industry</u>

1. Greenhouse Gas Emissions Reduction Potential in Petroleum and Petrochemical Sector: Dr. Viganda Varabuntoonvit
   - Petroleum and Petrochemical industry is one of the important industries in Thailand and in the world. It's considered as high GHG emissions industry not only from its energy intensive in production, but also the feedstock for the sector is mainly from fossil fuel.
   - Many researches show the potential of process improvement in energy efficiency, process improvement, renewable resources, etc.
   - The study aim to evaluate carbon intensity of the sector in Thailand, the projection of the expansion capacity, and apply the possible technology to find the potential of GHG emissions reduction in the sector with Life Cycle Perspective.

<u>Sustainable tourism</u>

1. Environmental Sustainable Tourism Logistics Activities Criteria as a Tool to Prevent Climate Change:Asst. Prof. Dr. Kullapa SoratanaKullapa
   - The study aimed to prevent negative effects of tourism logistics' activities on climate change by proposing the environmentally sustainable tourism criteria ⟶ initiative & expanding sustainability development to tourism industry (raising awareness)
   - The criteria were developed based on life-cycle framework by taking natural resources as inputs and goods, waste and emissions as outputs ⟶ requires database development
   - The criteria were developed for several tourism logistics, including tourist attractions, accommodations, restaurants, shop & souvenirs, transportation and tourists' activities
   - Climate change can potentially harm the major resource of tourism industry, tourist destinations

- LCA is the most suitable tool to quantify environmental impacts from upstream to downstream processes, however, it's a time cosuming process and requires a comprehensive inventory
- Tourism industry couldn't wait, thus the industry needs environmentally sustainable criteria to evaluate and guide their operations to avoid climate change

2. Assessment of Environmental Impacts and Cost in Phuket, a Tourist Island, using Integrated Techniques: Dr. Kritana Prueksakorn
   - It is well recognized that the rapid Phuket's economic development is due to tourism activities. Nonetheless, it is still doubtful how much it costs for the total direct and indirect expenses including environmental costs such as area lost from sea level rise caused by climate change.
   - The aim of this study is to assess the environmental impacts and costs of Phuket's tourism in a life-cycle perspective. In this phase of the investigation, critical environmental aspects including global warming, land-use change, water scarcity, and metals contamination will be assessed using integrated methods.

Smart Water Resource Management

Dr. Chaiwat Ekkawatpanit
Topic leader

Since 2011 severe floods in Thailand, National Hydroinformatics and Climate Data Center (NHC) was established to unify the hydro-meteorological observations and other data related to water monitoring, forecasting and management in order to provide an online data access and Decision Support System (DSS) for flood monitoring and forecasts. From IPCC AR5 Report, climate impacts on Asian countries are categorized into three issues: flood, heat, and drought. The water resources management in Thailand is currently managed by area-based consideration composed of irrigation, and rainfed areas. Conjunctive water management using Managed Aquifer Recharge (MAR) is use to increase drought resilience of groundwater through aquifer storage capacity and reduce the flood water in the downstream. Department of Water Resources was applied the rainfed classification results to implement the water distribution projects by using solar-powered irrigation systems in the high critical rainfed areas to provide environmentally sustainable. For the Royal Irrigation Department have several adaptation issues, for example, exposure reduction via structural and non-structural measures, or even effective land-use planning, were proposed in the IPCC Report.

There are research study the climate change impact on water resources using Global Climate Model (GCMs) and hydrological model for evaluate the risk of flood and drought in the future. For the satellite, the machine learning system (ML) use to estimate rainfall from Himawari 8 satellite data. The comparison between the rainfall estimation by empirical method and machine learning in which validation by GSMap rainfall have been done. Moreover the satellite products can download and used to assess agricultural drought. Apart from the satellite, there are other promising technologies such as data mining, data assimilation that are capable of driving water resource management towards sustainability. Smart technology not only makes our lives better, but also offers an opportunity to improve water resources management.

IoT & Big Data

Dr. Phond Phunchongharn

Topic leader

In the section of big data and IOT, we have 2 talks and 5 posters, in total 7 researcher from Thailand. One of the talk is about applying big data analytics in the preventive maintenance in the data center at CERN delivered by me. Another talk is delived by Dr. Ratchawadee about the LoraWAN (long range wide area network) and the opportunity of using LoraWan in the application of vehicle and farming. We have 5 posters as follows:

1. WELSE: IOT for health monitoring by Dr. Tasaneewan, especially, in the remote area. The people in those area have more chance to access to the medical facility. For example, to monitor kidney function through blood testing.
2. Understanding Thailand Export Data by Dr. Pucktada. It is about finding the relationship of import/export goods and the company by clustering technique and a deep learning technique is used for feature selection.
3. NoomMae by Dr. Pimwadee, is the application to collect the data about breastfeeding from Thai mothers, analyze and recommend the suitable places for breastfeeding.
4. Kid diary platform by Dr. Supiya is used for tracking the kid development,health, and vaccination for Thai kids.
5. Large-Scale Data Clustering by Using Biologically-Inspired Algorithm by Dr. Anan. This research propose a better clustering algorithm for big data by using the Hadoop ecosystem together with Artificial Bee Colony algorithm.

We can see that big data and IOT technology has been applied in many research field in Thailand, such as healthcare, economy, data center, vehicle, and farming. We also have some research for improving the algorithms for big data analytics. This would provide you the picture of Thai research in this area. We are looking forward finding some opportunities to collaborate with you in some ways.