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NECTEC
Annual Report 2019

National Electronics and Computer Technology Center

NECTEC Annual Report 2019

National Electronics and Computer Technology Center

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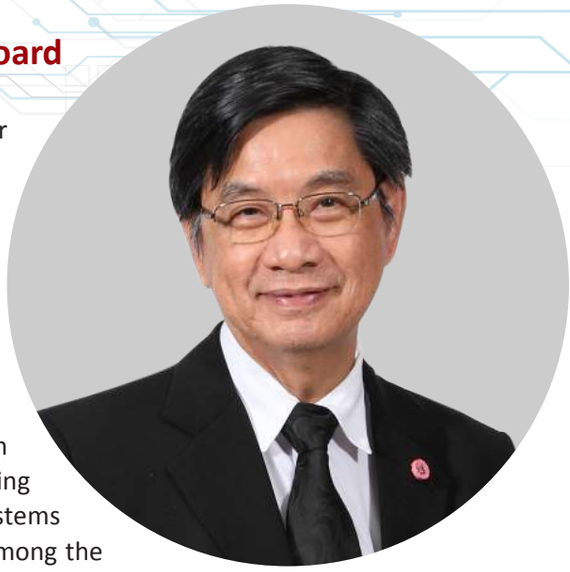
Content

Message from Chairman of the Executive Board



In 2019, the National Electronics and Computer Technology Center (NECTEC) celebrated the 33th anniversary and it entered the 28th year as a specialized center under the National Science and Technology Development Agency (NSTDA). 2019 is also the first year of the restructuring of the Ministry of Higher Education, Science, Research and Innovation and the reform of the new ministry that will be a model for further restructuring of other ministries in three areas including:

1. Administrative Reform: The reform focuses on fostering working flexibility and agility by lessening redundant working process in governmental systems and facilitating Talent Circulation and Mobility among the universities and research institutes.
2. Regulatory Reform: The focus will encourage the substantial adoption of the Regulatory Sandbox in Thailand.
3. Budgetary Reform: Budget will be allocated in the form of Block Grant and Multi-year Budgeting.

Organizations under the Ministry of Higher Education, Science, Research and Innovation, therefore, are required to jointly drive the Ministry to truly become "Ministry of Intelligence; Ministry of Opportunities; and Ministry of Future." As an organization under the new ministry, it's a challenging mission for NECTEC's executives, researchers and employees to deliver research outcomes that could be actually applied for real use and generate impacts to the country's economic and social development.

NECTEC, in 2019, achieved such a mission with the delivery of an essential technology foundation known as "AI for Thai", the artificial intelligence service platform that was developed to support AI research and development in Thailand. The platform showed NECTEC's significant step in integrating knowledge, expertise and artificial intelligence resources accumulated for over 20 years to provide as an open service for the local research community. The platform is hoped to be the country's vital advanced-technology infrastructure to stimulate further AI research and development while leveraging the capabilities of Thai researchers to achieve the national-standard levels.

Moreover, NECTEC has laid down a foundation for future research to drive Thai society and economy to grow sustainably and pace into the so-called knowledge-based and innovative economy country through the development of frontier research in the area of Quantum Computing & Engineering (QCE) and Terahertz (THz) technology.

In the meantime, NECTEC has taken a role in managing two national infrastructure service centers including NSTDA Supercomputer Center (ThaiSC) and the Center for Cyber-Physical Systems (CPS) which are under NECTEC's Computing and Cyber-Physical Resources Unit.

ThaiSC is a center to provide cutting-edge high-performance computing (HPC) infrastructure to support the development of science, technology and innovation to serve the country's large-scale problems. The Center for Cyber-Physical Systems (CPS) is the national knowledge center in CPS, which is equipped with experts, tools, and testbeds for innovation development with support of knowledge dissemination in CPS and IoT technology to the private sector. Its goal is to increase Thailand's competitiveness in the world stage and strengthen the country's CPS and IoT value chain.

In the fiscal year 2019, NECTEC showed a strong performance in creating collaboration to generate research outcomes that serve needs of the country especially in target industries. The outcomes, which have been conducted with an aim to achieve the most benefits to the country, cover beneficial works for current use and works which are speculated to be essential in the near future.

Under technology transfer mission, NECTEC signed 112 contracts of technology transfer with outside organizations, valued at Bt154 million. Of the total contracts, 96 are contract researches and joint-researches combined.

All research and development works reflected NECTEC's hard working towards creating benefits to the nation and the Thai people. I would like to thank and send good wishes to NECTEC's executives, researchers and employees as well as alliances from government agencies, private sector, non-profit organizations and universities. I also would like to invite you all to help create synergy in driving the National Electronics and Computer Technology Center (NECTEC) under the National Science and Technology Development Agency (NSTDA) to move forwards creating benefits to the nation.

(Taweesak Koanantakool)
Chairman of the Executive Committee
National Electronics and Computer Technology Center

Message from NECTEC's Executive Director

On October 1, 2019, my executive team and I completed the first-year term in managing the National Electronics and Computer Technology Center (NECTEC) under a vision "to establish an essential foundation for advanced electronics and information technology development in Thailand." The attempt is to drive the emergence of technology ecosystem to support Thailand 4.0 mission in line with the National 20-Year Strategy (2018-2037) and the National 20-Year Research and Innovation Strategy (2017-2036).

To push the emergence of technology foundation substantially, NECTEC has rearranged its five-year strategy (2017-2021) by focusing on technology development according to Target Output Profile (TOP). In the fiscal year 2019, NECTEC delivered an essential technology foundation to the country known as "AI for Thai", the Thai-owned artificial intelligence service platform that received well-responses from users both in the industrial and service sector.

NECTEC also supported the learning and teaching of computer programming in Thai schools to prepare Thai youths to pace into the 21st century. In 2019, NECTEC disseminated 200,000 own-developed embedded system boards known as KidBright to schools nationwide. KidBright community, which comprises of developers, educational personnel, private sector in smart electronics, and policy makers from the government sector, was established to build an ecosystem to powerfully drive the development of Thai education and Thai economy together.

I sincerely hope that this annual report for the fiscal year 2019 will be useful to government agencies, private sector, educational sector as well as those who are interested in research and development related to electronics and computer technology to use it as a reference and light up new ideas in bringing NECTEC's research and development results to create values to the country and for further collaboration.

Dr. Chai Wutiwiwatchai
Executive Director
National Electronics and Computer Technology Center

Executive Summary

The fiscal year 2019 is the first year that NECTEC's new-appointed management team took action following its assigned mission. The team set a vision "to establish an essential foundation for advanced electronics and information technology development in Thailand" by fostering the development of an advanced electronics and information technology ecosystem through the establishment of the national infrastructure, the formation of educational network alliances, and the creation of private and industrial sector partnership to support the country's Thailand 4.0 mission.

NECTEC determined Target Output Profile (TOP) as its key strategy to develop advanced technology and infrastructure in line with the National 20-Year Strategy (2018-2037) and the National 20-Year Research and Innovation Strategy (2017-2036). The center proceeded a paradigm shift in accordance with the restructuring of the Ministry of Higher Education, Science, Research and Innovation by using innovation for sustainable development under the "Thailand 4.0" mission and the National Science and Technology Development Agency (NSTDA)'s Strategy Plan 6.2 (Fiscal Year 2019-2023), which focus on enhancing Thailand's competency in technology development to be in the forefront; creating Thailand's core technology strengths; and being a good partner to help create knowledge-based society using science and technology.

In the fiscal year 2019, NECTEC achieved its goal in establishing an essential foundation for advanced electronics and information technology development in Thailand known as "AI for Thai." In September 2019, the center made an announcement and delivered the Thai-owned artificial intelligence (AI) service platform to the country. The platform was developed based on AI and machine learning technology to respond to the requirements of users both in the industrial and service sector.

NECTEC was allocated Bt1,450 million budgets in the fiscal year 2019, of which Bt972 million was actually spent (67 per cent of the budget allocated). The outstanding results are as follows:

Research, Development, Design and Engineering

- High Pressure Hydrothermal System with Remote Tracking: The system was developed to support commercial production of the growth process of large-size single crystal Zinc oxide (ZnO), which is an optical semiconductor for future development of white-light LED devices.
- Morphological Analyzer for Rice Traits: The software comes with a morphological phenotype measuring tool for rice traits. The Department of Rice expects to use the system to help the breeders make deeper rice evaluation to offer more precise results than manual observation and assessment.
- Partii - Thai Speech Recognition System: It's the Thai speech-to-text platform designed to support a variety of applications as needed.
- Thai MOOC - Central Learning and Teaching Management System for Open Education to Support Lifelong Learning: The Thailand Massive Open Online Course is an open online learning system that supports unlimited students. It's a source of knowledge, allowing learners to access information at all times regardless of time and spaces.
- Performance Testing System for Blockchain Application in Different Workloads and Number of Nodes: The adoption of blockchain technology in various applications requires a performance testing system to check the usage suitability to meet a determined purpose.
- Drainage Simulation System for Dams in consistent with the Adjustment of Draining Manual: The system helps predict water levels in reservoirs. Data is displayed hourly to enable the officials to plan for the drainage through the overflow drainage building.
- Battery Set and Charger: Morakot 10424 model 01: The battery set and charger were designed for munition purpose. It's a co-development between NECTEC and the National Metal and Materials Technology Center (MTEC).

- Traffy City Platform: The innovative platform was developed to support data-driven city management. Sensor and artificial intelligence technology are used to help transform problems in the city to be data; and then data to understanding, so problems will be solved efficiently. People are allowed to help the city to solve problems and leverage the city to offer better living and higher quality of life.
- JibJib CUI: The conversational user interface allows humans to communicate with the computer through natural conversation. The system was designed to be a virtual assistance that can interact and communicate with users naturally. It supports communication through typing, chat, and Thai voice commands.

Technology Transfer

NECTEC's Technology Transfer is operated by Partner Development and Technology Transfer (PDTT), Strategic Planning and Partner Development Division (SPD). In the fiscal year 2019, NECTEC signed 112 contracts for technology transfer with outside organizations valued at Bt154 million. Of the total contracts, 9 are licensing; 54 are contract researches; 7 are funding contracts; and 42 are joint-research contracts.

Infrastructure

Realizing the importance of basic science development in Thailand, Her Royal Highness Princess Maha Chakri Sirindhorn spent six times to visit the European Organization for Nuclear Research known as CERN, the world's leading science research institute. In the third visit, the princess signed a collaboration agreement in "Expression of Interest in the Participation of Physicists from Universities and Research Institutes from Thailand in the CMS Experiment at the CERN LHC Accelerator."

The agreement was signed under a collaboration between Synchrotron Light Research Institute (Public Organization) and CERN to allow physicists from Thailand to participate in particle physics experiments with the Compact Muon Solenoid Experiment (CMS) group to strengthen research in particle physics in Thailand. This collaboration involved in developing computational infrastructure with high data capacity and fast computation performance to accumulate and analyze a large amount of data from CERN experiments.

Currently, nine organizations including NECTEC are in the consortium and NSTDA takes responsibility as the Office of the Consortium.

Advanced Technology Research and Development

To prepare Thailand's readiness in advanced technology research and development, NECTEC put efforts in frontier technology research and development especially on Quantum and Terahertz technology. Its goal is to establish Quantum knowledge for the country's development; and to build up Terahertz platform, which is to use high-frequency electromagnetic waves for spectrum visualization and identification used for non-destructive testing in various sectors such as, food and security.

Moreover, NECTEC also takes a responsibility in managing the national advanced technology infrastructure centers including NSTDA Supercomputer Center (ThaiSC) and the Center for Cyber-Physical Systems (CPS).

NSTDA Supercomputer Center (ThaiSC) provides cutting-edge high-performance computing (HPC) infrastructure to facilitate the national R&D community to complete their large-scale computational science research, data analytics, and AI research with faster and more accurate results. The center focuses on significant outcomes to be the national high-performance computing service provider and Thailand's representative (National Focal Point) in HPC international stage.

The Center for Cyber-Physical Systems (CPS), meanwhile, is the national and regional leading knowledge center in CPS. The center is equipped with experts, tools, and testbeds for innovation development with support of consultation and knowledge dissemination in CPS and IoT technology to the private sector. Its goal is to increase Thailand's competitiveness in the world stage and strengthen the country's CPS and IoT value chain.

Organization Information

Vision

To establish an essential foundation
for advanced electronics and information technology
development in Thailand

Mission

To foster the development of an advanced electronics
and information technology ecosystem
through the establishment of the national infrastructure,
the formation of educational network alliances,
and the creation of industrial sector partnership
to support the country's Thailand 4.0 mission.

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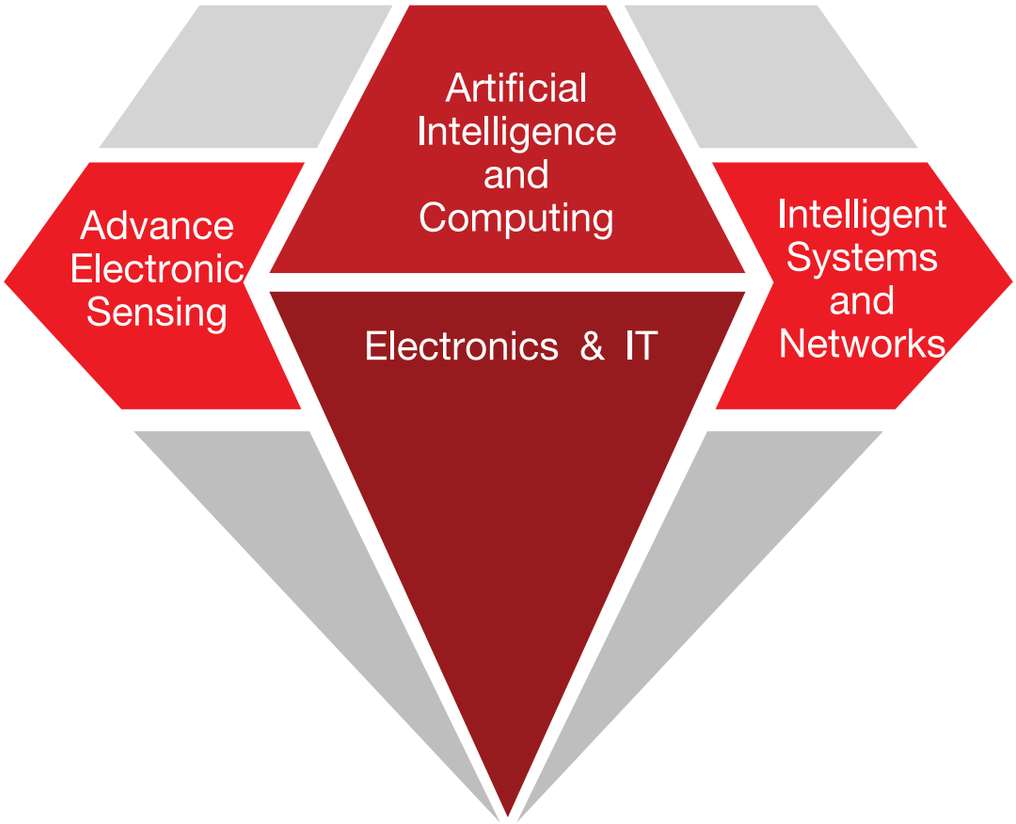
Competency

The center accommodates international-level
researchers in Intelligent Electronics and IT;
Advanced Electronic Sensing;
Artificial Intelligence and Computing;
and Intelligent Systems and Networks.



Research works at NECTEC are aimed at integrating three key technologies for the country's development to establish the country's advanced technology infrastructure as follows:

Advanced Electronic Sensing Research and Development

The research aims to strengthen the development of electronic sensors and related components within the country and boost up the country's expertise in the field to drive the emergence of advanced electronic sensor manufacturing industry for export.

Intelligent Systems and Networks Research and Development

The research focuses on developing advanced technology in intelligent systems and networks technology related to public utilities, agriculture, transportation, industry, and services. Its goal is to create knowledge, prototypes and innovations that benefit the economy and society while upgrading the industry to achieve Thailand 4.0 goal.

Artificial Intelligence and Computing Research and Development

The goal is to enhance Thailand's strengths and expertise in computational science and artificial intelligence and to foster the integration of big data within the country to help develop new innovation which is a foundation for the country's and the region's development.

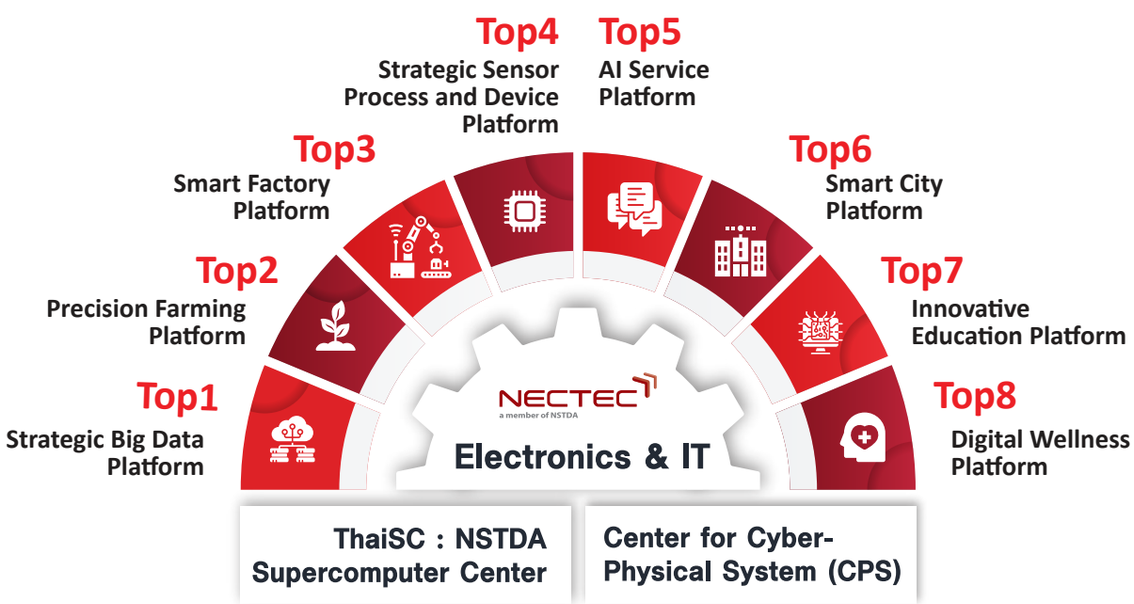
Operations

NECTEC announced the adoption of Target Output Profile (TOP) to achieve a significant target in developing advanced technology and infrastructure in line with the National 20-Year Strategy (2018-2037) and the National 20-Year Research and Innovation Strategy (2017-2036).

The center also proceeded a paradigm shift in accordance with the restructuring of the Ministry of Higher Education, Science, Research and Innovation by using innovation for sustainable development according to the "Thailand 4.0" mission and the National Science and Technology Development Agency (NSTDA)'s Strategy Plan 6.2 (Fiscal Year 2019-2023), which focus on enhancing Thailand's competency in technology development to be in the forefront; creating Thailand's core technology strengths; and being a good partner to help create knowledge-based society using science and technology.

Goals and Operations

NECTEC determined eight targeted results for research and development (8 TOPs) consisting of:



NECTEC Executives

1. Chai Wutiwiwatchai, Ph.D. Executive Director
2. Alisa Kongthon, Ph.D. Deputy Executive Director
3. Panita Pongpiboon, Ph.D. Deputy Executive Director
4. Kalaya Udomvitid, Ph.D. Deputy Executive Director

NECTEC Executive Board

Thaweesak Koanantakool
Chairman

Narong Sirilertworakul
Vice-Chairman

Committee

Sak Segkhoonthod

Manoo Ordeedolchest

Sommai Lakananuruk

Wanlop Surakampontorn

Danucha Pitchayanan

Surapol Opasatien

Sompong Preeprem

Suwit Wibulpoprasert

Wuthipong Suponthana

Chai Wutiwiwatchai
Committee and Secretary

Kalaya Udomvitid
Committee and Assistant Secretary

Personnel

NECTEC has 588 personnel in 2019.
Categorized by Education Level
and Job Title

Education Level

Ph.D.
134
22.79%

Master Degree
238
40.48%

Bachelor Degree
197
33.5%

Diploma
19
3.23%

Job Title

Senior Executive
4
0.68%

Executive
22
3.74%

Support Personnel
94
15.99%

R&D / Engineering
375
63.78%

R&D Support
75
12.76%

Knowledge Development & Transfer
6
1.02%

Business
12
2.04%

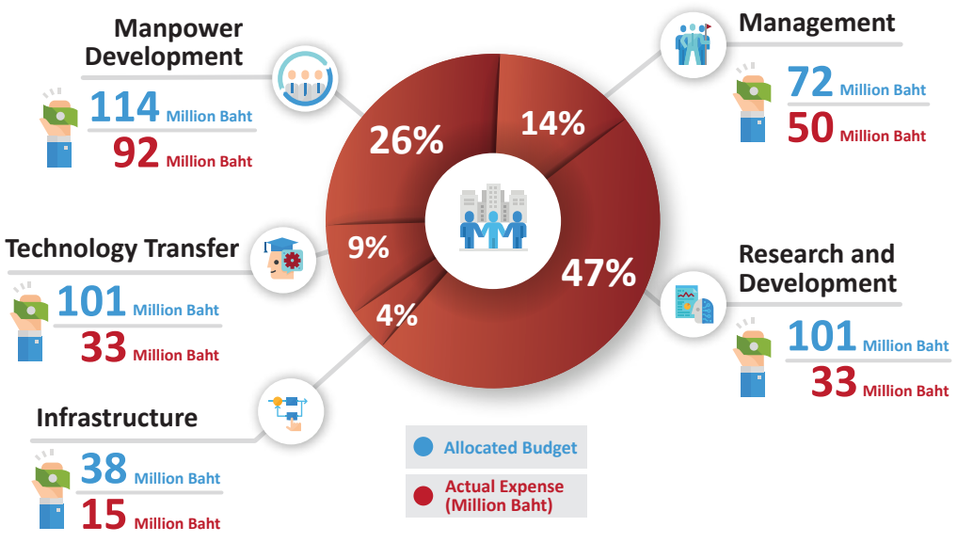
Budget

NECTEC was allocated Bt1,450 million budgets in the fiscal year 2019, of which Bt972 million was actually spent according to its missions (67 percent of the budget allocated). The operational expense worth at Bt361 million was divided into:

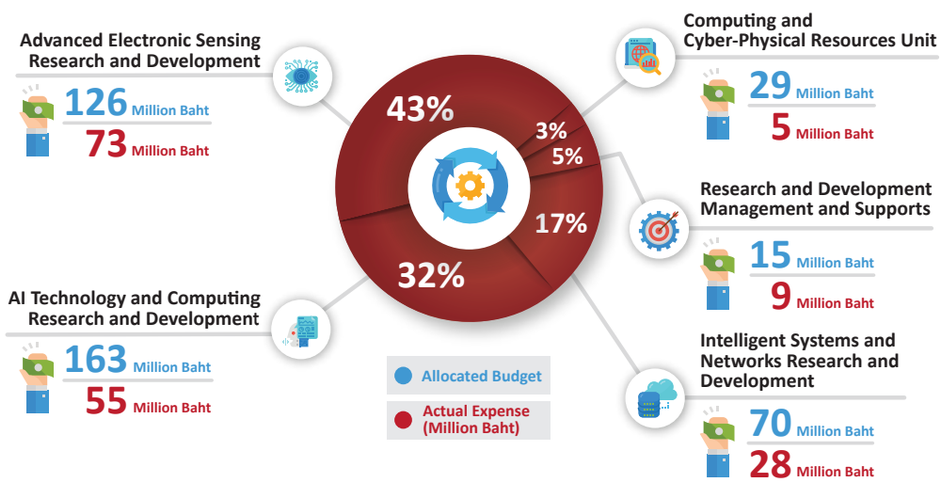
Research and Development: Bt170 million (47 percent) allocated to five areas as follows:

- Advanced Electronic Sensing Research and Development (43 percent)
- Artificial Intelligence and Computing Research and Development (32 percent)
- Intelligent Systems and Networks Research and Development (17 percent)
- Research and Development Management and Supports (5 percent)
- Computing and Cyber-Physical Resources Unit (3 percent)

Actual Expenses according to the mission



Research and Development Expesnse

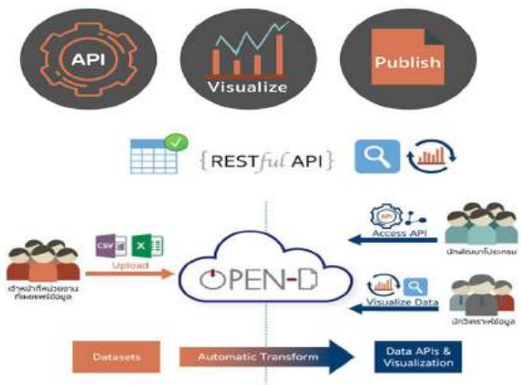


Performance in 2019

TOP1 Strategic Big Data Platform

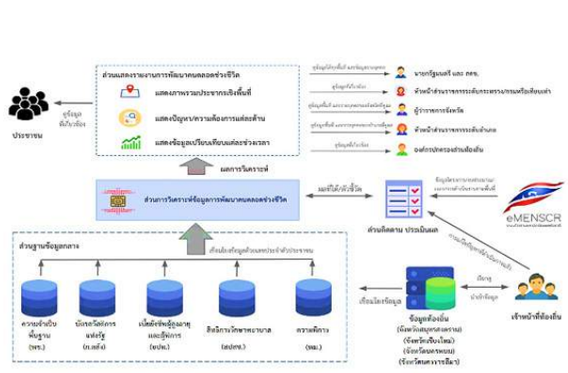
The platform helps analyze the country's strategic data by linking essential population database with the national strategic projects for further innovation development.

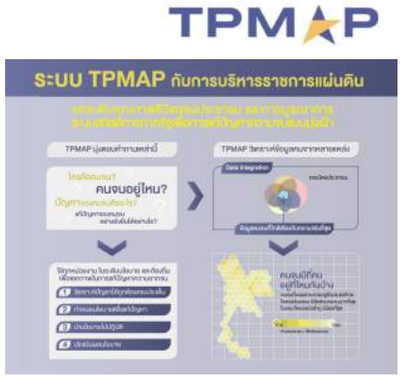
- **Open Data Services: Data.go.th 2.0**
  Programmers can access to more than 30 percent of the total Data-API-based data sets.



- **Electronic Monitoring and Evaluation System of National Strategy and Country Reform (eMENSCR)**
  - Data-driven platform for government project planning.
  - Access to "emenscr.nesdb.go.th" has opened for division-level government agencies nationwide since April 2019.
  - Support of 20,601 projects from the government's 340 departments and 2,301 divisions.
  - More than 200 persons in the National Strategy Committee and the National Reform Committee can monitor the operations through the system.

- **Thai People Map and Analytics Platform (TPMAP)**
  - 5-level drill-down area analysis
  - Population database > 50 million people
  - Linking with government welfare databases from the Ministry of Social Development and Human Security; the National Health Security Office (NHSO); and the Ministry of Agricultural and Cooperatives.





TOP2 Precision Farming Platform

Integrated with AI technology, the platform can be implemented in agricultural areas with investment cost affordable by small-size farmers.

Agri-Map Phase 4

Agricultural data has been integrated to enhance the efficiency of agricultural land use with an update of the latest information to create new layers of data to support big data and agricultural map print-out.

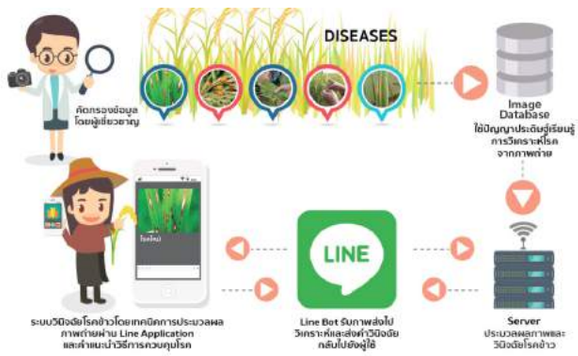
WiMaRC

Wireless Sensor Network for Management and Remote Control (WiMaRC) was developed to manage crop requirements based on sensor and IOT technology

Land Use Decision on Support

The system supports decision making on suitable crop selection with an update of nationwide soil data sets from the Land Development Department.

Rice Disease LineBot



The mobile application was developed for the diagnosis of rice diseases by using image analysis and artificial intelligence to distinguish blast disease and dry leaf disease.

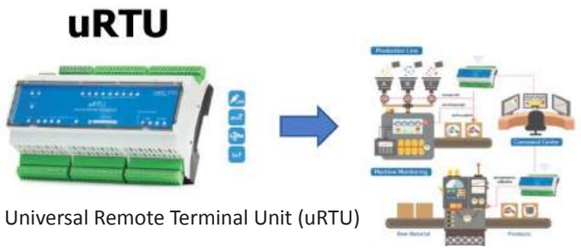
Morphological Analyzer for Rice Traits

It's the rice morphology measurement system using three-dimensional technology.

TOP3 Smart Factory Platform

The intelligent industrial platform consists of separate embedded devices used to detect or measure various parameters in industrial plants with data linkage to the center for factory management.

Edge Computing for IIOT Platform uRTU



Universal Remote Terminal Unit (uRTU)

Designed for use with varied any types of signal detectors. It can increase or decrease the amount of input and output, both analog and digital signals, by adding or reducing the maximum extension modules (maximum to 5 modules depending on the type of the signals from the signal detection equipments).

uRTU can be applied to many applications such as Surveillance system, Data reading system for equipment controlling in the factory and the parameter reading system for data processing and management that benefits to Industry 4.0.

RTLS-UWB2 uNAI

The platform was designed to track indoor positioning in real time through ultra-wideband signals and wireless sensor networks that use an electronic plate for efficient location tracking.

Generator Inspection Vehicle (GIV) Generation 2 (20- millimeter Thickness)

Image processing algorithm was integrated to specify precise location. The robot has been used for nationwide power plant maintenance at the Electricity Generating Authority of Thailand.

TOP4 Strategic Sensor Process and Device Platform

It's to develop high-quality specialized sensor technology that can compete at the international level.

- **Si Microphone**
  The contour cavity condenser silicon microphone enables changes in electrical capacitance with higher sensitivity. It also comes with water resistance in lower price.

- **SERS Chip**

The Surface-Enhanced Raman Spectroscopy (SERS) chip was developed for use in various chemical and biochemical diagnostics applications in security, forensic science and pharmaceutical purpose.

- **Laser Marking SERS**
  The low-cost SERS chip uses a laser making machine to detect Raman signals with quality similar to silver metal nanostructured SERS chip.

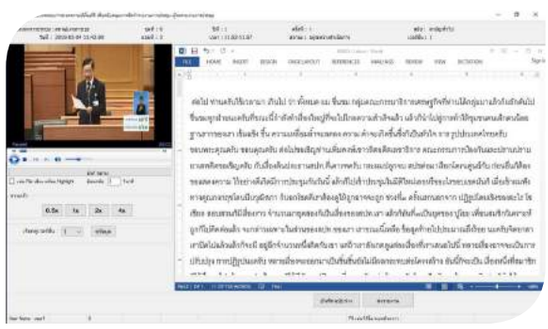
- **Film Coating Machine for SERS Chip**
  The nanostructured thin film coating machine uses sputtering process to offer continuous, fast, and safe operation with easy maintenance.

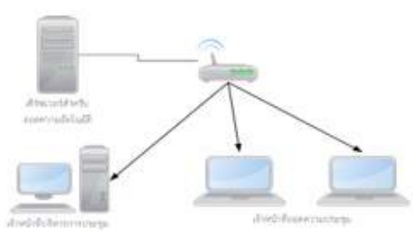
TOP5 AI Service Platform

AI Service platform was developed to support text, voice, and image processing.

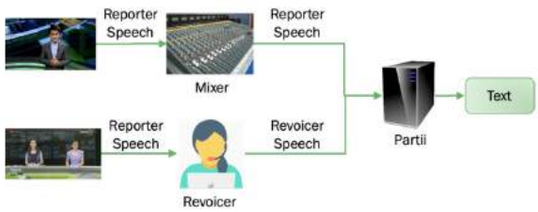
- **Partii 1.5 (on Cloud)**
  It's the Thai speech-to-text platform designed to support a variety of applications as needed such as talking with a smartphone and transcribing the speech to text in other applications.

  Partii on Cloud : Transcription testing for general meeting showed 70 percent accuracy using Docker technology.





Partii 2.0



Thai Speech Recognition System for Meeting . Transcription testing for news and DSI investigation meeting showed 80 percent accuracy using Deep Neural Network technology.

Conversational User Interface – CUI

The technology enables humans to communicate with the computer through natural conversation. It's a virtual assistant platform, allowing the computer to provide services including information request, answering, service reservation, or general chats to users naturally through typing, chat, and Thai voice commands. All the process can be done on the Cloud.

Version 1 Interacts with users through text and voice.

TOP6 Smart City Platform

The platform accumulates, processes, and analyzes data to enhance city management for better living and quality of life.

Phuket Smart City Management

The enabled innovative data-driven approaches to digitize and transform city management technology

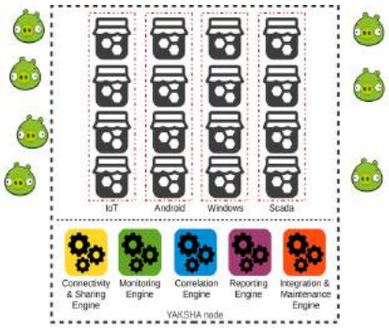
Smart Environment

- TanRaBad: Software Suite for Infectious Disease Surveillance and Control
- TanPibut: Software Suite for Natural Event Monitoring and Surveillance
- Traffy Waste: Intelligent Garbage Monitoring and Management System
- Traffy Fondue: Municipality Complaints Reporting and Management Platforms
- RakNam: A Prediction and Scenario-based System for Saltwater Intrusion

Smart Mobility

- Traffy Transit: Bus arrival time estimation system
- License Plate Recognition System and identify vehicle identity from CCTV images
- Tracking and positioning system from three-dimensional maps in confined areas

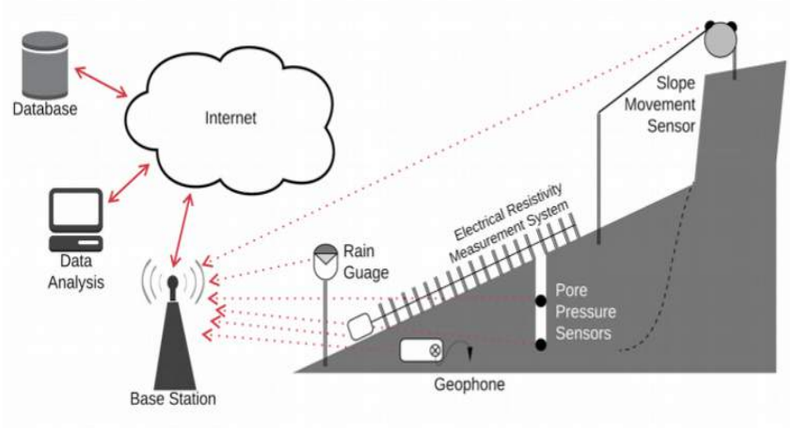
YAKSHA



The advanced application is used to create knowledge and awareness on cyber security.

Landslide Real-Time Monitoring

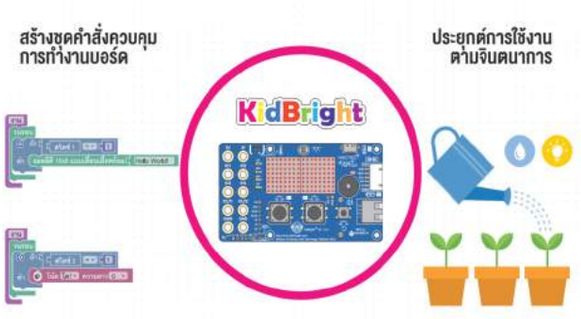
The real-time surveillance system using wireless sensor network was developed for use in landslide risk areas.



TOP7 Innovative Education Platform

It's to develop electronic devices and information system to support lifelong learning.

- **KidBright**



The embedded system board allows learners to easily create instruction sets through the KidBright IDE program on the computer. The generated instruction set will be sent to the KidBright board to perform the task as specified by the program, such as watering the plants to the specified humidity level or turning on-off the lights according to the time specified.

- **MuEye RoboKid**

A small-size microscope was developed to display images through a computer screen. The instrument can adjust the focal distance or move the position of the specimen by commanding through the KidBright board, facilitating learners to use the microscope with more convenience and fun.

- **Thai MOOC**

The Thailand Massive Open Online Course is an open online learning system that supports unlimited students for lifelong learning.

- **ThaiJO : Thai Journals online**

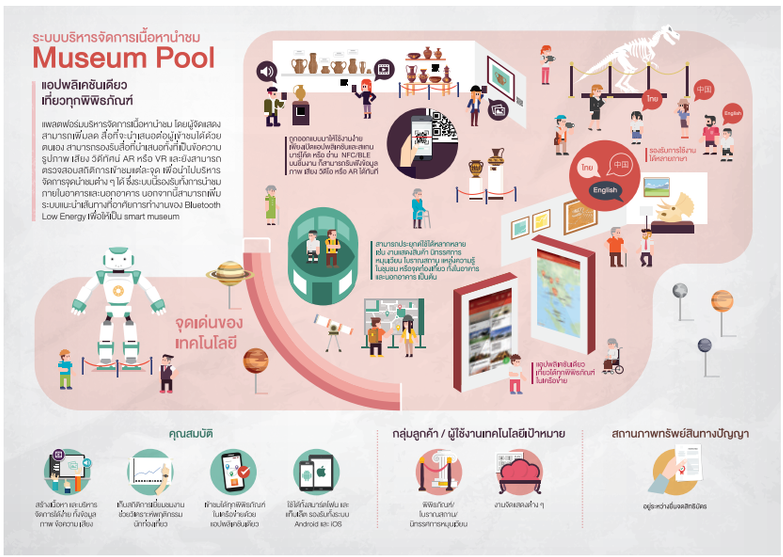
ThaiJo aims to be the standard for the management and collection of academic knowledge from Thai researchers. The Database consists of statistical interest and specialties that will be used to support an analytic and a recommendation for experts and plagarism reviews.

- **Navanurak**

Navanurak is an e-culture open data platform that stores, manages, exchanges, and disseminates cultural data and knowledge in digital form for the preservation of cultural information.

Museum Pool

Museum Pool is the museum content management system and a learning platform that allows people to access to historical or scientific information of the museum through mobile devices.



KidBright Virtual Prototype

The program allows developers to create the prototype on a virtual KidBright software that simulates the working process of electronic devices when connected to the board to see the results virtually.

TOP8 Digital Wellness Platform

The platform was designed to collect physical and behavioral data for health tracking and analysis to provide health recommendations to people. The data is vital to help the country determine the direction of national health and wellness policy development. The pilot project is expected to start tracking child health information.

KidDiary: Recording and Screening Program for Early Childhood Development

The development of KidDiary V.2 supports nutrition assessment as well as oral and dental health care. The program also links the health tracking system between the schools and the hospitals (KidDiary School + Hospital).

Thai School Lunch

The system was designed to make automatic lunch recommendations for Thai schools.

- **KidARN: Hearing Screening System for Early Childhood**
  The system allows the screening process to be done quickly and precisely by asking the children to identify pictures corresponding to the spoken Thai language they heard.

Frontier Research

- **Terahertz Technology**
  - Row-type Terahertz Receiver
  - Terahertz Application Platform for Food and Agriculture
  - Research and development on the Smith-Purcell Terahertz Signal Generator for Image Generation

- **Quantum Computing & Engineering Technology**
  - **Quantum Random Number Generator (QRNG)**
    Quantum Random System or RandomQ is true and unpredictable random system using QRNG. It is the core of encryption, award announcing and event simulation for randomly award annoucement. The prototype can connect with the Internet and link with IBM's Quantum Computer.

Two National Infrastructure Service Centers

- **NSTDA Supercomputer Center (ThaiSC)**
  ThaiSC provides cutting-edge high-performance computing (HPC) infrastructure to facilitate the national R&D community to complete their large-scale computational science research, data analytics, and AI research with faster and more accurate results. The center focuses on significant outcomes to be the national high-performance computing service provider and Thailand's representative in HPC international stage including in ASEAN and EU.

  Computational Platform for Research, Science, Technology and Innovation
  - High performance computational infrastructure for large-scale national research
  - Resources integration for complex multi-dimensional problem solving
  - Enhancement of Thailand's competitiveness among competitors

- **Center for Cyber-Physical Systems (CPS)**
  CPS is the national and regional leading knowledge center . The center is equipped with experts, tools, and testbeds for innovation development with support of consultation and knowledge dissemination in CPS and IoT technology to the private sector. Its goal is to rise up Thailand's competitiveness in the world stage and strengthen the country's CPS and IoT value chain.

  In the fiscal year 2019, the development of prospected products and research prototypes emphasized on the processing of diverse data to create value and to help the country in problem solving, enhancing the development of new innovation within the entire ecosystem.

High Pressure Hydrothermal System with Remote Tracking

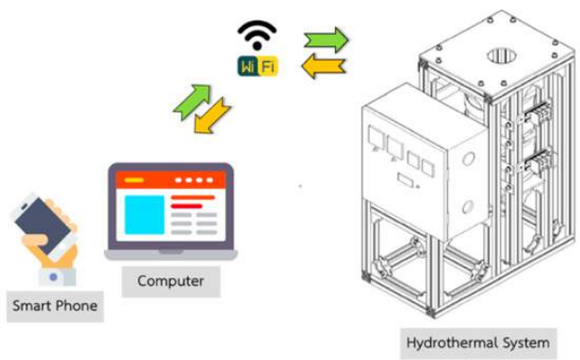
The system was developed to support commercial production for the growth process of large-size single crystal Zinc oxide (ZnO), which is an optical semiconductor for future development of white-light LED devices. The single crystal obtained from the process will have a complete crystal quality and purity with the largest size when compared to other crystal growing systems.

Highlights

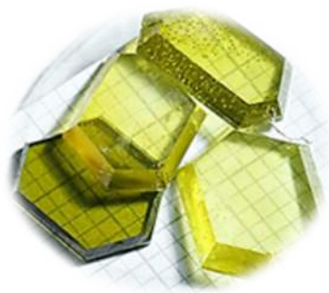
- Crystals can be grown simultaneously with support of mass production.
- The machine's operating status can be shown. A bundled program can monitor the conditions of crystal growth in real-time via the internet.
- Require low utilities expenses but obtain high-quality crystal for commercial.
- Equipped with a high-level security system, data is automatically stored on the cloud with encryption to prevent data leakage.

IP Status: In drafting process on design patent (1 title)

Users: Max Lumen Co., Ltd.: The company was approved by the Board of Investment (BOI) for production expansion worth at Bt14,900 million and it has purchased land to build a new production plant.



Working process of Hydrothermal System



Large-size Single Crystal ZnO

Morphological Analyzer for Rice Traits

The software comes with a morphological phenotype measuring tool for rice traits. The Department of Rice expects to use the system to help the breeders make deeper rice evaluation to offer more precise results than manual observation and assessment.

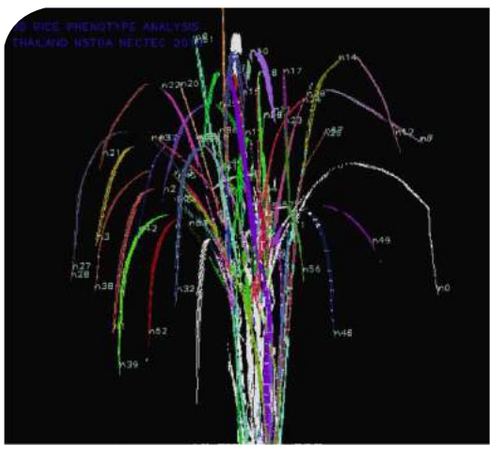
Highlights

- Results are received more precisely than manual observation and assessment with 85 percent accuracy.
- The system is more efficient than the previous manual measurement, offering time reduction for the launch of new rice varieties.

IP Status: 3 Invention Patents

Users: Pathum Thani Rice Research Center, The Department of Rice

Rice Clump Shape Measurement



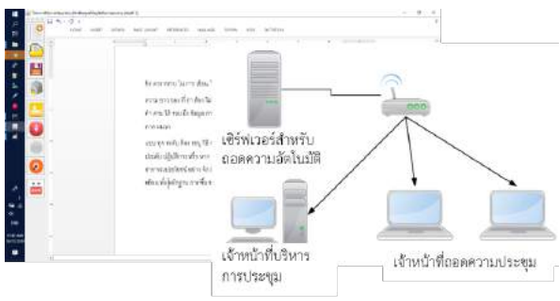
Classification of Rice Plant Composition by Colors

Partii - Thai Speech Recognition System

It's the Thai speech-to-text platform designed to support a variety of applications as needed such as talking with a smartphone and transcribing the speech to text in other applications.

Highlights

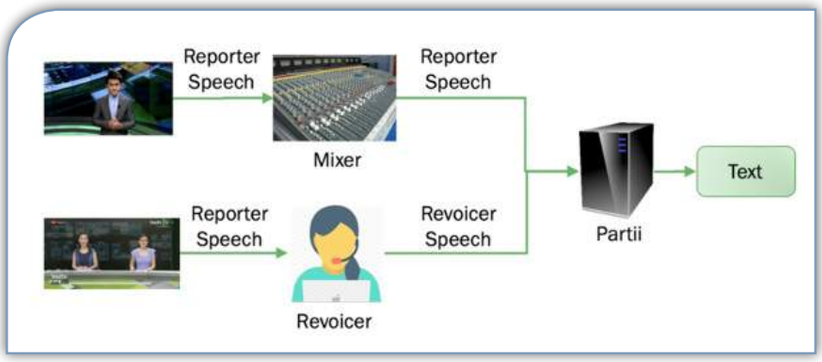
- Recognizing speech regardless of speakers or contents
- Covering no less than 140,000 common words
- 80 per cent accuracy
- Speed response at 1.5 times of the length of audio input
- Specifying the number of transcription processing units for each machine
- Support for continuous audio and WebAPI



Transcription for DSI Investigation Meeting

IP Status: 1 Patent Submission

Users: King Mongkut's University of Technology North Bangkok licensed the technology to help the transcription for the Department of Special Investigation (DSI)'s investigation meeting. The technology is being presented for use in the government agencies and private companies such as Thairath TV, Backyard and Onion Shack.



Testing Method for Live News Program

Thai MOOC - Central Teaching and Learning Management System for Open Education to Support Lifelong Learning:

The Thailand Massive Open Online Course is an open online learning system that supports unlimited students. It's a source of knowledge, allowing learners to access information at all times regardless of time and spaces. The platform supports both Thai and English language and links with Open Educational Resources (OER).

Highlights

- Thai MOOC prototype has been used to support online learning system for various courses.
- Learners are required to make identification through the Civil Registration System of the Department of Provincial Administration.
- The prototype supports 2,000 concurrent users with scaling-up ability as required.
- Support of system Implementation across data centers.

Users: The Office of the Higher Education Commission

OER Screen and Statistics Screen

Identification using ID card Information

Performance Testing System for Blockchain Application in Different Workloads and Number of Nodes

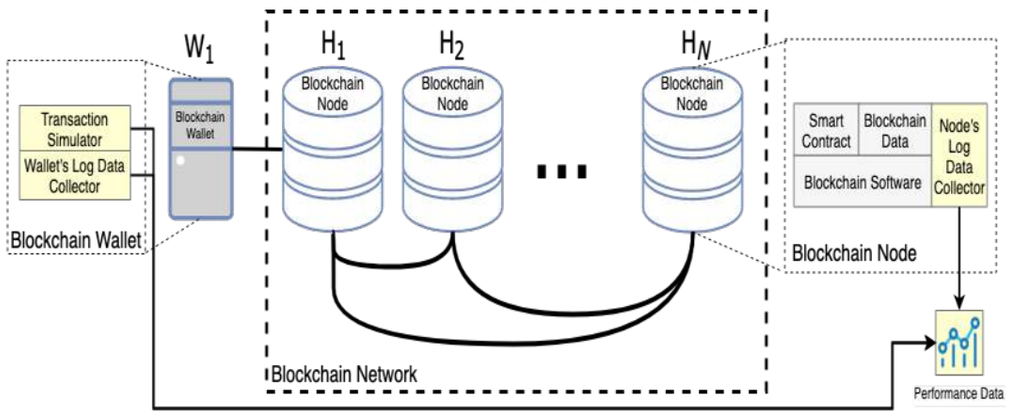
The adoption of blockchain technology in various applications requires a performance testing system to check the usage suitability to meet a determined purpose. The prototype was developed to test the performance of blockchain applications in order to understand its capabilities and limitations of transaction processing for further analyzing the usage suitability.
The system measures the efficiency of the completion rate of request processing; request processing time; processing delay; processing rate; the number of nodes needed for transaction processing; and the system's ability to return in process when errors occur. The performance measurement is beneficial for system administrators to understand the system's performance and its limitations so they can make better system management to serve user's expectations appropriately.

Highlights

- The system is flexible and can be applied to measure the blockchain efficiency to obtain diverse indicators. It can be used with more than one blockchain platform.
- In case of normal situations, the testing system can measure transaction processing times during both low-volume and high-volume transaction periods.
- The system can provide blockchain performance data although some nodes are off.

IP Status: 1 Patent Submission

Users: Stock Exchange of Thailand



Elements of Blockchain Performance Testing System

Drainage Simulation System for Dams in consistent with the Adjustment of Draining Manual

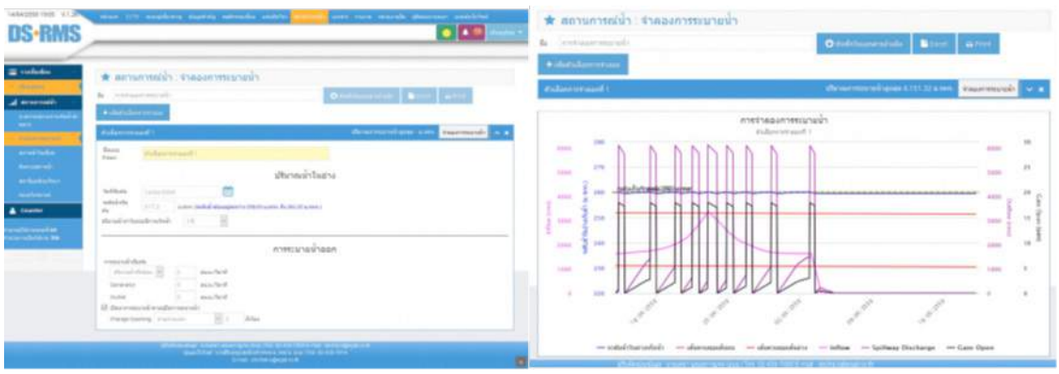
The system helps predict water levels in reservoirs. Data is displayed hourly to allow the officials to plan for the drainage through the overflow drainage building, preventing the over-high-level water that may affect the dam's safety and structure. The system helps the officials make better drainage plans for each period with no effects on the community's safety while delivering sufficient water for use in the community.

Highlights

- The drainage simulation system can be used for three types of dams including concrete dams, embankment dams, and earth-fill dams.
- The system was designed for web application and facilitates the change of drainage rules.
- The official can easily change the drainage rules and simulate the drainage situation according to the rules to test and adjust the drainage plan that suits the water situations.

IP Status: 3 Invention Patents

Users: Electricity Generating Authority of Thailand (EGAT)



Drainage Simulation System

Battery Set and Charger: Morakot 10424 model 01

The battery set and charger were designed for munition purposes. It's a co-development between NECTEC and the National Metal and Materials Technology Center (MTEC). NECTEC's Terahertz researcher team developed battery management system (BMS) by making its own design of both the master board and the digital-circuit slave board.

Highlights

- The 2.16-kWh (24V 90Ah) battery set was designed in size and capacities to meet user's needs.
- The charger comes with both normal charge and rapid charge mode as well as a mode to help maintain the battery performance to have longer life time
- By using local components, the cost of the new-developed battery and charger set is only at Bt400,000; much lower cost than the set of battery purchased previously by the army which is between at Bt700,000 to Bt1.5 million. The maintenance can also be done locally.
- The battery and charger set passed electrical and mechanical tests from the Electrical and Electronic Products Testing Center (Thailand) (PTEC) and the Electrical and Electronics Institute (EEI).

Users: The prototype was delivered to Artillery Battalion Center, Phahonyothin Camp, Lop Buri Province for use in the artillery maintenance under the military's mission and in real use in the field. The technology has been transferred to the industrial sector for further production.

Traffy City Platform

The innovative platform was developed to support data-driven city management. Sensor and artificial intelligence technology are used to help transform problems in the city to be data; and then data to understanding, so problems will be solved efficiently. People can involve in solving problems and leveraging the city to have better living and higher quality of life, allowing the officials to manage problems conveniently and quickly with better results. The city's executives can access essential information and related statistics for precise planning and better decision making.

Highlights

The technology helps enhance smart city management, enabling problems in the city to be addressed to the city's executives and the officials for problem solving efficiently. The technology supports the involvement of several parties for city development with simplicity and easy accessibility, resolving the "Pain" of the city's residents, the officials and the executives effectively.

JibJib Conversational User Interface (CUI)

The technology enables humans to communicate with the computer through natural conversation. It's a virtual assistant platform, allowing the computer to provide services including information request, answering, service reservation, or general chats to users naturally through typing, chat, and Thai voice commands. All the process can be done on the Cloud.

Highlights

- CUI-based technology with Thai language support
- Understanding of Thai context
- New knowledge can be added.
- Connecting with other services through web services

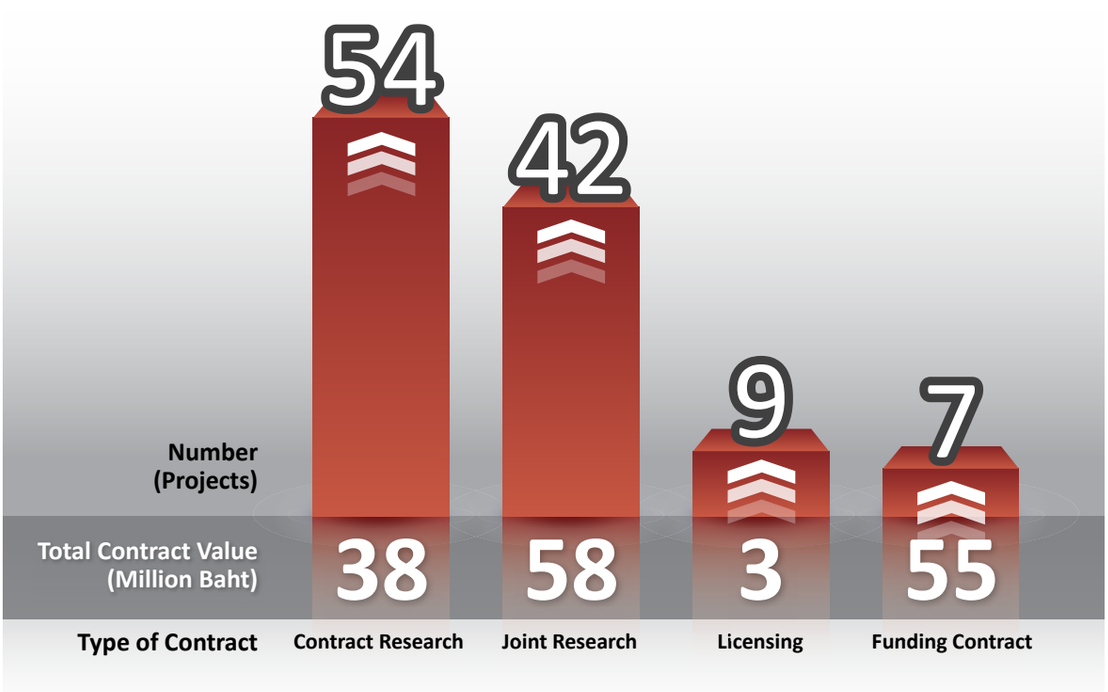
IP Status: 1 Patent, 1 Copyright, and 1 Patent Submission

Technology Transfer Portfolio

NECTEC's Technology Transfer is operated by Partner Development and Technology Transfer (PDTT), Strategic Planning and Partner Development Division (SPD). The technology transfer comprises of five models.

- **Licensing:** NECTEC authorizes companies by issuing a license to temporarily access its intellectual property rights and the prototype for further product commercialization.
- **Contract Research:** Requested by the government or private sector, the research will be conducted for a specified research project using NECTEC's technology and expertise to help strengthen the industry.
- **Joint Research:** It's a co-research and development project to help business and the industry to leverage their potential on technology development.
- **Consulting:** NECTEC's researchers and experts provide consultancy services on technology and product development and the manufacturing process to help outside organizations resolve their business limitations.
- **Technical Workshop:** NECTEC offers specific technical knowledge relevant to NECTEC's research and expertise through workshops instructed by experts in specific fields. The workshops help increase the competency of the participants, allowing them to utilize the knowledge for use in real situation.

In the fiscal year 2019, NECTEC created cooperation with outside organizations totally 112 contracts, valued at Bt154 million.



Remarks:

1. Consultancy service and technical workshops have been included in the budget of the contracts mentioned above.
2. The total contract value included both in-cash and in-kind.

International Collaboration Portfolio

Bilateral Collaborations

1. Japan

National Institute of Information and Communications Technology (NICT)

Since 2005, National Electronics and Computer Technology Center (NECTEC) has established a close collaboration with National Institute of Information and Communications Technology (NICT). In 2019, NECTEC and NICT signed 2 major agreements to strengthen closer R&D relationship, namely:

1. Second Amendment Agreement of Memorandum of Agreement for Collaboration in the Field of Electronics, Computer, Telecommunications and Information Technologies Research between NECTEC and NICT, Japan on April 1, 2019.
2. First Amendment to Collaboration Research Agreement on Silicon Optoelectronics between NECTEC (TMEC) and NICT, Japan on November 8, 2018.

In addition, both organizations focused on R&D in the topics of Cyber Security, Visual/Sensor IoT, Embedded and Automation, Wireless Networks, etc.

To enhance further R&D activities in the ASEAN region, NECTEC and NICT played a crucial role to push forward an initiative of collaboration through ICT Virtual Organization of ASEAN Institutes and NICT (ASEAN IVO) and Sub-Committee of Microelectronics and Information Technology (SCMIT).

The University of Electro-Communications (UEC)

On December 8, 2018, Prof. Dr. Pairash Thajchayapong, NECTEC Founder and the first executive director was invited as a guest of honor to attend the centennial anniversary of The University of Electro-Communications in Shinjuku, Tokyo, Japan. Both sides have established a long personal relationship dating back to early days of NECTEC. NECTEC signed Specific Agreement on Student Internship Program with UEC to supervise UEC graduate students since 2011. In 2019, the internship studies further extended to National Nanotechnology Center (NANOTEC) and National Center for Genetic Engineering and Biotechnology (BIOTEC) under National Science and Technology Development Agency (NSTDA) as well, the total number of dispatched students has reached 36 students.

NECTEC also have strong collaborations with several higher learning institutes in Japan such as Japan Advanced Institute of Science and Technology (JAIST) and Toyohashi University of Technology. In 2019, the First Amendment to Memorandum of Understanding of Research and Educational Collaboration with Toyohashi University of Technology was signed in August 18, 2019.

2. China

Chinese Academy of Sciences (CAS)

Chinese Academy of Sciences (CAS) is a major R&D partner of NECTEC with collaboration in several fields, namely:

- Collaboration on Chinese–Thai/Thai–Chinese Machine Translation System by Language and Semantic Technology Laboratory (LST) with Institute of Computing Technology (ICT)
- Collaboration on localization system by Location and Automatic Identification System Research Laboratory (LAI) with Shanghai Advanced Research Institute (SARI)
- Collaboration on agricultural technology by Knowledge Elicitation and Archiving Laboratory (KEA) with Institute of Remote Sensing and Digital Earth (RADI)

In 2019, NECTEC secured funding from the 22nd Session of the Sino-Thai Joint Committee on Scientific and Technical Cooperation by the Ministry of Foreign Affairs, as well as from the Ministry of Science and Technology for the joint cooperative projects on Science, Technology and Innovation with China. Thanks to these contributions, an official visit by NECTEC Executive Director and researchers to CAS institutions and the Royal Thai Embassy in Beijing was initiated during May 26-29, 2019 to monitor and report on R&D progress between NECTEC and CAS institutions as well as to exchange knowledge.

3. Singapore

NECTEC joined a consortium of 23 institutions and signed Memorandum of Understanding for Universal Speech Translation Advanced Research (U-STAR) Consortium on June 2, 2019 with National University of Singapore (NUS) as lead coordinator to extend the previous MOU valid from 2013 to 2016. The new MOU would be extended until 2024.

4. Taiwan

National Applied Research Laboratories (NARLabs)

NECTEC organized a joint workshop between NSTDA and National Applied Research Laboratories (NARLabs) on March 27, 2019 at Thailand Science Park to explore and establish R&D collaboration between both organizations. The joint workshop was held according to the Memorandum of Understanding between NSTDA and NARLabs signed on December 1, 2018. NECTEC researchers sought to collaborate with NARLabs in the areas of High Performance Computing (HPC), Remote Sensing Data in Agriculture Application, CMOS and MEMS, Photonics Technology and Opto-Electrochemical Sensing, Smart Factory and Smart City. Previously, NECTEC and NARLabs had mutual interest in HPC with National Center for High-performance Computing (NCHC) of Taiwan.

5. South Korea

In July 2019, NECTEC Deputy Executive Director and researchers launched a new collaboration with the Republic of Korea in the fields of Open Data, Smart City and Smart Factory. The objectives of the visit were to seek Korean partners for joint research proposal for funding as well as to enhance R&D collaboration, expert exchange and signing MOU with leading R&D institutes. NECTEC team visited various R&D institutes and universities in South Korea such as Korea Local Information Research and Development Institute (KLID), National Information Society Agency (NIA), Smart Manufacturing Innovation Center (SMIC), Ministry of Interior and Safety (MOIS), Electronics and Telecommunications Research Institute (ETRI), Korea Advanced Institute of Science and Technology (KAIST) and Ulsan Institute of Science and Technology (UNIST).

Following this visit, Korean experts from KLID, NIA and SMC were invited to speak at NECTEC-ACE 2019 on September 9, 2019 to share their experiences of South Korea. The first Memorandum of Understanding with Korea Local Information Research and Development Institute was signed on this occasion for the collaboration in local informatization and e-Government.

6. Germany

Forschungszentrum Jülich

NECTEC participated in the NSTDA-Jülich Annual Workshop during July 18-19, 2019 at Thailand Science Park to explore further R&D activities of mutual interest between both organizations. The joint workshop followed the signing ceremony of Framework Cooperation Agreement between NSTDA and Jülich concerning an Establishment of Joint Laboratory on Bioeconomy. NECTEC researchers sought to collaborate with Jülich in the areas of phenotyping platform and automation development. In addition, both sides agreed to jointly develop proposals for funding from the Federal Ministry of Education and Research of Germany (BMBF) and Helmholtz Association of German Research Centres.

Multilateral Collaborations

1. ASEAN Sub-Committee on Microelectronics and Information Technology (SCMIT) under ASEAN Committee on Science, Technology and Innovation (COSTI)

Dr. Chai Wutiwiwatchai, NECTEC Executive Director, took over the position of Chairman of the ASEAN Sub-Committee on Microelectronics and Information Technology (SCMIT), succeeding Dr. Sarun Sumriddetchkajorn, as Thailand Focal Point on the Sub-Committee. The tunure of the Chairmanship is three years and lasts until the end of 2020.

NECTEC representatives attended the 76th Meeting of ASEAN Committee on Science, Technology and Innovation (ASEAN COSTI-76), held in Bali, Indonesia during June 24-28, 2019 to update and report the activities of “Real-time Monitoring Based on Wireless Sensor Networks for Landslide Prone Areas Project”, funded by ASEAN Science Technology and Innovation Fund (ASTIF) with the total budget 50,000 USD for 3 years (2018-2020). In addition to the ASEAN COSTI meeting, NECTEC also attended the ASEAN strategic meetings with Dialogue Partners, namely, the European Union and Japan. A side meeting with ASEAN Secretariat and NICT representatives was also held to discuss for prospective collaboration between ASEAN Sub-Committee of Microelectronics and Information Technology (SCMIT) and ICT Virtual Organization of ASEAN Institutes and NICT.

2. ASEAN High Performance Computing (HPC) Taskforce

Dr.Piyawut Srichaikul was nominated by Thailand National COST Chairman to serve as Key Opinion Leaders (KOLs) of Thailand on the ASEAN High Performance Computing (HPC) Taskforce. He was also elected to serve as the Co-Chair of the Taskforce. His significant contributions for ASEAN HPC were as follow:

1. The attendance of ASEAN COST-75 Meeting during 15-19 October 2018, Cebu, the Philippines to report related activities of the ASEAN HPC Taskforce-1 for official endorsement.
2. The attendance of ASEAN HPC Taskforce-2 during March 13-14, 2019 in Singapore, hosted by The Agency for Science, Technology and Research (A*STAR) of Singapore.
3. The attendance of ASEAN HPC Taskforce-3 during September 5-6, 2019 in Bangkok, Thailand, hosted by NECTEC.

The ASEAN High Performance Computing (HPC) initiative not only enhanced the cooperation among the ASEAN member states, but also was linkage for further collaboration with other dialogue partners such as Enhanced Regional Dialogue Instrument (E-READI) of EU and Japan in the future.

3. ICT Virtual Organization of ASEAN Institutes and NICT (ASEAN IVO)

ASEAN IVO, an initiative of National Institute of Information and Communications Technology (NICT) of Japan, has the mission to seek and identify strategic ICT research areas in the ASEAN region, and promote collaborative projects in them. NECTEC Executive Director has served as one of the Steering Committee of ASEAN IVO since its inception.

NECTEC has actively collaborated on R&D activities under ASEAN IVO with multiple partners. In 2019, "Relay Station Network Based on Low-power Wide-area Network (LPWAN) Technologies for Disaster Management" led by Dr.Kanokvate Tungpimolrut, secured a funding from ASEAN IVO for 2019-2021. Members of the consortium in this project were Universiti Teknology Brunei (UTB) from Brunei, Advanced Science and Technology Institute (ASTI) and Mapua University from the Philippines, National University of Laos (NUOL) and Technology Computer and Electronics Institute (TCEI) from Laos PDR, University of Computer Studies, Yangon (UCSY) from Myanmar and NICT from Japan.

4. Networking for Museums' Content Management in ASEAN Project Phase 2

NECTEC continued the "Networking for Museums' Content Management in ASEAN Project" Phase 2 in 2019 with the financial support from the Ministry of Science and Technology of Thailand. The ASEAN partners consisted of University of Computer Studies, Yangon (UCSY) from Myanmar, Technology Computer and Electronic Institute (TCEI) and National University of Laos (NUOL) from Lao PDR as well as Indonesian Institute of Sciences (LIPI). The project aimed to digitize cultural heritage and to provide basic museum information for guiding visitors through museum exhibitions. Currently, visitors can use Museum Pool Application, developed by NECTEC, to get more information in the Bagan Archaeological Museum, 64 major tourist spots around Bagan Ancient City, as well as 60 QR stands around Shwedagon Pagoda in Yangon. NECTEC and UCSY were pleased that such a collaboration was part of support Bagan to receive the recognition as UNESCO's World Heritage Site in 2019.

5. e-Asia Joint Research Program (JRP)

In 2019, NECTEC, in collaboration with Gunma University of Japan and Thuyloi University of Viet nam, commenced the research project "Establishment of a Landslide Monitoring and Prediction System" after receiving support from e-Asia Joint Research Program (JRP) for 2019-2021.

With the support from e-Asia JRP, NECTEC has actively participated in other two projects:

1. "Development of Information Gathering and Utilization Systems using small UAV for Disaster Risk Assessment, Monitoring and Response" in partnership with National Research Institute for Earth Science and Disaster Prevention (NIED) of Japan, Philippine Institute of Volcanology and Seismology (PHIVOLCS), Indonesian Institute of Sciences (LIPI) and Vietnam National University.
2. "Research of Expandable Cluster based Energy Infrastructure in e-Asia Countries" in partnership with Waseda University of Japan, Mindanao State University-Iligan Institute of Technology of the Philippines and National Institute of Technology Malang of Indonesia during 2017-2021.

6. European Union

High Performance Computing Collaboration under Enhanced Regional Dialogue Instrument (E-READI)

ASEAN and EU representatives held the first EU-ASEAN High Performing Computing (HPC) Coordination Group Meeting at Suntec Singapore Convention & Exhibition Centre in Singapore during March 14-15, 2019 as a forum for linkages between two regions for knowledge exchange, R&D collaboration, capacity

building in HPC. The collaboration was a joint initiative under Enhanced Regional Dialogue Instrument (E-READI) of European Union in consultation with ASEAN COSTI.

Southeast Asia – Europe Joint Funding Scheme for Research and Innovation (JFS)

Dr.Teera Phatrapornnant of NECTEC, joined a consortium with Forschungszentrum Jülich of Germany and University of Computer Studies, Yangon (UCSY) of Myanmar, submitting a research proposal for funding from Southeast Asia-Europe Joint Funding Scheme (JFS) under the theme of Bioeconomy. The Project "Strengthening agriculture 4.0 technology in a Thailand-Myanmar-Germany collaboration: development of a plant-based irrigation platform (Irrigation4.0)" was one of the nine funded projects of 2019 and the first ever successful proposal from NECTEC under JFS. The project is expected to be complete in 2022.

National e-Science Infrastructure Consortium

The collaboration between Thailand and CERN has been continually created and it's in progress with the agreement signing in the "Expression of Interest in the Participation of Physicists from Universities and Research Institutes from Thailand in the CMS Experiment at the CERN LHC Accelerator" between Synchrotron Light Research Institute (Public Organization) and CERN.

The agreement allows physicists from Thailand to participate in high-energy particle physics experiments with the Compact Muon Solenoid Experiment (CMS) group to strengthen particle physics research in Thailand with support of related activities. This collaboration involved in developing computational infrastructure with high data capacity and fast computation performance to accumulate and analyze a large amount of data generated from CERN experiments.

The National e-Science Infrastructure Consortium proposed the development of computational infrastructure including high performance computer and storage system as well as network development to support high-energy particle physics research.

To make best utilization of the infrastructure development, the consortium also proposed to use the infrastructure to support computational research in three areas.

Research/Field	Examples of Research
High-Energy Particle Physics	- Joint Research with CMS and ALICE - Establishment of CERN's tier-2 computer centers: T2-TH-CUNSTDA and T2-TH-SUT
Computational Science and Engineering	- Drug Design - Coastal Water Current Simulation - Climate Change Simulation - Advanced Material Development
Computer Science and Engineering	- Natural Language Processing - Design and Implementation of ALICE Connex Platform - Development of Large-Scale Computing Platform

The operation of the consortium is a collaboration among general members from nine organizations and associate members from three organizations respectively. Its Board of Directors comprises of head of general members from each organization as well as experts in operational policy governance. Several working groups including Resource Working Group; Tools Working Group; Usability Management Working Group; and Network Working Group have been appointed to coordinate and carry out activities through the sharing of knowledge and experiences. NSTDA acts as the Office of the Consortium.

1. Chulalongkorn University
2. Suranaree University of Technology
3. King Mongkut's University of Technology Thonburi
4. Hydro and Agro Informatics Institute (Public Organization)

5. National Science and Technology Development Agency
6. National Astronomical Research Institute of Thailand (Public Organization)
7. Digital Government Development Agency (Public Organization)
8. Synchrotron Light Research Institute (Public Organization)
9. Thailand Institute of Nuclear Technology (Public Organization)
10. School of science, Mae Fah Luang University
11. Walailak University
12. Faculty of Science, Kasetsart University

The member organizations have contributed resources to provide services to research groups based on the research type and tools/software usage. At present, the total resources of the consortium consist of:

- 5,036 processor cores
- 1,375-terabyte storage system (September 2019). Some of the resources are dedicated to local research as an open service. Researchers can apply to use the resource service through the Office of the Consortium.

Resource Usage Results (2011 – Present)

Resources utilized by 262 research projects
258 total users: 64 researchers/instructors and 194 students
81 of system in use / 306 academic papers from users be published

In addition to the development of computational infrastructure, the member organizations also supported the formation of user and infrastructure developer community through trainings, workshops and seminars as included:

Workshops on e-Science and High-Performance Computing

The workshops have consistently been organized since 2012 to be a stage for researchers in the alliances and users to exchange research topics and strengthen the collaboration within the consortium.



Trainings and seminars on computational applications with efficient resource utilization (Example: Computational Chemistry Software for Algorithm Development)



Talk activities and public relations on the development of computational infrastructure; resource usage promotion; and the survey on usage status and requirement.

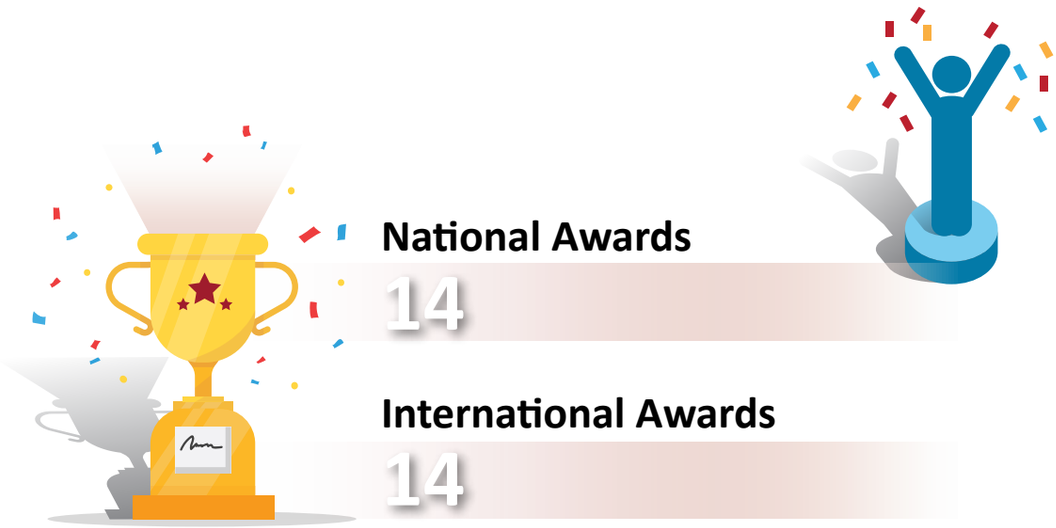




Meetings of the National e-Science Infrastructure Consortium's Board of Directors to determine service policies and directions in driving the consortium's infrastructure development.


Awards

In the fiscal year 2019, NECTEC received 14 international awards and 14 national awards respectively.



International Awards

International awards comprised of 14 research awards and paper awards.

Research Award

Silver Medal: International Invention Contest

Research Title: "KidBright: Intelligent Embedded System Board"

Recipients: Dr. Saowaluck Kaewkamnerd, Dr. Atcha Kopwitthaya and Phiranan Kanchanasrisunthorn

From "The 47th International Exhibition of Inventions Geneva" at Geneva, Switzerland

Silver Medal : International Invention Contest

Research Title: "MuTherm: Non-contact Multiple Patients Fever Screening"

Paper Awards

Goal Medal and Certificate

Research Title: iGASSET: Non-MEMS Low Power Gas Sensing Technology

Recipients: Opto-Electrochemical Sensing Research Team in cooperation with Graphene and Electronic Printing Innovation Research Team

Awarder: Korea Invention Promotion Association (KIPA)

Awarding Date: December 8, 2018

ISLA Asia-Pacific Awards in Senior Information Security Professional Category

Recipient: Dr. Chalee Vorakulpipat

Awarder: (ISC)² Secure Summit APAC 2019

Awarding Date: July 10-11, 2019 at Conrad Hotel, Hong Kong

Best Presentation Award

Article Title: Security Implementation for Authentication in IoT Environments in Data Encryption and Information Security session at IEEE International Conference on Computer and Communication System

Recipients: Dr. Chalee Vorakulpipat, Ekkachan Rattanalerdnusorn, and Pitak Thankaew

Awarder: Nanyang Technological University (One-North Campus), Singapore

Awarding Date: February 23-25, 2019

Best Academic Paper Award

Article Title: "Prediction of Dissolved Oxygen Concentration for Shrimp Farming Using Quadratic Regression and Artificial Neural Network"

Recipients: Kasorn.Galajit, Suradej Duangpummet, Jakkaphob Intha, Dr. Rachaporn Keinprasit, Prachumpong Dangsakul, Khongpan Rungprateepthaworn and Dr. Jessada Karnjana and Pitisit Dillon (Co-research Students from KMUTNB)

Awarder: The 13th International Joint Symposium on Artificial Intelligence and Natural Language Processing (iSAI-NLP 2018)

Awarding Date: November 15-17, 2018 at Pattaya, Chonburi / Bangkok

Article Title: A Development of an Ontology-based Personalized Web from Rice Knowledge Website

Recipients: Thanet Ruengchitpakorn, Jaroon Phrombutra and Dr. Thepchai Supnithi

Awarder: The Thirteen International Conference on Knowledge, Information and Creativity Support Systems (KICSS 2018)

Awarding Date: November 15-28, 2018

Best Academic Paper Award

Article Title: "Speech Watermarking Technique Based on Sigular Spectrum Analysis and Automatic Parameter Estimation using Differential Evolution for Tampering Detection"

Recipients: Kasorn.Galajit, Dr. Jessada Karnjana, Mongkonchai Intarauksorn (Co-research Student from SIIT), Asst. Prof. Dr. Pakinee Aimmanee (SIIT) and Prof. Dr. Masashi Unoki (JAIST)

Awarder: The 13th International Joint Symposium on Artificial Intelligence and Natural Language Processing

Awarding Date: November 15-17, 2018 at Pattaya, Chonburi / Bangkok

Best Academic Paper Award

Article Title: "Improving Accuracy of Dissolved Oxygen Measurement in an Automatic Aerator-Control System for Shrimp Farming by Kalman Filtering"

Recipients: Dr. Jessada Karnjana, Thanika Duangthanoo, Seksun Sartsatit, Sommai Chokrung, Anuchit Leelayuttho, Kasorn.Galajit, Asadang Tanatipuknon (Co-research Student from SIIT) and Pitisit Dillon (Co-research Student from KMUTNB)

Awarder: The 3rd International Conference on Computational Intelligence in Information Systems CIIS2018

Awarding Date: November 16-18, 2018 at Universiti Teknologi Brunei, Brunei Darussalam

Best Academic Paper Award

Article Title: Digital Audio Watermarking Method Based on Singular Spectrum Analysis with Automatic Parameter Estimation Using a Convolution Neural Network

Recipients: Dr. Jessada Karnjana, Kasorn.Galajit, Asst. Prof. Dr. Pakinee Aimmanee (SIIT) and Prof. Dr. Masashi Unoki (JAIST)

Awarder: 14th International Conference on Intelligent Information Hiding and Multimedia Signal Processing

Awarding Date: November 26-28, 2018, at Sendai, Japan

"Best Paper Award" and "Best Presentation Award"

Research Work: Article titled "Recommendation System with Limited Time for Visiting Museum" From International Conference on Culture Technology (ICCT 2019)

Recipients: Dr. La-or Kovavisaruch, Dr. Taweesak Sanpechuda, Krisada Chinda, Thitipong Wongsatho, Sodsai Wisadsud and Anuwat Chaiwongyen from Location and Automatic Identification System Research Team

Awarding Date: August 13-16, 2019 at Pattaya

Excellent Presentation Award

Research Paper: "An Ontology-based Study of Culture Tourism Knowledge Management: A Case Study of Thai Wikipedia Articles"

Recipient: Strategic Analytics Networks with Machine Learning and AI Research Team From International Conference on Culture Technology (ICCT 2019)

Awarding Date: August 13-16, 2019 at Pattaya

Certificate of Honor for Outstanding Performance in the "2019 ACM Europe Summer School on HPC Architectures for AI and Dedicated Applications"

Recipient: Dr. Putt Sakdhnagoll, Researcher at NSTDA Supercomputer Center (ThaiSC), the National Computing and Cyber-Physical Infrastructure (NCCPI)

Awarding Date: July 17-24, 2019 at Barcelona, Spain

Certified ScrumMaster®

Recipient: Dr. Apivadee Piyatumrong, Researcher at NSTDA Supercomputer Center (ThaiSC), the National Computing and Cyber-Physical Infrastructure (NCCPI)

Awarded by SCRUM ALLIANCE® on April 24, 2019

National Awards

NECTEC received totally 14 national awards for its research works and personnel.

Research Awards

L'Oréal Research Fund "For Woman in Science" 2018 in Physical Science

Recipient: Asst. Prof. Dr. Surapa Thiemjarus

Research Work: "Pervasive Healthcare System for Elderly People and Patients"

Awarder: L'Oréal (Thailand) Co., Ltd.

Awarding Date: October 5, 2018 at Grand Hyatt Erawan Bangkok

Invention Award in "Thailand Inventors' Day" 2019

Awarder: Air Chief Marshal Dr. Prajin Juntong, Deputy Prime Minister

Award Type: Excellence Award / Honorary Award / Good Thesis Award

Awarder: National Research Council of Thailand (NRCT)

Awarding Date: February 2, 2019 at Bangkok International Trade & Exhibition Centre: BITEC Bangna

Outstanding Technologist Award 2019

Research Work: "3D Cone-Beam Computed Tomography" (Cone-Beam CT)

Recipients: Prof. Dr. Pairach Thachayapong, Dr. Saowapak Thongvigitmanee, Dr. Kritkrai Sitthisereepratheep and 16 NSTAD's researchers

Awarding Date: October 7, 2019 at Mae Fah Luang University, Chiang Rai

Invention Excellence Award

Research Work: "Brain-Controlled Hearing Aid"

Recipients: Dr. Pasin Israsena Na Ayudhaya, Anukool Noymai, Tharapong Soonrach, Sangvorn Seesutas and Krit Janard

Invention Excellence Award

Research Work: "Network Platform for Internet of Everything" (NETPIE)

Recipients: Dr. Panita Pongpaibool, Chavee Issariyapat, Pramrudee Aiumsupucgul, Anun Panya, Chaiwith Santaweesuk, Sirawich Mulinta, Dr. Aimaschana Niruntasukrat, Dr.Koonlachat Meesublak, Attagorn Sirisuwan, Wanlapa Soonraj, Satita Mukda and Witchuda Akapan

Invention Excellence Award: National Research Council of Thailand

Research Work: "Smart Paper Sensor for DNA Diagnostic of infectious Diseases"

Recipient: Dr. Adisorn Tuantranont

Honorary Award

Research Work: "TanRabad" The Software Suite for Dengue Epidemic Surveillance and Control supports the mission of health officers to enhance dengue surveillanceand improve prevention and control strategy.

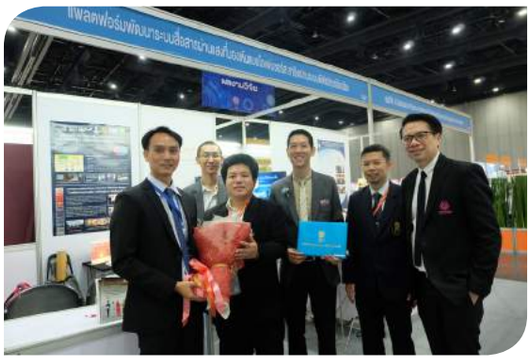
Recipients: Dr. Naiyana Sahavejchapan, Visit Wongwilai, Watcharakorn Nuthong, Suriya Urueakolan, Nithipat Wongvichai, Asmaporn Chatrattikorn, Laddawan Klingkusum, Kamron Aroonrua, Chakkapong Phonhan, Pornthiwa Choksoongnoen, Piruin Panichphol; Manoch Rattananen, Dr.Sopon Iamsirithaworn (MD), Dr. Darin Areechokchai (MD) and Pongsakron Sadakron

Excellence Thesis Award

Thesis Title: Factors Affected to Business Decision Making on Remanufacturing: Thai Industry Case Study

Recipient: Dr. Jirapan Chaowanapong

Honorary Award



Research Work: Open-Source Visible-Light-Communication Development Platform with the Demonstration on Intelligent Museum Used Case

Recipient: Dr. Kata Jaruwongrungsee

Thailand ICT Awards 2019

- **Winner Award: Public Sector and Government Category**

  Research Work: Thai School Lunch

  Recipients: Dr. Supiya Charoensiriwat, Parus Boonporn, Dr. Nantaporn Ratisoontorn, Pongsak Tiyananti, Apatha Pithong, Dr. Nida Chatiwattanasiri and Jantima Jansaksri

  Awarding Date: September 16, 2019

- **Winner Award: Technology Award: Big Data Analytics**

  Research Work: Traffy Waste

  Recipient: Dr. Wasan Pattara-atikom, Intelligent Transport System Research Team

  Awarding Date: September 16, 2019

Organization Management Awards

Establishment Models on Occupational Safety, Health, and Environment (Provincial Level) 2018

Recipient: Sopawan Witdumrong.
Senior Division Director,
Infrastructure Management Division

Awarder: Jaroonsak Singhadate,
Deputy Governor of Pathum Thani

Awarding Date: November 12, 2018

Outstanding Good Organization Award on the Provision of Facilities for People with Disabilities on International Disability Day 2018

Recipient: Sopawan Witdumrong. Senior Division Director,
Infrastructure Management Division

Awarder: Gen. Anantaporn Kanchanarat,
Minister of Social Development and Human Security

Awarding Date: December 3, 2018

Contributions to Create Economic and Social Impacts

NECTEC is a national center under the National Science and Technology Development Agency (NSTDA). Its mission is to drive Thailand's development in progress by using knowledge and research and development to drive the economic, social and community sectors to achieve higher efficiency. The center put focus on the study of methods to help create added value to local contents in order to generate the overall economic and social impacts to the country.

NECTEC's executives set a policy by determining the economic and social impacts as the organization's strategic indicator (Balanced Scorecard) since the fiscal year 2007. Each department is required to accumulate results, impacts and reference evidences and summarize them into the impact value presented to the center's and NSTDA's Executive Board annually. The results will be used for the preparation of a budget request proposed to external agencies

In the fiscal year 2019, NECTEC generated economic and social impact value at Bt20,179 million from its 88 research and development projects. The top ten projects that created the most impact value included: