



Engineering Research and Innovation

FACULTY OF ENGINEERING

PRINCE OF SONGKLA UNIVERSITY (PSU)

THAILAND

Major Research Areas I

ME

Mechatronics and robotics

ComE

IoT / Smart city

EnvE

CE

Computer integrated manufacturing

IE

Energy technology and smart grid

EE

ChE

Waste valorization and biorefinery

MatE

Environmental sustainability and circular economy

Major Research Areas II

ME

Rubber engineering

ComE

Biodiesel /Oleochemicals

EnvE

Logistics and supply chain

CE

IE

Advanced materials

EE

ChE

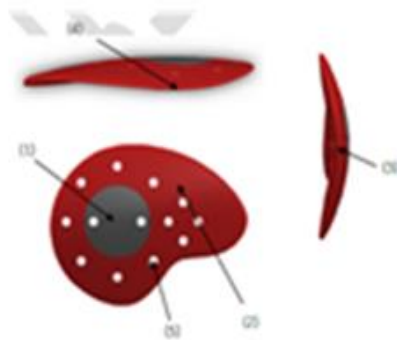
Coastal erosion control restoration

MatE

Hydropower and wind

Rubber Engineering

NR-Hip Protector



NR-Heel Protector

Heel Soother

ยางรองส้นเท้า เพื่อสุขภาพของกระดูกข้อต่อ และ กล้ามเนื้อ เส้นประสาทขาเท้า



Assoc.Prof.Dr.Wiriya Thongruang,
Department of Mechanical Engineering,
E-mail : riya1968@gmail.com

Parawood Horizontal Bandsaw

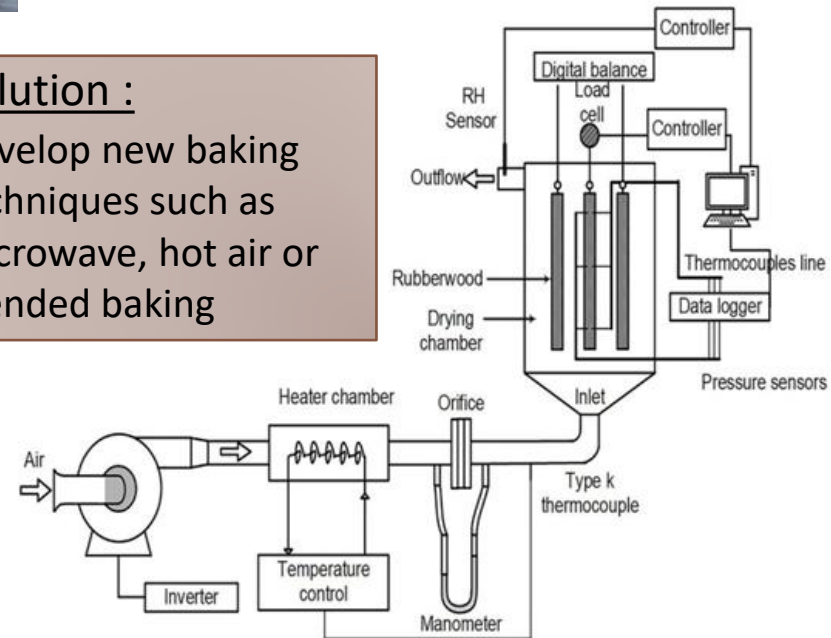


Parawood Baking Technology



Problem :
Waste wood after baking

Solution :
Develop new baking techniques such as microwave, hot air or blended baking



Assoc.Prof.Dr.Wiriya Thongruang,
Department of Mechanical Engineering,
E-mail : riya1968@gmail.com

Assoc. Prof. Dr. Thanate Ratanawilai,
Department of Industrial Engineering,
E-mail : thanate.r@psu.ac.th

Mechatronics & Robotics

Beach Cleaning Robot



Large Payload Track Robot



- Outdoor terrain
- Water sparse and dust proof
- 100kg payload

Domestic Service Robot

Rank 3rd, RoboCup Japan Open 2014 Fukuoka, Japan
Rank 11th, World RoboCup 2013 Eindhoven, Netherlands
Rank 11th, World RoboCup 2012 Mexico City, Mexico



YouTube

<https://www.youtube.com/watch?v=xL68jx0MIYs>

- Laser Scan Mapping
- Autonomous navigation
- Face & object recognition
- Human tracking
- Voice command & response

- Flexible gripper



Assoc.Prof.Dr.Pruittikorn Smithmaitrie, Department of Mechanical Engineering,
E-mail : spruitti@me.psu.ac.th

Obstacle Avoidance Drone at Night



- Obstacle avoidance capability both day and night
- Avoid both moving and static objects

Alarm activating drone: auto take-off, go target, and return



- Fully autonomous for security check points

Autopilot on Helicopter platform



- Gasoline engine helicopter platform
- Larger payload and longer flight time
- Autonomous functions such as altitude hold, position hold, soft landing, waypoint, auto take-off, return, etc.
- 10km Ground-to-Drone communication

Smart Military



3D Mapping & Navigation Drone

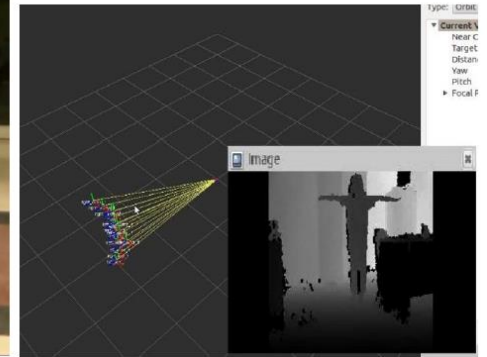


- Real time 3D-mapping by drone
- Self navigation Outdoor-to-Indoor

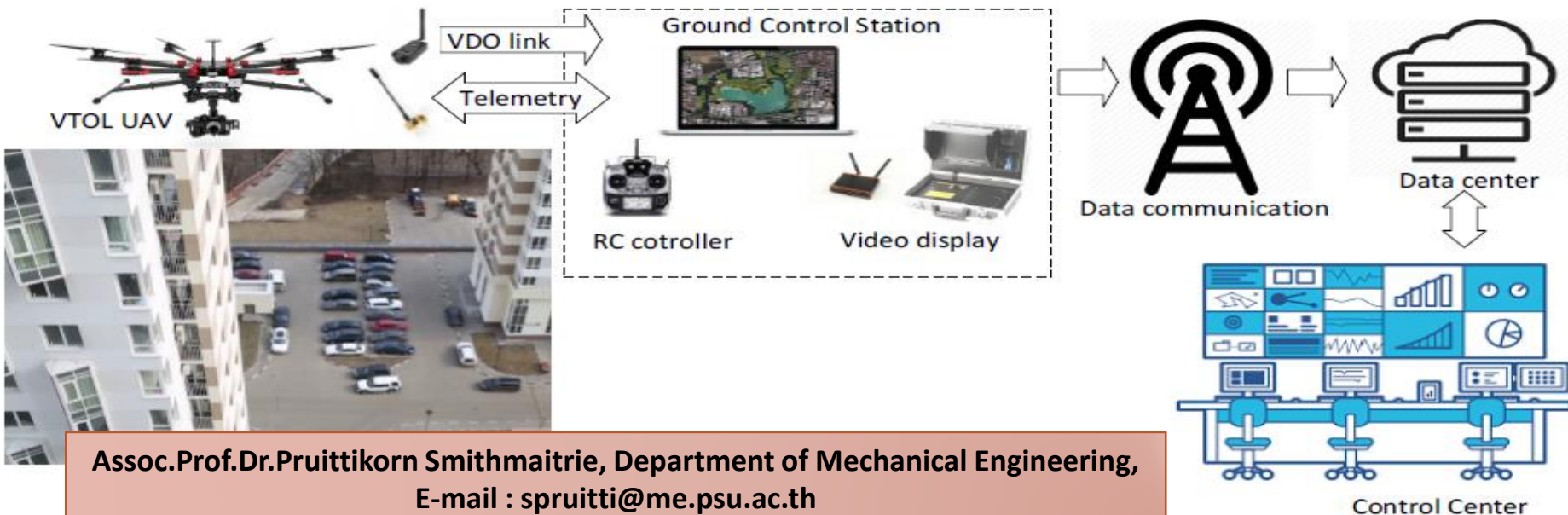
Human Tracking Mobile Robot



- Autonomous human detection
- Robot tracking human



Security Drone With IoT Technology



Assoc.Prof.Dr.Pruittikorn Smithmaitrie, Department of Mechanical Engineering,
E-mail : spruitti@me.psu.ac.th

Formula Car and EV



**15th TSAE Auto Challenge 2019-
Reward 3rd Overall**

**Assoc.Prof.Dr.Charoenyut Dechwayukul,
Department of Mechanical Engineering,
E-mail : dechvac@gmail.com**

Oil palm leaflets separator and oil palm leaflets shredder for the diet of ruminant animals

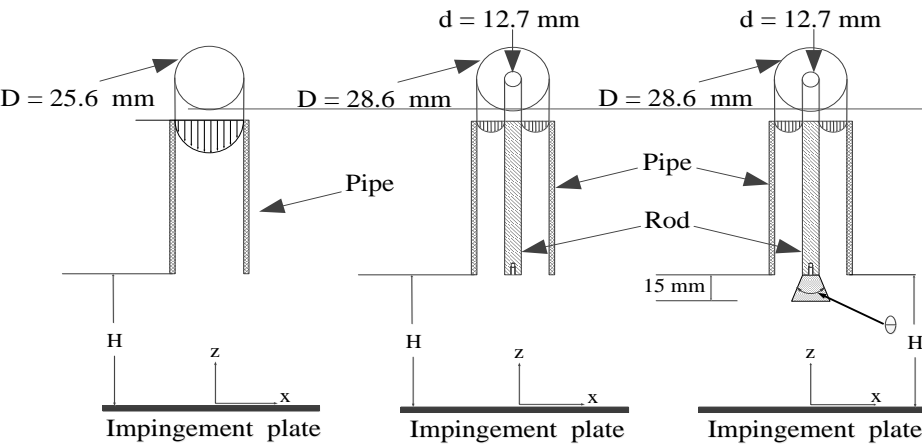


**Asst.Prof.Dr.Krit Somnuk,
Department of Mechanical Engineering,
E-mail : krit.s@psu.ac.th**

Impinging Jet using Special Nozzles

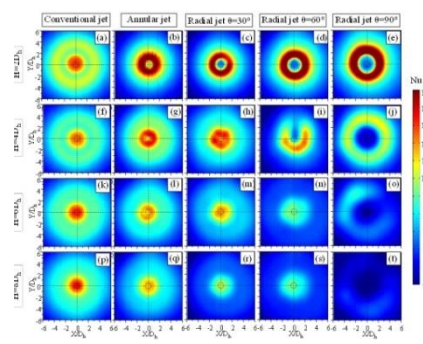
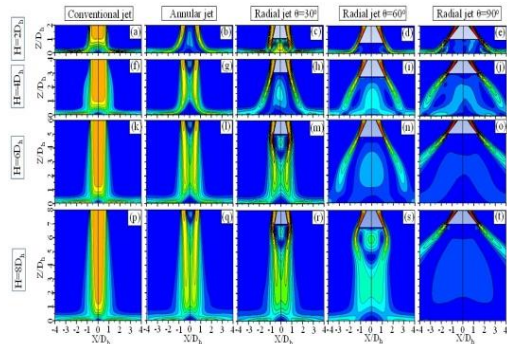
Annular nozzle

Radial nozzle



Flow patterns

Nusselt number on impingement surface

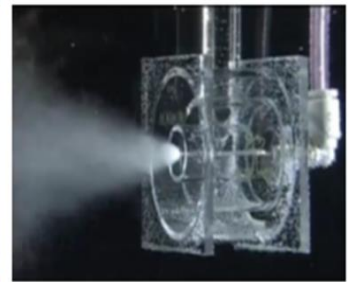


- Development of high efficiency microbubble generator nozzle
- Application of microbubble: Aeration, Biogas purification, Coal upgrade



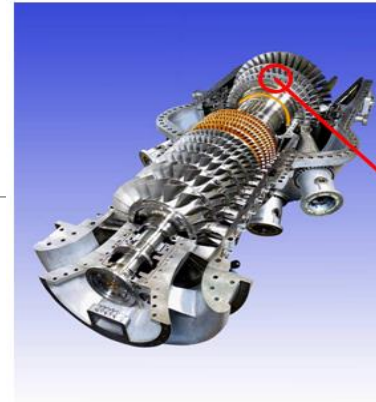
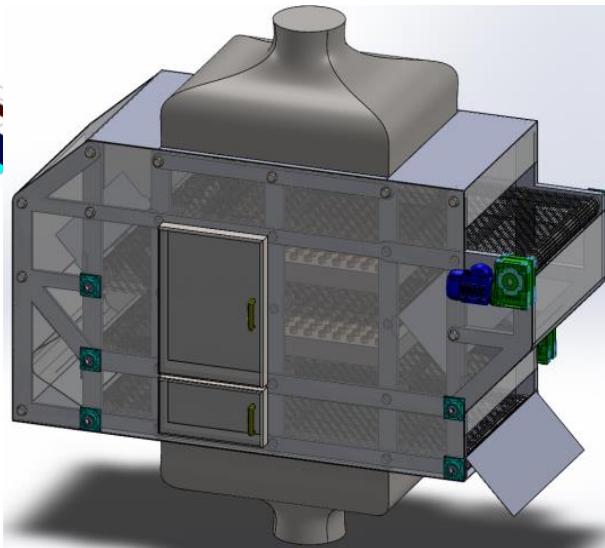
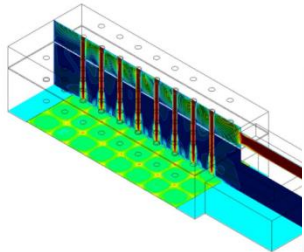
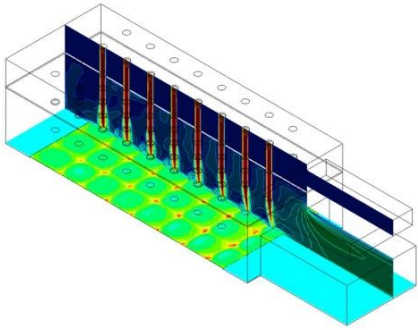
← ฟองอากาศขนาดใหญ่

ฟองอากาศขนาดเล็ก

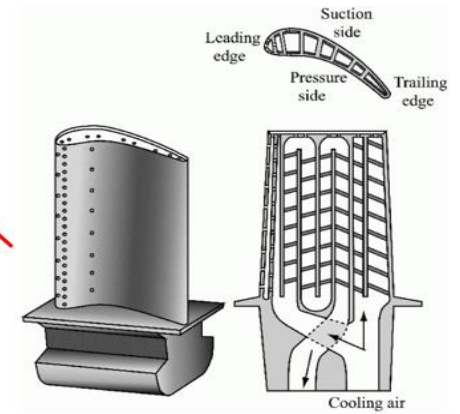


Jet impingement dryer

Heat Transfer and Simulation

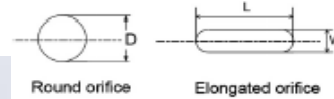


Industrial gas turbine



Convection cooling in serpentine channels

Jet impingement in confined channel



AR=1	D = 13.2 mm	
AR=4	L = 24 mm	W = 6 mm
AR=8	L = 33.6 mm	W = 4.2 mm

Fig. 2. Orifice geometries with identical cross-section area.

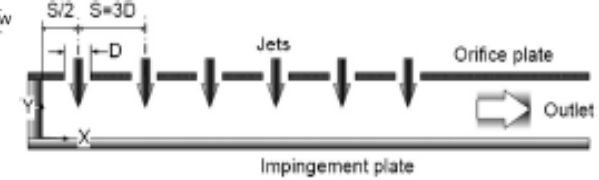
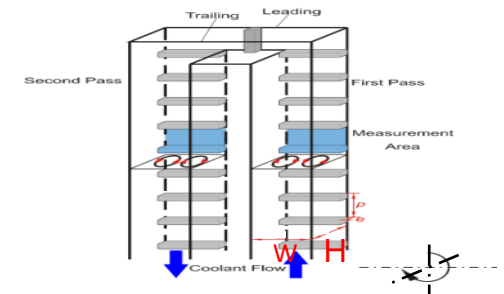
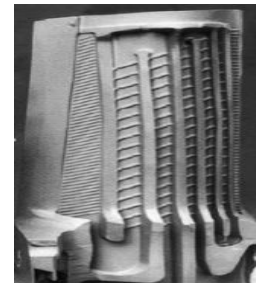


Fig. 1. Experimental model of array of jet impingement.

Rib turbulators in rotating serpentine channel



IoT & Smart City

Smart and Sustainable City



Smart Tourist card



e-coupon

SOS

Outdoor navigation



Marine tourist safety system



Voice Alert & SMS

Smart tourist card Mobile App

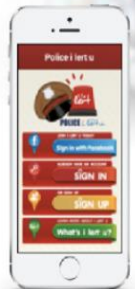


Smart Platform

Command Center

SOS alert you mobile app

SOS Other security mobile app



Phuket Smart City Initiative

Environmental monitoring device and IOT

IoT Environment Sensor

ก๊าซคาร์บอนมอนอกไซด์ (Carbon Monoxide)

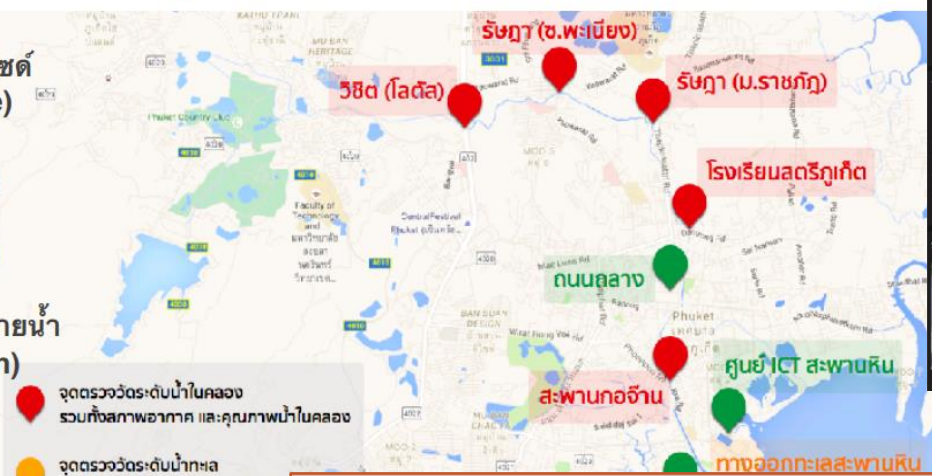
อุณหภูมิ และความชื้น (Temperature & Relative Humidity)

ปริมาณออกซิเจนละลายน้ำ (Dissolved Oxygen)

ปริมาณน้ำฝน (Rain Gauge)

ระดับน้ำในคลอง / ทะเล (Ultrasonic Distance)

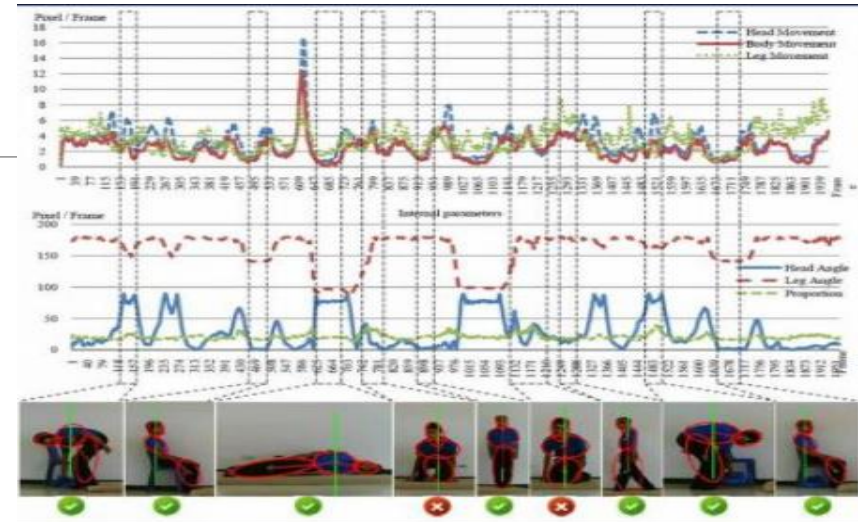
ภาพจุดติดตั้งเซ็นเซอร์ตรวจสอบด้านสิ่งแวดล้อม



Asst.Prof.Dr.Wannarat Suntiamorntut, Department of Computer Engineering,
E-mail : wannarat@fivedots.coe.psu.ac.th

Image processing and AI for vehicle tracking

Distant tracking and well being care for elderly



Grandma Elderly care system

AR-MA

09:09 09/02/2018 : B

LOGIN :

Login:
Nikom.suvonvorn@hotmail.com

Password:

Sign in

AR-MA

AR-MA

EVENTS

SETTING

DESCRIPTION

S

DELETE

Asst.Prof.Dr.Nikom Suvonvorn, Department of Computer Engineering,
E-mail : nikom.suvonvorn@gmail.com

Machine Monitoring System - MMS



PSU-mms-IoT Module

3G/4G Internet

Data Collector

Sensor Interface Module

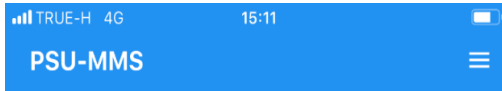
สายเชื่อมไปยัง Sensor 3 จุด

Design and installation of MMS for 104 SMEs (equipped with 312 sensors)

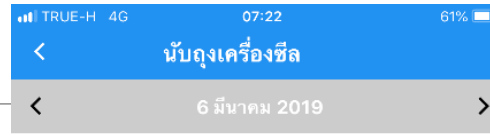
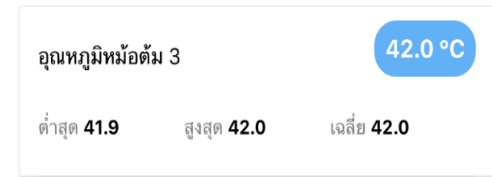
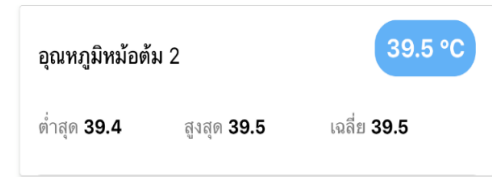
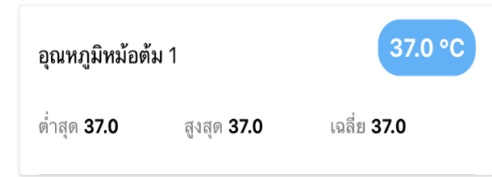
Manufacturing machine monitoring system (MMS) for modernizing local SMEs



MMS Mobile App



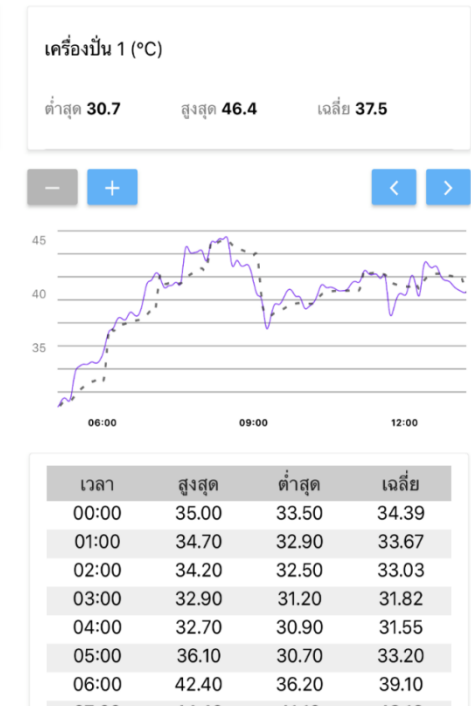
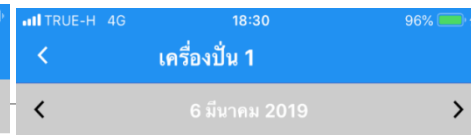
ตำราเอก



นับถูกเครื่องซีล **327 ถูง**

อัตราการผลิต 327 ถูง/วัน

05:00	0
06:00	0
07:00	0
08:00	0
09:00	0
10:00	64
11:00	0
12:00	112
13:00	0
14:00	151
15:00	0
16:00	0
17:00	0
18:00	0
19:00	0
20:00	0
21:00	0
22:00	0
23:00	0



Cloud Data Service

สนับสนุนโดยศูนย์คอมพิวเตอร์

จัดเก็บข้อมูล อัตราการผลิต ขึ้น/ชั่วโมงตัวแปรที่มีผลต่อการผลิต เช่น อุณหภูมิ ความชื้น ความดัน การทำงานของพนักงาน อัตราการใช้พลังงานไฟฟ้า จัดเก็บ >1 ล้าน ชุดข้อมูล/เซ็นเซอร์/สป



Waste valorization & Biorefinery

Waste valorization : Biogas production from wastes and lignocellulose

Biogas Engineering Research Laboratory

Rubber wastewater (X 35)



Cir-Plug Flow Seafood processing plant



Chicken rendering plant



Biogas cleanup



Grass + manure -> Energy + Fertilizer



Assoc.Prof.Dr.Sumate Chaiprat, Department of Civil Engineering,
E-mail : sumate.ch@psu.ac.th

Application of Residual Material as Media in Ammonia Gas Removal by Biofiltration



รูปที่ 7 แสดงลักษณะของปุ๋ยหมักจากของเสียโรงงานยาง



รูปที่ 8 แสดงลักษณะของปุ๋ยคอก

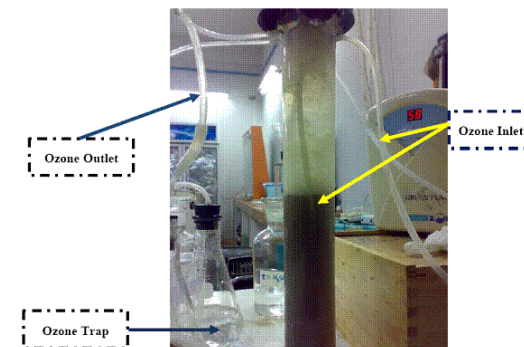


รูปที่ 9 แสดงลักษณะของขาน้อย



รูปที่ 10 แสดงลักษณะของเส้นใยปาล์ม

Comparison Colour and COD Removal Efficiency from Palm Oil Mill Effluent (POME) By Ozone, Peroxone and Fenton Process



Hydropower & Wind

Wind Energy



Low speed wind turbine 10 kW (cut in 2 m/s)

Assoc.Prof.Dr.Sumate Chaiprapat, Department of Civil Engineering,
E-mail : sumate.ch@psu.ac.th

Hydropower for the community

Power plant building



1st Weir



2nd Weir



3rd Weir



4th Weir

Biodiesel & Oleochemicals

Biodiesel production process from palm fatty acid distillate using static mixer coupled with ultrasound



Biodiesel production using probe-type ultrasound



2019

The Honor Award of Research Work Award 2019, National Research Council of Thailand (NRCT)

2018

The Honor Award of Invention 2018, National Research Council of Thailand (NRCT),



2017

Bronze Prize from Korea Invention Promotion Association

Asst.Prof.Dr.Krit Somnuk, Department of Mechanical Engineering,
E-mail : krit.s@psu.ac.th

Diesohol fuels blended with palm fatty acid distillate as an emulsifier and a diesel extender



 ประยุกต์ใช้วัตถุดิบในประเทศ ต้นทุนต่ำ เนื่องจากได้จากผลพลอยได้ของอุตสาหกรรมน้ำมันปาล์ม

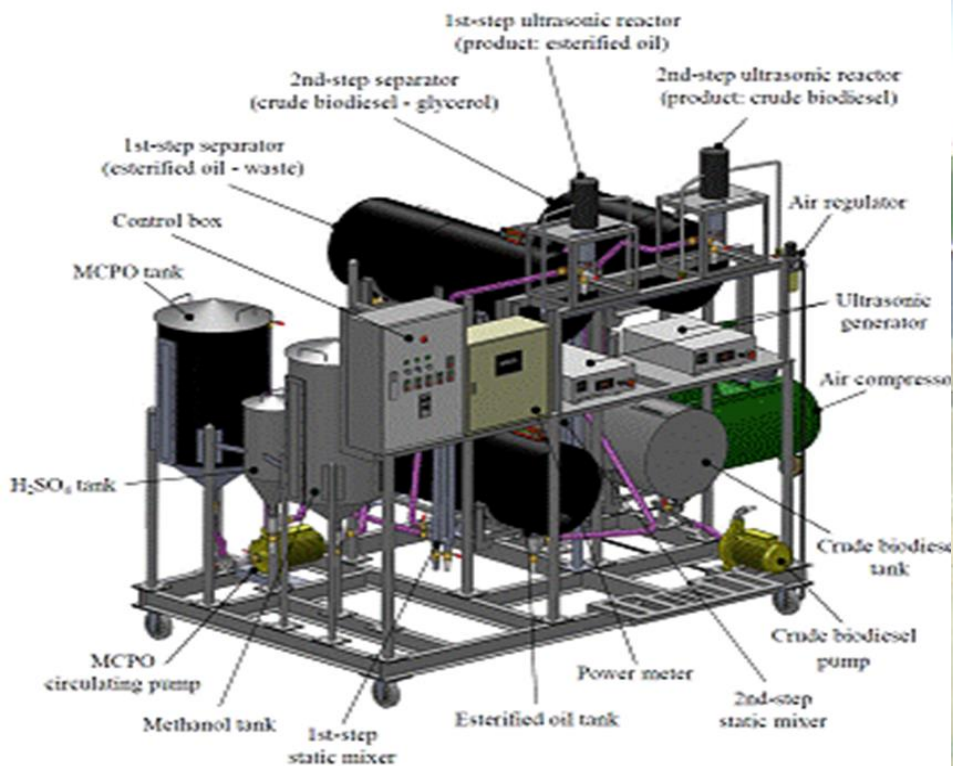
 มีวัตถุดิบจำนวนมากกว่า 100,000 ตัน/ปี

 ช่วยปรับปรุงคุณสมบัติการหล่อลื่นและการเผาไหม้ของเครื่องยนต์ดีเซลและใช้งานได้จริง

 ทดแทนสารอิมัลซิไฟเออร์พาณิชย์ที่มีราคาแพงมากนำเข้าจากต่างประเทศและทดแทนการใช้สารเพิ่มซีเทน



Process intensification for biodiesel production from vegetable and waste oils



Logistics & supply chain

Traffic Eng to improve city-to-city transportation



Infrastructure efficiency and road safety



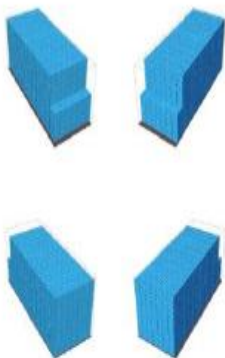
Asst.Prof.Dr.Paramet Luatthep, Department of Civil Engineering,
E-mail : paramet@eng.psu.ac.th

Work study on container loading for seafood processing plant

Space	Qty	Length	Width	Height	Weight	Cube	Efficiency
Trailer CON_20	968	5.89	2.33	2.38	23674.123	32.662407	80.47%

Item
PACK_6

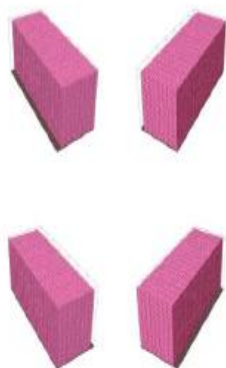
0.447 - 0.32
- 0.183 /
22.2



Space	Qty	Length	Width	Height	Weight	Cube	Efficiency
Trailer CON_20	2804	5.89	2.33	2.38	23847.032	693907	65.77%

Item
PACK_12

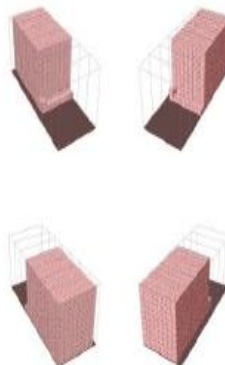
0.546 -
0.261 -
0.12 / 8.25



Space	Qty	Length	Width	Height	Weight	Cube	Efficiency
Trailer CON_20	693	5.89	2.33	2.38	23867.032	959407	52.34%

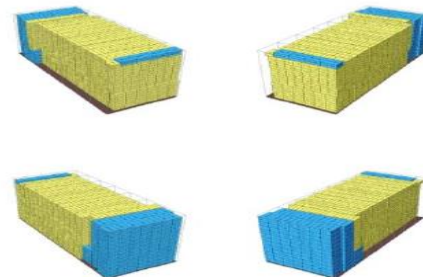
Item
PACK24

0.346 -
0.261 -
0.234 / 26.5



Space	Qty	Length	Width	Height	Weight	Cube	Efficiency
Trailer CON_20	2259	5.89	2.33	2.38	23655.742	32.662407	86.26%

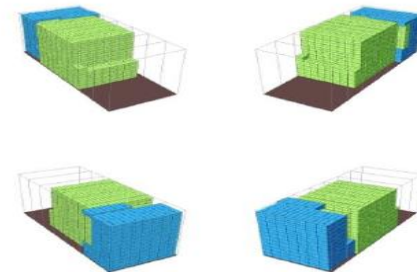
0.346 -
0.261 -
0.12 /
8.25



(ก) ตัวอย่างผลการจัดเรียงสินค้าแบบ Pack-6+Pack-12

Space	Qty	Length	Width	Height	Weight	Cube	Efficiency
Trailer CON_20	841	5.89	2.33	2.38	23655.496	32.662407	59.42%

0.346 -
0.261 -
0.234 / 26.5



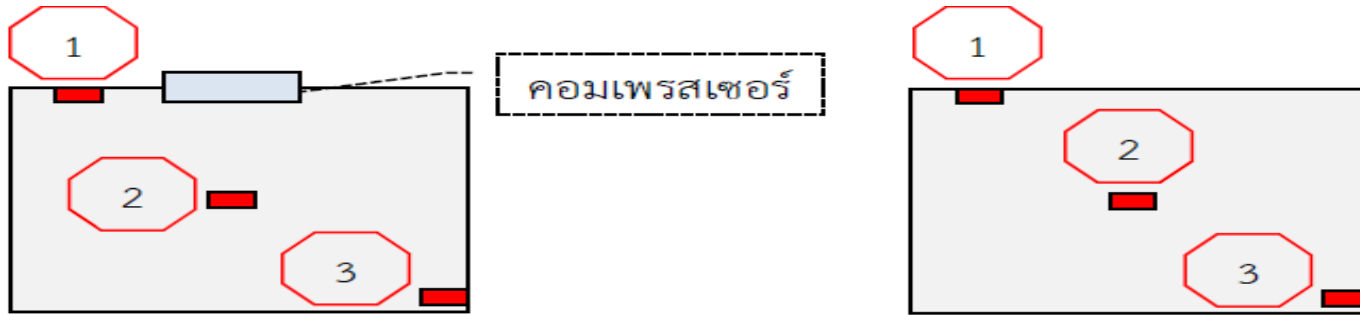
(ข) ตัวอย่างผลการจัดเรียงสินค้าแบบ Pack-6+Pack-24

รูปที่ 1 ผลการจัดเรียงสินค้าจากโปรแกรม โปรแกรม Load Planner แบบโหลดสินค้าชนิดเดียวกัน

Pack-6 Pack-12 และ Pack-24 ตามลำดับจากซ้ายไปขวา

รูปที่ 2 ตัวอย่างผลการจัดเรียงสินค้าแบบผสมระหว่าง Pack-6+Pack-12 และ Pack-6+Pack-24

Local pasteurized milk industry case study of logistic control



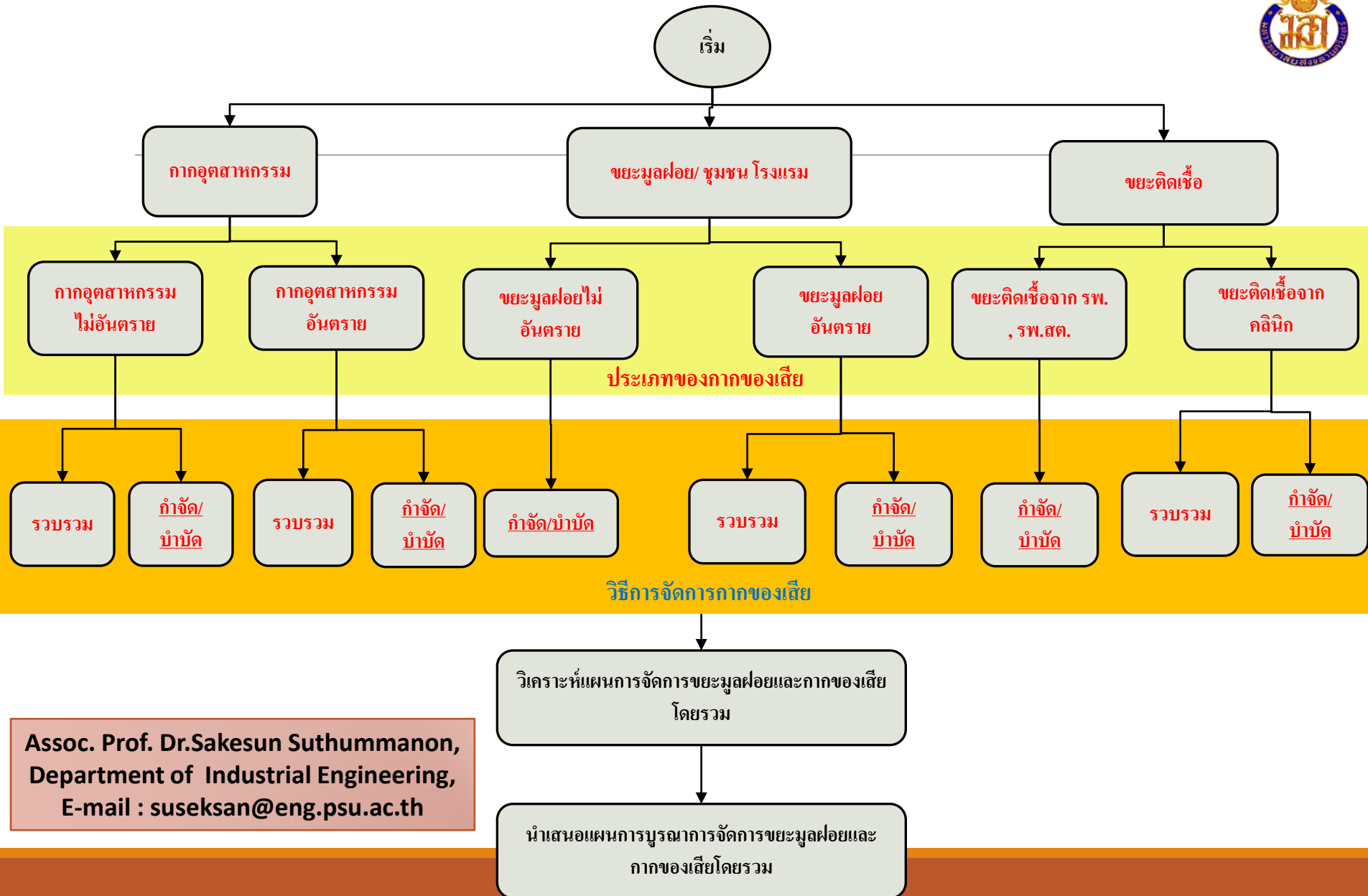
รูปที่ 1 ตำแหน่งการติดตั้ง Data Logger รถที่มีคอมเพรสเซอร์ (ซ้าย)
และรถที่ไม่มีคอมเพรสเซอร์ (ขวา)

หมายเหตุ: หมายเลข 1 ตำแหน่งผนังรถด้านหน้า
หมายเลข 2 ตำแหน่งตรงกลางรถ
หมายเลข 3 ตำแหน่งประตูรถด้านหลัง



Tracking sensor and data logger for pasteurized milk delivery

Logistics for solid wastes for Trang province



Assoc. Prof. Dr.Sakesun Suthummanon,
 Department of Industrial Engineering,
 E-mail : suseksan@eng.psu.ac.th

Advanced materials

Thermochromic & Photochromic Materials

Chromism is a reversible change in a substance's colour resulting from a process caused by some form of stimulus. Many materials are chromic, including inorganic and organic compounds and conducting polymers, and the property can result from many different mechanisms. There are also several types of chromism, which are detailed below.

Thermochromism is the reversible colour change of a substance induced by temperature change. A large variety of substances, organic, inorganic, organometallic, supramolecular and polymeric systems exhibit this phenomenon. Thermochromic has also been applied to important technical areas that involve other external influences as well as heat in the observed colour change, e.g. thermochromic pigments.



Photochromism is the reversible transformation of a chemical species between two forms by the absorption of electromagnetic radiation, where the two forms have different absorption spectra. Photochromism has attracted much interest due to its potential for use in automobile and building glazing as well as energy conservation.



Interactive wireless endoscope



Assoc. Prof. Dr. Pornchai Phukpattaranont,
Department of Electronic engineering,
E-mail : pornchai.p@psu.ac.th

Wood-Plastic Composites

❖ Materials and processes



Polypropylene (recycled)

Para wood power

Additive



composite materials

Forming process

Composite sheet

❖ Products



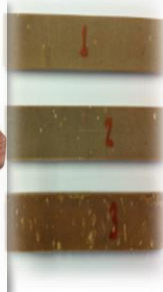
Pedestrian Flooring



Picture frame

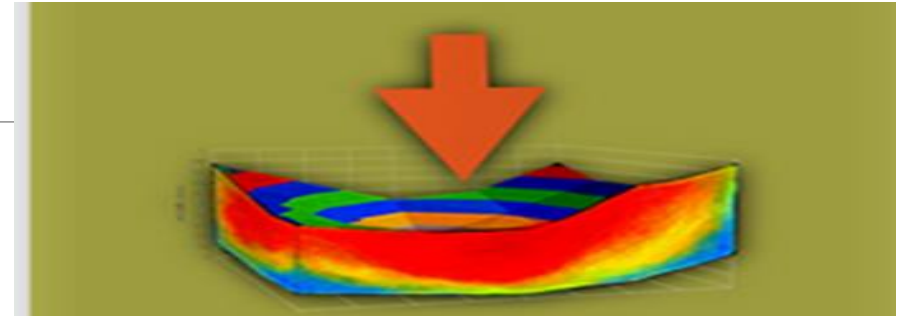


TOYS



Wood-Plastic

Impact absorber material prepared from natural rubber



Materials



Products



Assoc. Prof. Dr. Thanate Ratanawilai,
Department of Industrial Engineering,
E-mail : thanate.r@psu.ac.th

Ast.Prof.Pornsiri Kaewpradit,
Department of Chemical Engineering,
E-mail : pornsiri.k@psu.ac.th

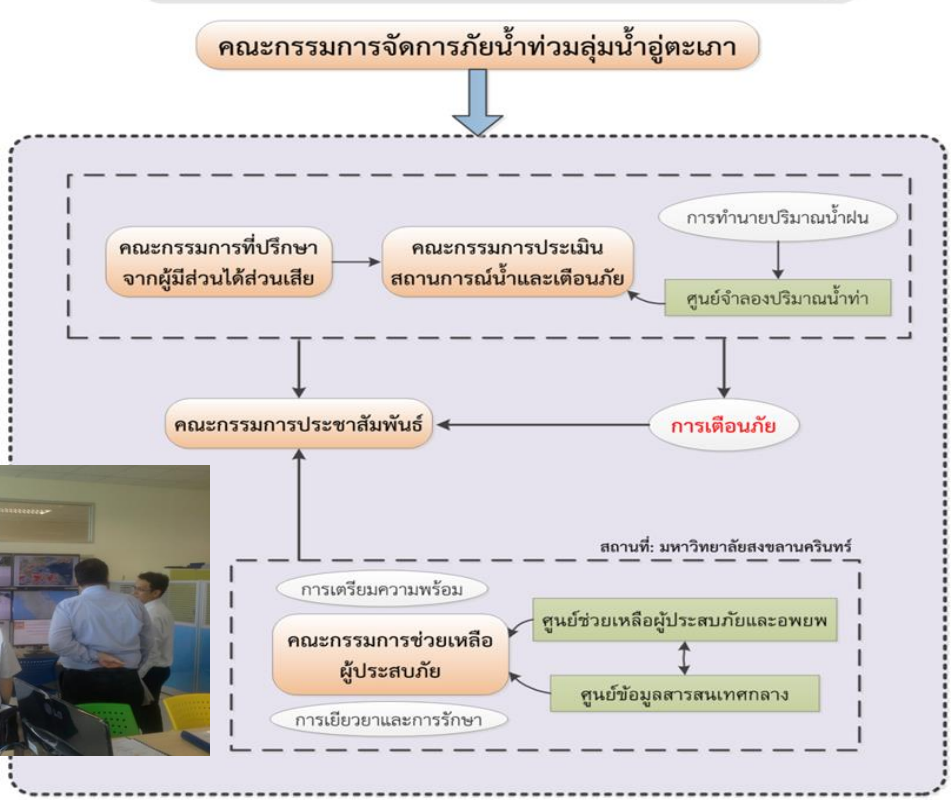
Environmental sustainability

Installing the Flood Warning Sensor System



Flood Management : Hatyai Model

ระบบการรับมือสถานการณ์น้ำท่วมขนาดใหญ่
Hat Yai Model 2011



Assoc.Prof.Dr. Tanit Chalermyanont, Department of Civil Engineering, E-mail : tanit.c@psu.ac.th

Carbon, water, and ecological footprints

Products

- Rice
- Crude palm oil
- Rubber products
- Tapioca flour
- Sugar
- Molasses ethanol
- Molasses and Sugarcane ethanol



Policy Recommendation

Coastal restoration

PSU Seadome



Asst.Prof. Payom Rattanamane, Department of Civil Engineering,
E-mail : payom.r@psu.ac.th