Multi-site Visualization System for Decision Support System

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National Electronics and Computer Technology Center (NECTEC)

Outline

• Brief introduction of NECTEC
• ICT based real time Dam Safety monitoring system with EGAT
• Necessity of Decision Support System
NECTEC Vision and Mission

Vision

“Being a core organization collaborating with alliances in R&D of electronics and computer technologies for strengthening the sustainability of Thai industries and the sufficiency society.”

Mission

- Research, development, design and engineering
- Technology transfer to industries and communities
- Human resource development
- Policy research, industrial intelligence and knowledge infrastructure
Number of staffs
-- March 2015 --

Total 665 people

Job function

Support

R&D

Graduation

Doctoral

Bachelor

Master
<table>
<thead>
<tr>
<th>NECTEC R&amp;D Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Institute of Technology for Persons with Disabilities and Elderlies</strong></td>
</tr>
<tr>
<td><strong>Intelligent Informatics Research Unit</strong></td>
</tr>
<tr>
<td><strong>Thai Microelectronics Center</strong></td>
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<tr>
<td><strong>Electronics and Computer Equipment Certification Section</strong></td>
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<tr>
<td><strong>Information Communication and Computing Research Unit</strong></td>
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<tr>
<td><strong>Innovation and Engineering Development Unit</strong></td>
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<tr>
<td><strong>Thai Organic and Printed Electronics Innovation Center</strong></td>
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<tr>
<td><strong>Biomedical Electronics and Systems Development Unit</strong></td>
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<tr>
<td><strong>Advanced Automation and Electronics Research Unit</strong></td>
</tr>
<tr>
<td><strong>Wireless Information Security and Eco-Electronics Research Unit</strong></td>
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<tr>
<td><strong>Intelligent Devices and Systems Research Unit</strong></td>
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EGAT’S MAIN DAM

<table>
<thead>
<tr>
<th>Region</th>
<th>EGAT</th>
<th>Royal Irrigation Department (RID)</th>
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<tbody>
<tr>
<td>North</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Central region.</td>
<td>-</td>
<td></td>
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<tr>
<td>Northeastern.</td>
<td>7</td>
<td>8</td>
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<tr>
<td>East</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>South</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14</strong></td>
<td><strong>21</strong></td>
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<tr>
<th>Region</th>
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<tr>
<td>Central region.</td>
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<tr>
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<td>222</td>
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<tr>
<td>East</td>
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<td>47</td>
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<tr>
<td>West</td>
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<td>7</td>
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<tr>
<td>South</td>
<td>1</td>
<td>31</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>20</strong></td>
<td><strong>367</strong></td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>34</strong></td>
<td><strong>388</strong></td>
</tr>
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</table>

Electricity Generating Authority of Thailand (EGAT)
Contracted Capacity Type of Fuel
Year 2010

Capacity of EGAT = 14,998 MW or 48.50%
Capacity of Independent = 15,922 MW or 51.50%
Total Capacity = 30,920 MW

REGCO, KEGCO, RGCO, IPT, TECO, GLW, EPEC, BLCP, GPG And RPCL
THPL, HHPC, NTN-2, and NNG-2
HVDC (High Voltage DirectCurrent Transmission) - Thailand - Malaysia
Is this a lake?

Thailand’s Worst Disaster in 70 Years... (2011)

Is it a canal?
33 Large Dams and Reservoirs

November 1, 2011

80% ขึ้นไป  เกณฑ์น้ำดีมาก 29 แห่ง
50 - 80%  เกณฑ์น้ำดี 3 แห่ง
30 - 50%  เกณฑ์น้ำพอใช้ 1 แห่ง
≤ 30%  เกณฑ์น้ำน้อย - แห่ง

หมายเหตุ: เขื่อนแควน้อยเริ่มเก็บกักน้ำในฤดูฝนปี 5252
Past earthquake locations in South East Asia

- **Dam failure or levee breeches:**
  * Hydrological and seismic hazards
  * Old dams were built with old safety standard
  * Dam failure is disastrous

- **High possibility of earthquake in this region:**
Chi-Kang Dam, Taiwan
Effect from Chi-Chi Earthquake (Sep 20, 1999)
Object: to ensure that all EGAT Dam’s structure do not create unacceptable risks to public safety and welfare, property, the environment and cultural resources.

Risk
- Flood
- Earthquake
- Reservoir Operation (Missed Operation)

Dam Monitoring
- Dam Behavior => Not Conform with Design Criteria
- Hydrology & Flood => Over than Design
- Seismic Force => Over than Design

Degree of Damage
- Low
- Medium
- High

Impact (if Failure)
- Social
  - High (Low Water Level)
- Generation
  - High
EGAT'S DAM SAFETY REMOTE MONITORING SYSTEM

- Bhumibol dam
- Srinagarind dam
- Rajjaprabha dam
- Ubolratana dam
- Chulabhorn dam
- Pak Mun dam
- Mae Chang dam
- Sirikit dam
- Vajiralongkorn dam
- Bang Lang dam
- Sirindhorn dam
- Huai Kum dam
- Nam Pung dam
- Upper Pond lamtaklong

EGAT - Civil Maintenance Engineering
- Electricity Maintenance Engineering
- Geology
- Hydrology

NECTEC - Softwares
- Electronics
- Telecommunication
DAM SAFETY REMOTE MONITORING SYSTEM

Hydro-Meteorological Instruments
- Reservoir Water level
- Tailrace Water level
- Rain
- Evaporation
- Air Temperature
- Humidity

Dam Instruments
- Seepage
- Hydraulic piezometer
- Open standpipe piezometer
- Observation well
- Weir
- Settlement & Displacement

Seismological Instruments
- Seismometer
- Accelerometer

- DAM SAFETY ONLINE MONITOR
- EXPERT SYSTEM
- WAR ROOM
Automatic Dam Behavior Monitoring System, 2007
Hydro-Meteorological and Dam Instruments

Field Devices

Remote Terminal Unit

Sensor

4-20mA Signal

Protocol

Control Room Devices

Communication

Master station server & HMI
Behavior Inspection System of Dam, 2009-2010
Seismic Monitoring
MEMS based seismometer

Electricity Generating Authority of Thailand (EGAT)
Seismometer Network

MYANMAR (Burma)
Phuket
Phnom Penh
Ho Chi Minh City
Cambodia
Gulf of Siam
Malaysia
Kuala
Penang
India
SEAMAN SEA
Laos
Hanoï
Luang Prabang
Pattaya
Bangkok
Thailand
Laos
Myanmar
Burma

GPRS
LAN
GPRS
GPRS
GPRS
Dam Safety Remote Monitoring System

Implement on 2013-2016
Hydro-Meteorological Instruments

Dam Instruments

Seismological Instruments

RTU. (Remote Terminal Unit)

fiber optic cable

DAM SERVER

Database Server

CONTROL ROOM

OFFICE

DAM

EGAT NETWORK

EGAT Head Office

WAR ROOM

Internet

Intranet

Bhumibol dam
Srinagarind dam
Rajjaprabha dam
Ubolratana dam
Chulabhorn dam
Pak Mun dam
Mae Chang dam

Sirikit dam
Vajiralongkorn dam
Bang Lang dam
Sirindhorn dam
Huai Kum dam
Nam Pung dam
Upper Pond lamtaklong
Land slide monitoring system

- 3 stations in Mae-Hong-Song
- 243 stations in Chaingmai

Village/Community

Data center

Light

Sound

Web site broadcasting
Decision Support System of tap water - Metropolitan Water Authority
PaaS for Early Disaster Monitoring System

- Data Presentation Management
  - Disaster Visualization
  - Disaster Notification

- Data Processing Management
  - Landslide
  - Cold
  - Earthquake
  - DAM Behavior
  - ...

- Data Acquisition Management
  - Catalog Service
  - Sensor Profile Service
  - Data Caller
  - Data Transformer
  - Data Importer

- Data Storage
  - SQL Database
  - NoSQL Database
  - File System

- API

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Service
Thank you for your attention