Vietnamese - German University

The Scientific Workshop and Exhibition: Introduction to VGU Research Directions

Binh Duong, October 9th 2018

10 years VGU Vietnamese-German University 2008 - 2018

WORKSHOP AGENDA

Time	Activities	Author/presenter
8.30 - 9.00 (30 mins)	Welcome & Registration	
9.00 - 9.15 (15 mins)	Opening speech from representative of PB VGU	Prof. Dr. Tomas Benz
9.15 - 9.55 (40 mins)	IT-Security in times of cloud computing, big data and IoT	Prof. Dr. Martin Kappes
9.55 - 10.05 (10 mins)	Q&A	
10.05 - 10.25 (20 mins)	Wireless sensing network to monitor air pollution	Dr. Vo Bich Hien and Dr. Khieu Huu Loc
10.25 - 10.35 (10 mins)	Q&A	
10.35 - 10.55 (20 mins)	Towards Livability: Assessment of Quality of Life in Urban Areas of Binh Duong	Dr. Pham Thai Son
10.55-11.05 (10 mins)	Q&A	
11.05 - 11.25 (20 mins)	Model-Driven Security & Privacy	Assoc. Prof. Manuel Garcia Clavel
11.25 - 11.35 (10 mins)	Q&A	
In parallel with the presentation session 11.35 - 12.10 (35 mins)	Tea breaks + Poster session (All posters are exhibited in the conference room) + Photo group	VGU lecturers, open research discussions and sharing
12.10 - 13.00 (50 mins)	Lunch at VGU	
13.00 - 13.40 (40 mins)	Development and application of smart brake featuring magneto-rheological fluid (MRF)	Assoc. Prof. Dr. Nguyen Quoc Hung
13.40 - 13.50 (10 mins)	Q&A	
13.50 - 14.10 (20 mins)	Protection of Aggregated Energy Storage Systems in AC and DC Micro-grids	Dr. Bui Minh Duong
14.10 - 14.20 (10 mins)	Q&A	
14.20 - 14.40 (20 mins)	Tea break	
14.40 - 15.00 (20 mins)	Examining the service efficiency of Vietnamese banking system	Dr. Le Minh Hanh
15.00 - 15.10 (10 mins)	Q&A	
15.10 - 15.30 (20 mins)	Research in Computational Fluid Dynamics: Some applications	Dr. Ho Xuan Thinh
15.30 - 15.40 (10 mins)	Q&A	
15.40 - 16.00 (20 mins)	Novel chemical and biological methods to treat wastewaters in Viet Nam	Dr. Tran Le Luu
16.00 - 16.10 (10 mins)	Q&A	
16.10 - 16.30 (20 mins)	Closing remarks	Assoc. Prof. Dr. Pham Van Song

PREFACE

The Scientific Workshop and Exhibition: Introduction to VGU Research Directions organized by the Department of Research Management, Vietnamese – German University on 9th October 2018. It brings together the emerging researchers and international experts, who will disseminate their latest thoughts, researches and outcomes to public through technical sessions, keynote talks and poster exibitions.

This event aims to present the results of notable researches as well as the scientific research potential of VGU's academic staff. On this occasion, three key research groups of VGU will be introduced. The establishment of these research groups will further expand the research capacity at VGU, which is turning 10 this year as a leading research-oriented university in Vietnam and in the region.

Objectives of the workshop are to introduce remarkable researches of VGU's academic staff, to exchange and to share professional knowledge in order to expand potential research cooperation with Institutes, Universities, Departments and Enterprises in Vietnam and abroad.

Thank you for attending our workshop, we hope that you find it informative and look forward to welcoming you in our next event!

ACKNOWLEDGMENT

First of all, we would like to express our cordial thanks to all who helped make this conference successful. We have much pleasure to thank the Department of Science and Technology, Ho Chi Minh city for their partially funding and the very efficient support during the workshop.

Secondly, we would like to express our very special thanks to Prof. Dr. Tomas Benz, President of VGU, who supported the local organization committee in organzing the Workshop. Our appreciations also go to the lecturers whose posters and research presentations would be presented at the event.

Thirdly, we would like to address a particular warm thank to the members of the scientific committee for their participation and expertise in the preparation of the event.

Last but not least, the organizers gladly acknowledge VGU staff who helped out with the organization and logistics to make sure that the formal steps run smoothly, which was already visible by how remarkable and smooth registration proceeded.

Sincerely,

Research Management Department.

IT-Security in Times of Cloud Computing, Big Data and IoT

Prof. Dr. Martin Kappes
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Informationssicherheit und Datenschutz
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Tel. +49 69 1533 2971

FRANKFURT UNIVERSITY OF APPLIED SCIENCES

Content

- New Chances, New Risks:
  The Limits of Classical Security Measures
- Information Security 4.0:
  Concepts and Strategies
- Examples:
  Cloud Computing, Big Data, IoT
- Information Security 2025
  Complex Event Processing, Anomay
  Detection, Netzwork Optimization

Research: General Aim

- Head of Research Group for Network and Information Security, Frankfurt UAS
- Applied research in Information Security, particularly Network Security and Surveillance
- Jointly with partners from industry and academia
- Developed solutions are not only academically sound, but also deliver innovation and immediate value to our project partners from industry

Research: Focus Areas, Technology

- Modern Paradigms for Network Analysis and Surveillance: Event-Driven Architecture and Complex Event Processing.
- Heuristic Network Optimization: Evolutionary Computing and other heuristics.
- Network Anomaly Detection: Machine Learning, Smart Grid
- Network Forensics: Case-Based Reasoning

It is Difficult to Predict the Future

„Everything that can be invented has been invented.“ --

Charles H. Duell, Commissioner, U.S. Office of Patents, 1899.

It is Difficult to Predict the Future

„I think there is a world market for maybe five computers.“ --

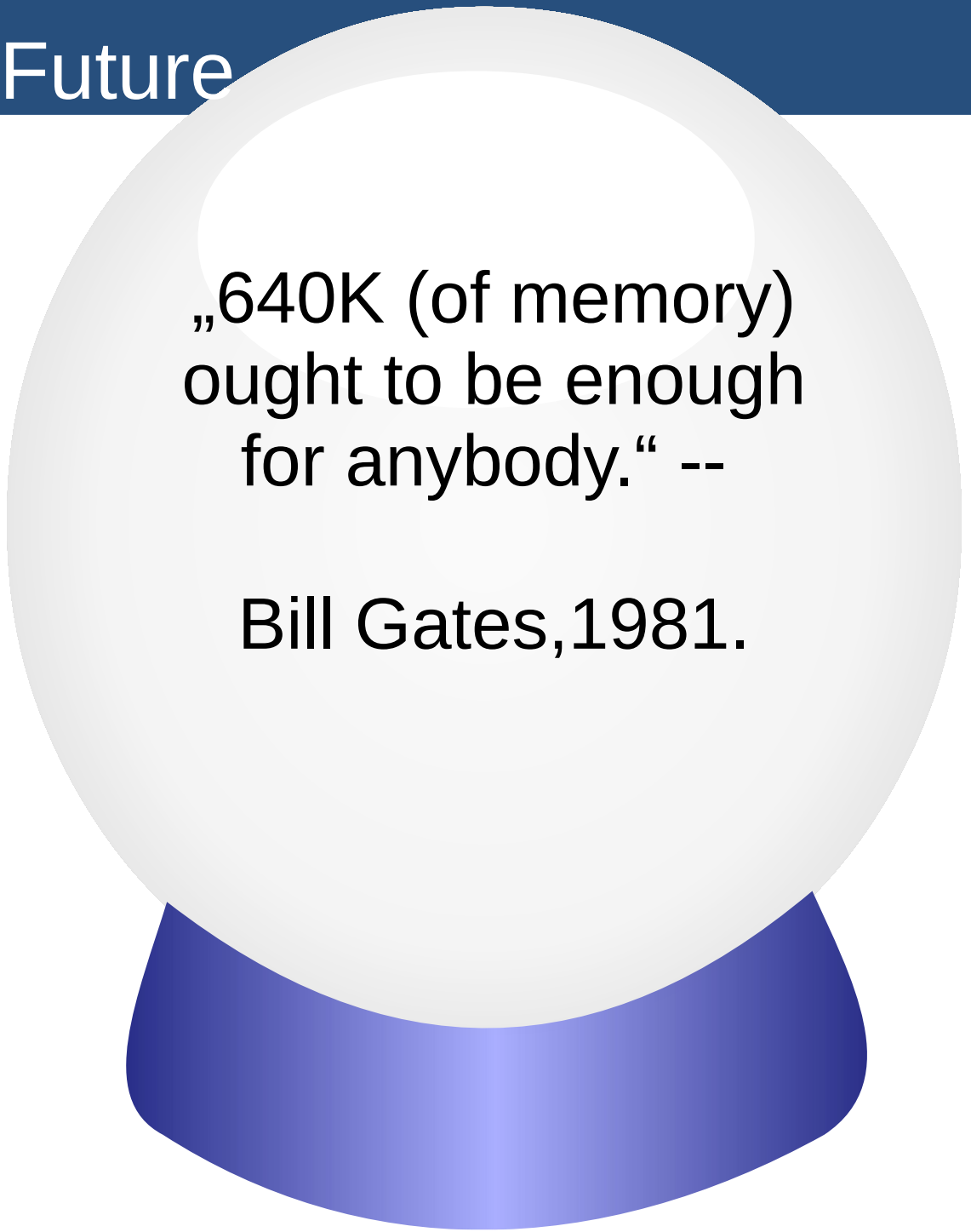
Thomas Watson, chairman of IBM, 1943.

It is Difficult to Predict the Future

„There is no reason anyone would want a computer in their home.“ --

Ken Olson, president, DEC, 1977.

It is Difficult to Predict the Future



„640K (of memory) ought to be enough for anybody.“ --

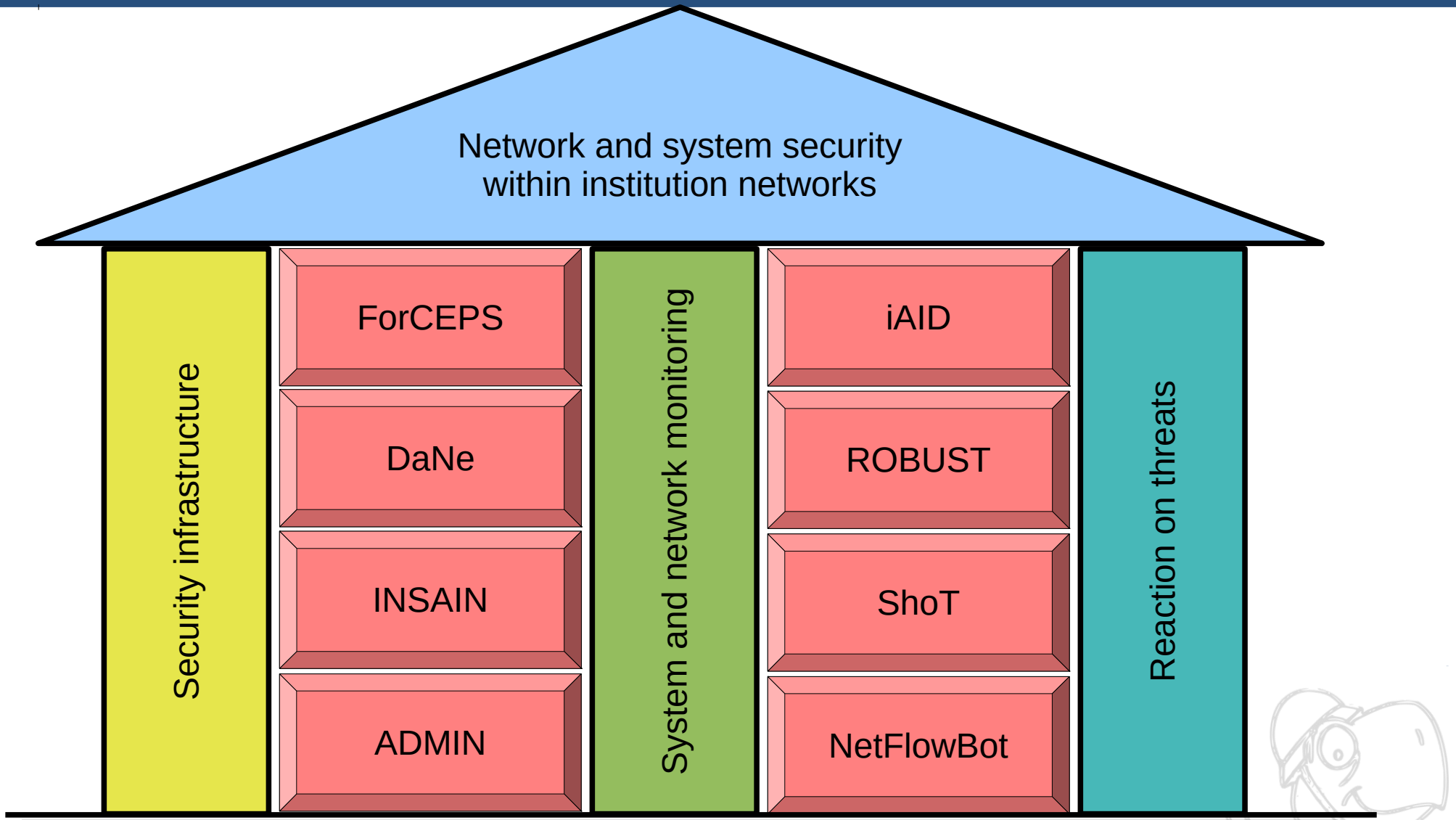
Bill Gates,1981.

It is Difficult to Predict the Future

„I see little commercial potential for the internet for the next 10 years.“ --

Bill Gates,1994.

Our Mission


Network and system security within institution networks
Security infrastructure
ForCEPS
DaNe
INSAIN
ADMIN
System and network monitoring
iAID
ROBUST
ShoT
NetFlowBot
Reaction on threats
Recognition of topology
Distributed surveillance
Anomaly Detection
Perimeter security
Security modules
Orchestrated deployment
Complex Event Processing
Network optimization
Automated defense

New Paradigms and Trends in Information Processing

- Industry 4.0
- Cloud Computing
- Data Analytics (Big Data)
- Mobile Devices, IoT

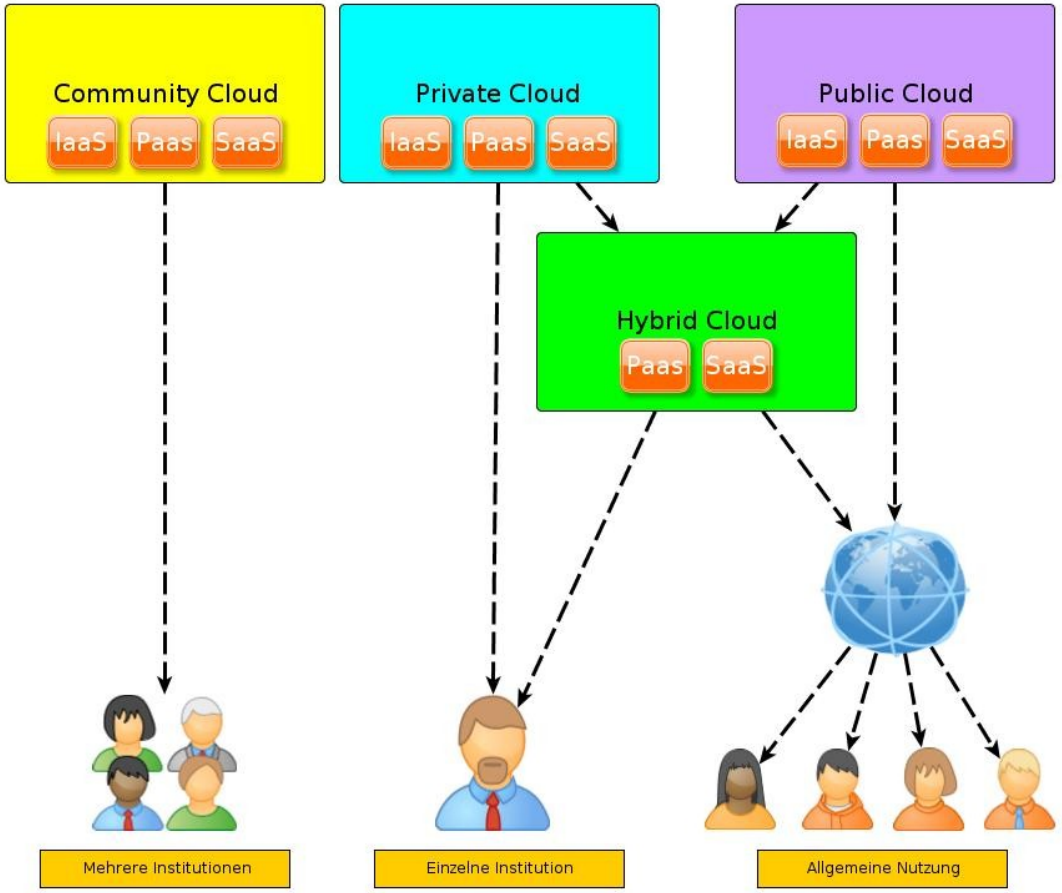
New Paradigms and Trends in Information Processing

- Industry 4.0
  - Automation and Data Exchange in Manufacturing and Logistics
- Cloud Computing
  - Outsourcing to third parties, provision via Internet
- Data Analytics (Big Data)
  - Information extraction also from big, complex data
- Mobile Devices, IoT
  - Mobile and „invisible“ IT

Industry 4.0

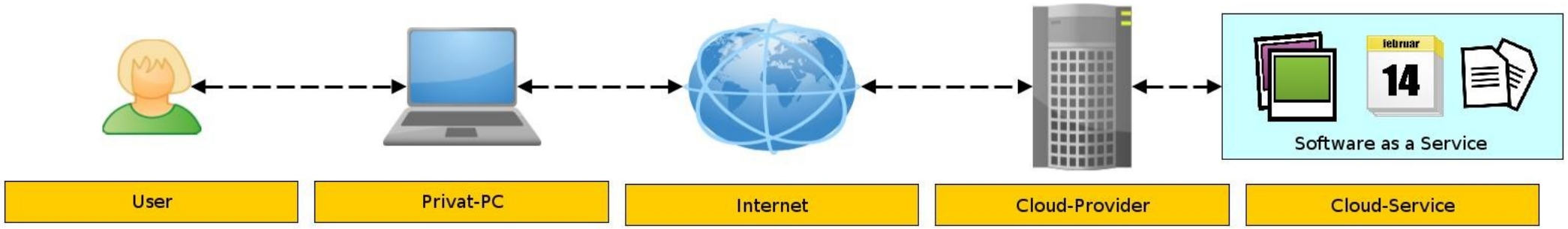
- Refers to the integration of industrial production/logistics with the Internet
- Term was coined by policics and comprises different, heterogeneous trends and technologies
- Undisputable trends:
  - Higly flexible production series,batch size 1
  - Self-optimization, -configuration and -diagnostics
  - New value chains
- Breaking isolation of IT in production generates massive security problems

Cloud Computing: Types



- Public Cloud: Outsourcing of IT-Services to external providers, provision (mostly) via Internet

Cloud Computing: Public Cloud



- Public Cloud: Outsourcing of IT-Services to external providers, provision (mostly) via Internet

Big Data (Data Analytics)

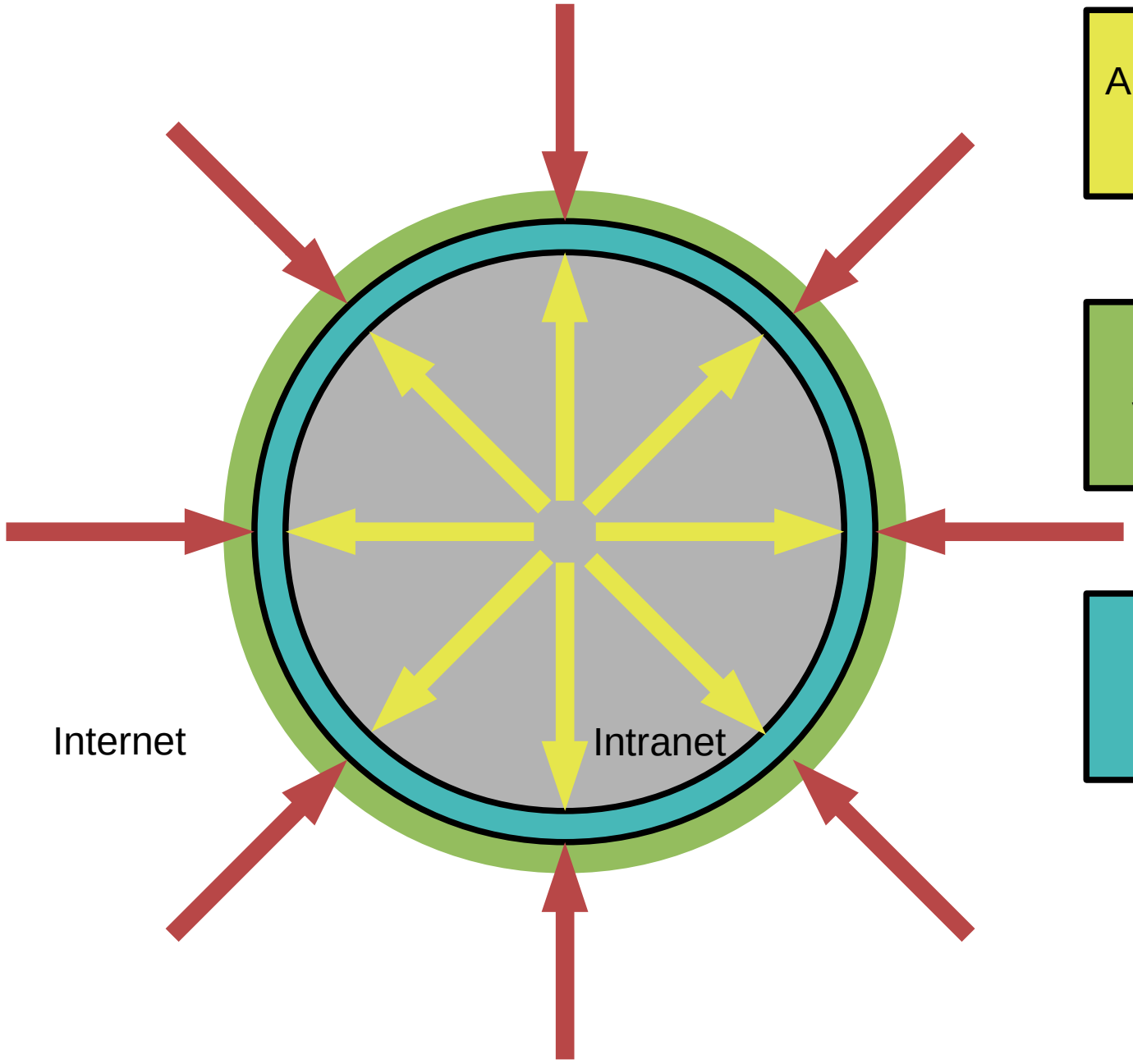
- Amount of available data is growing very fast
- Analysis is getting more complex, but offers more possibilities at the same time
- Often: Simple analysis of large amount of data

- **Analysis is often an external service (via Public Cloud)**

New Paradigms in Information Processing Break Classical Protection Mechanisms

In Addition, New Risks Arise

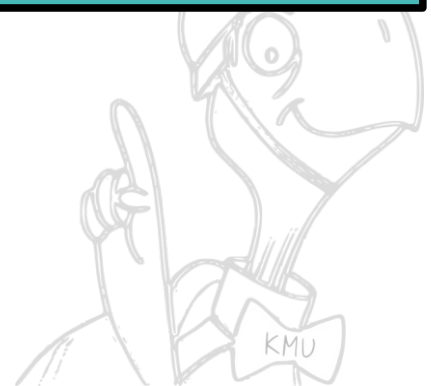
Network and System Security in Institutions: Classical View



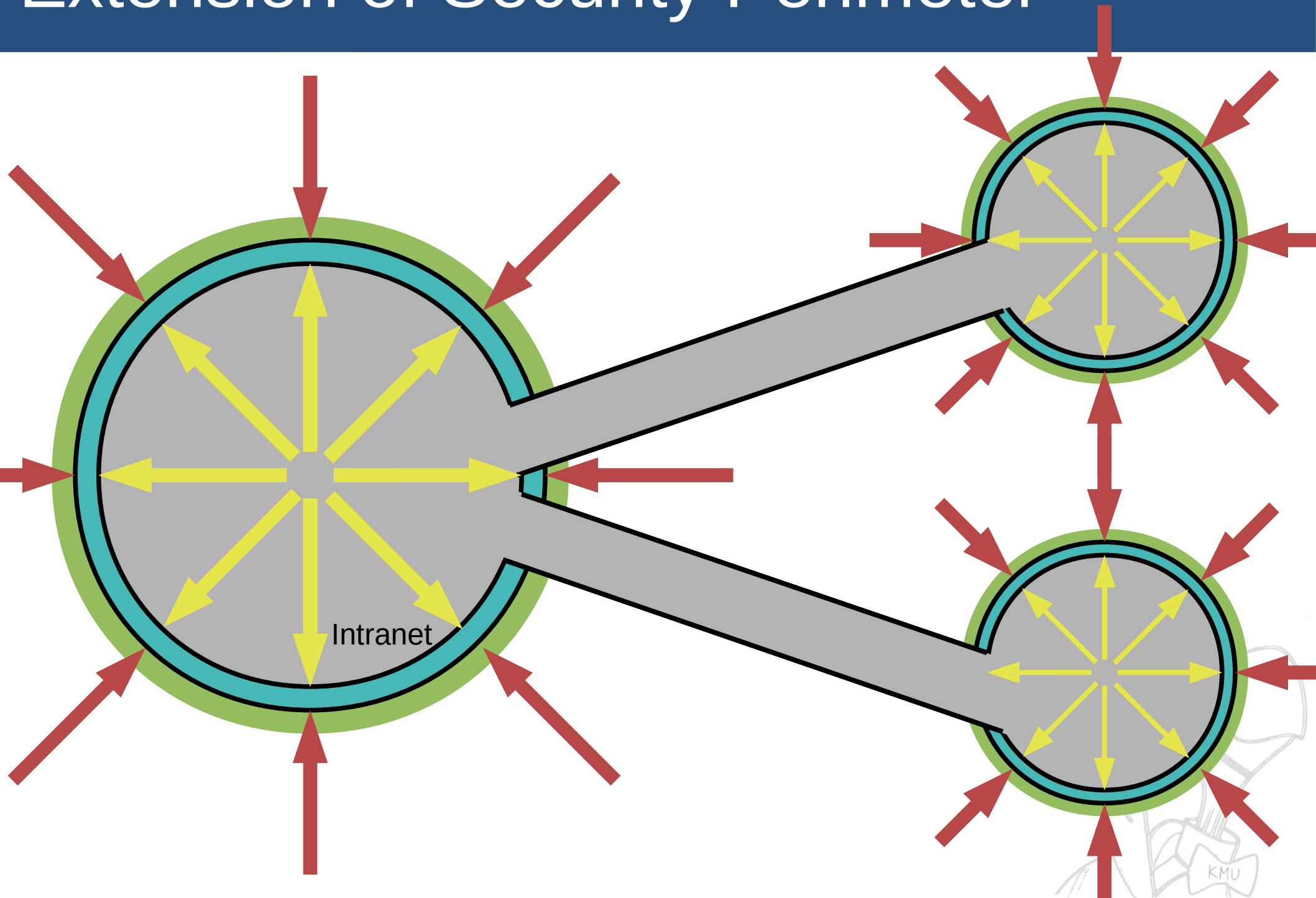
Appropriate security infrastructure within the institution's network

System and network monitoring

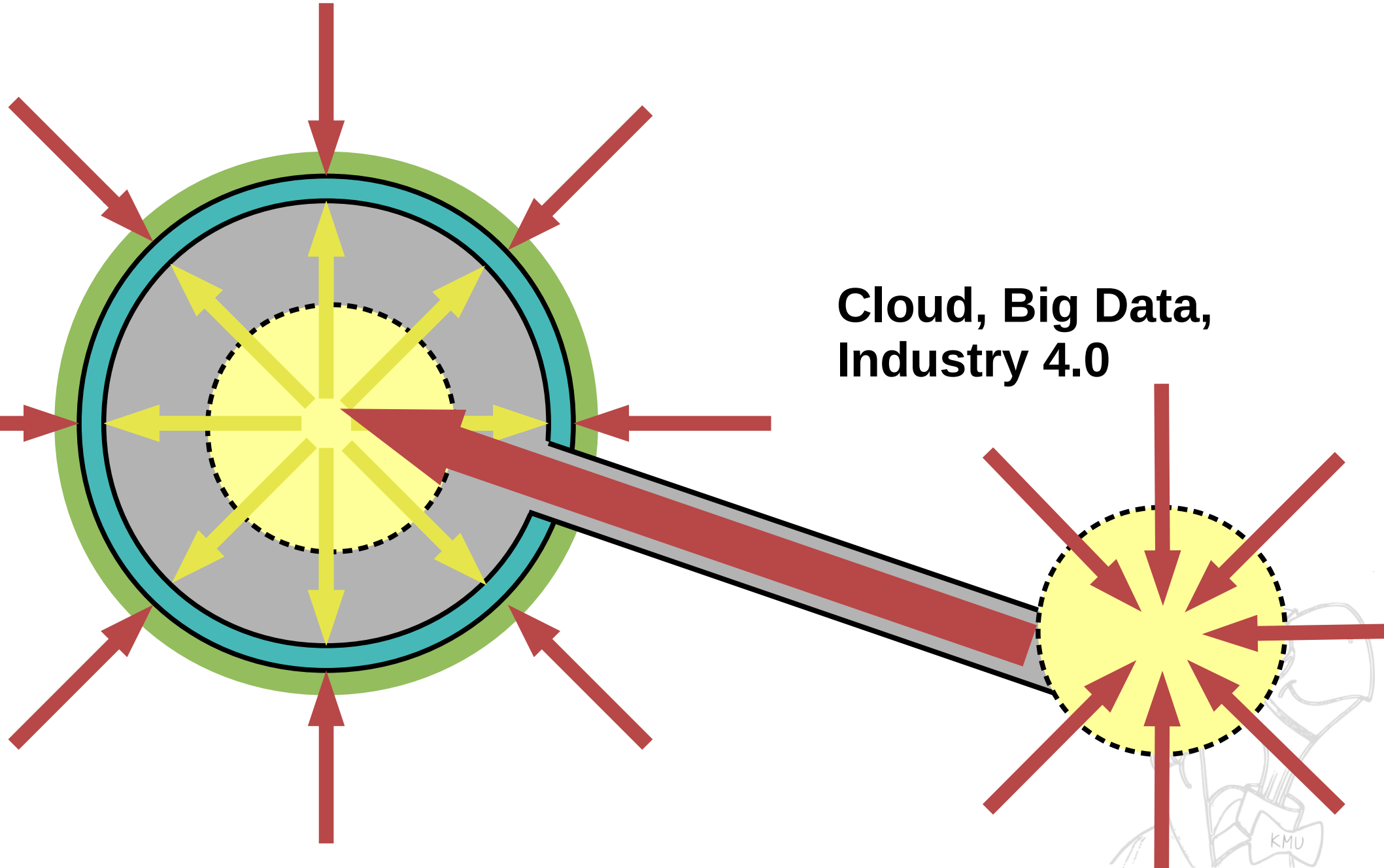
Reaction on threats



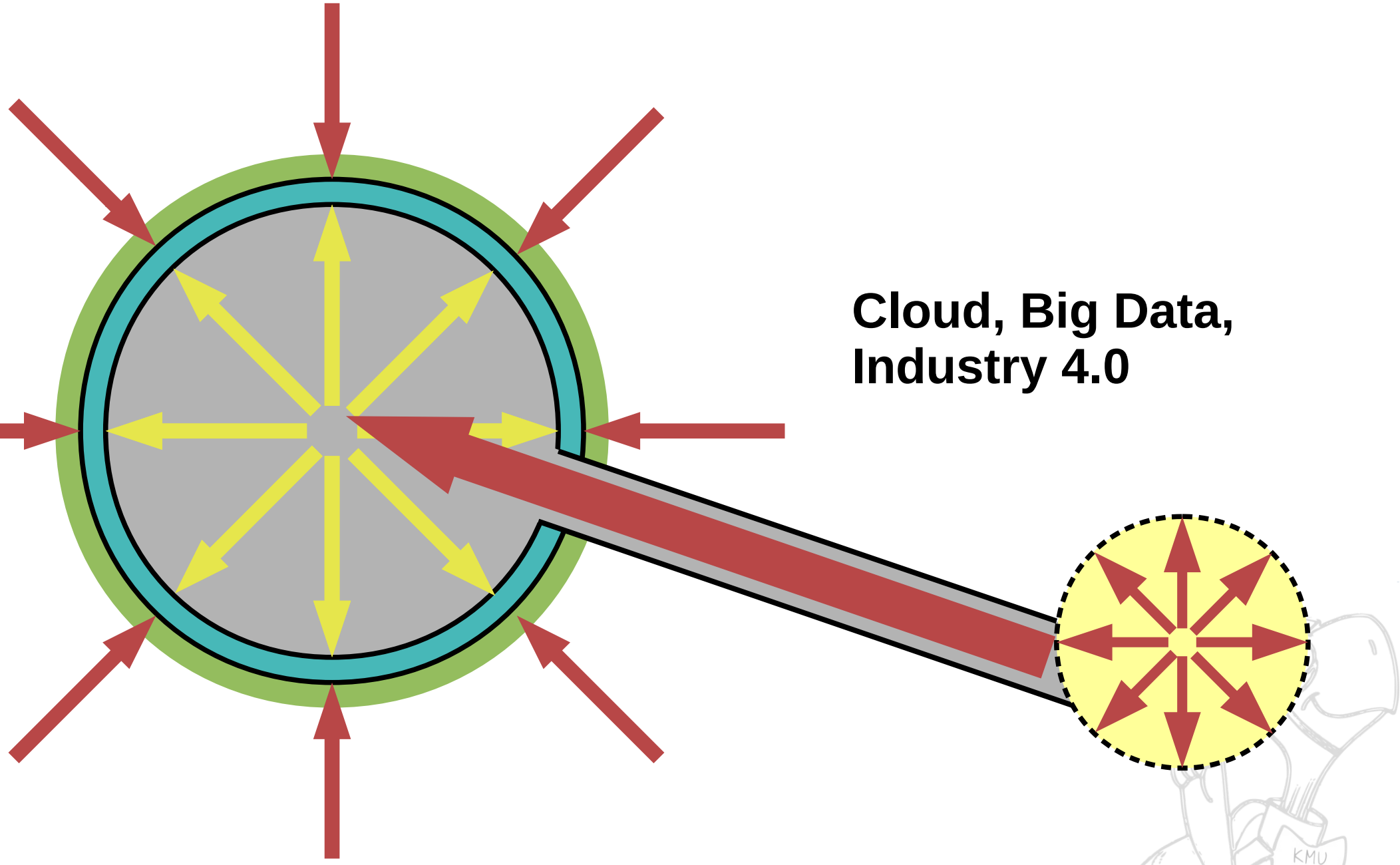
Extension of Security Perimeter



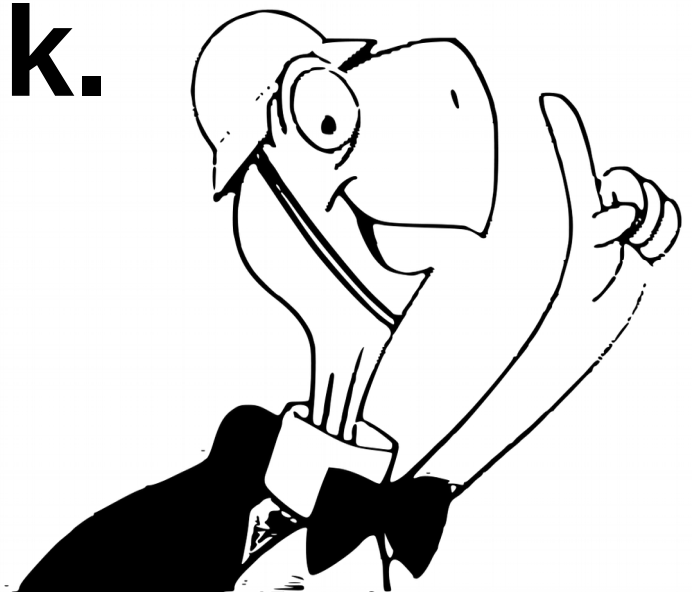
No More Secure Perimeters



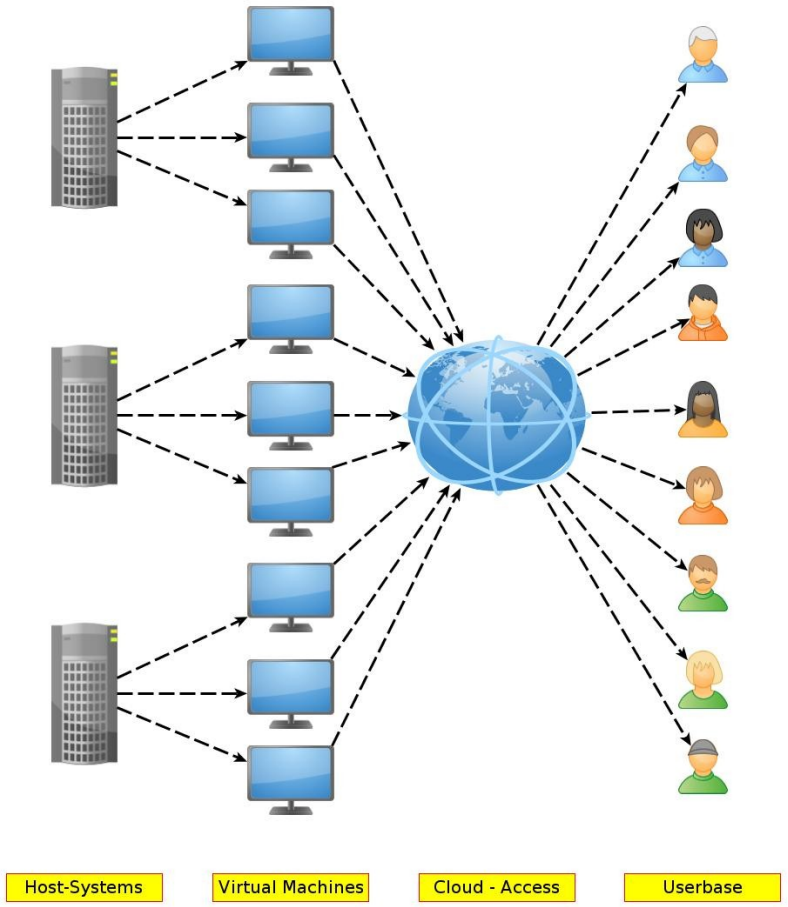
Insider-Attacks Possible



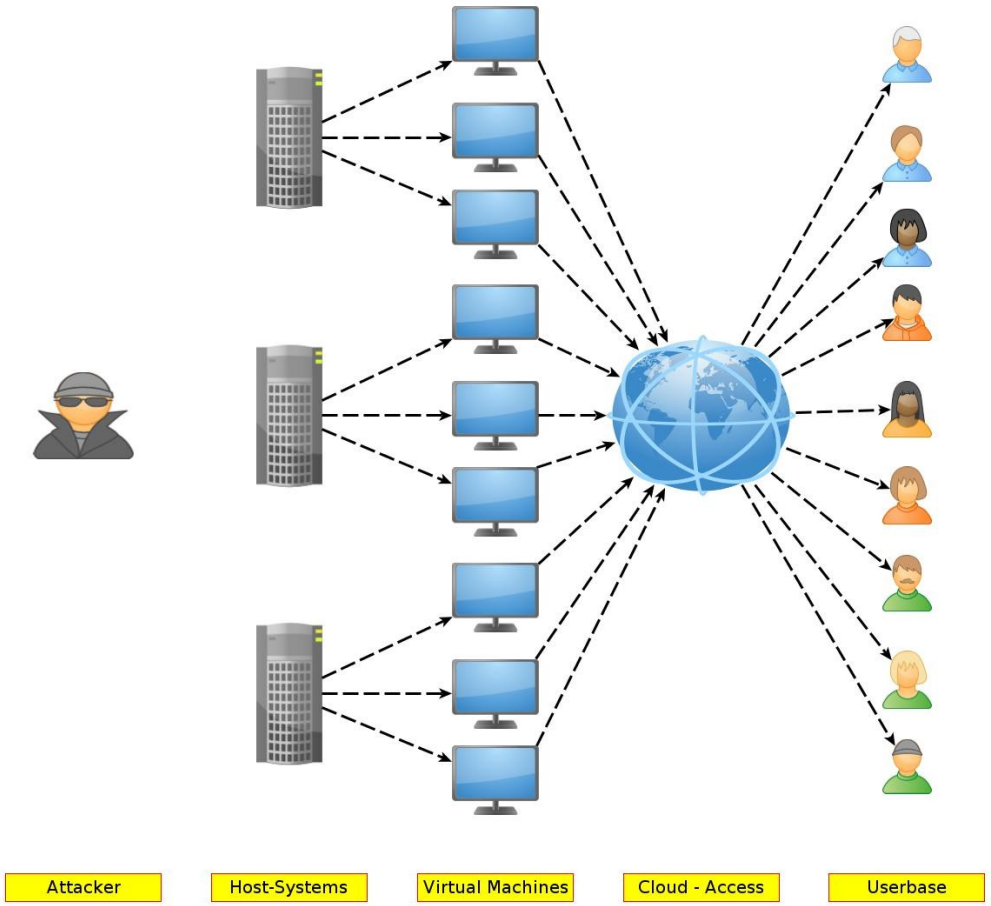
76% (99%) of all SMBs (not) using Cloud Computing see the loss of control over their own data as a risk.

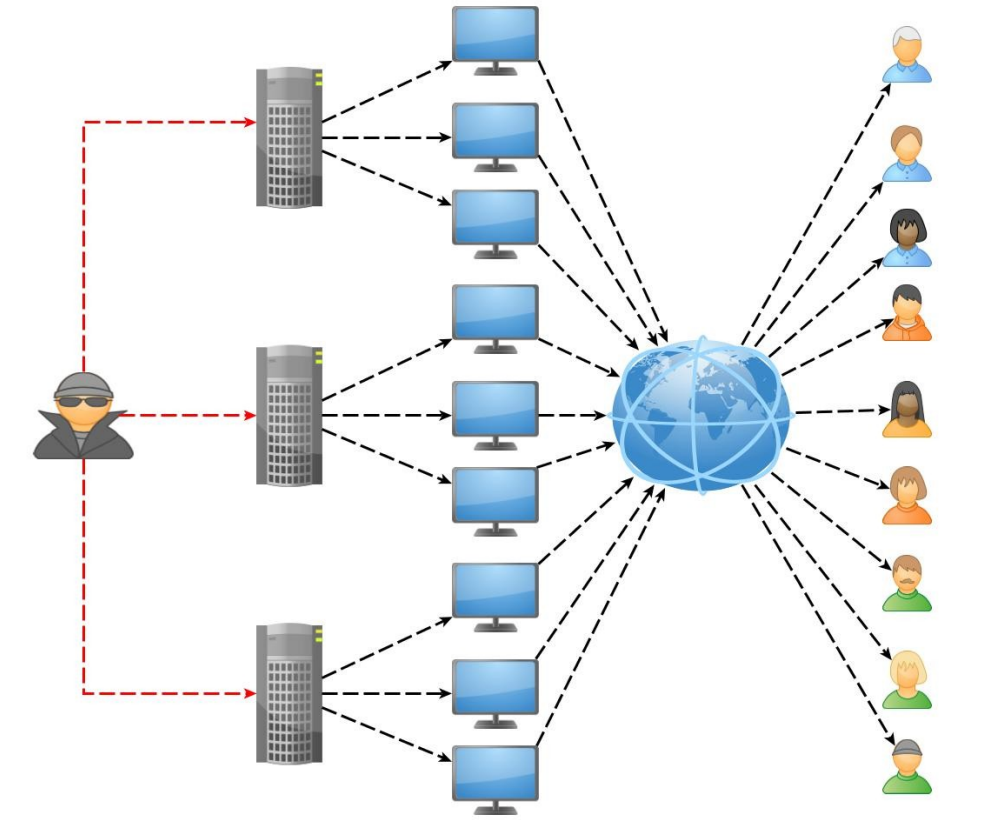


Cloud Computing



Cloud Computing: Insider Attacks

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Host-Systems
Virtual Machines
Cloud - Access
Userbase


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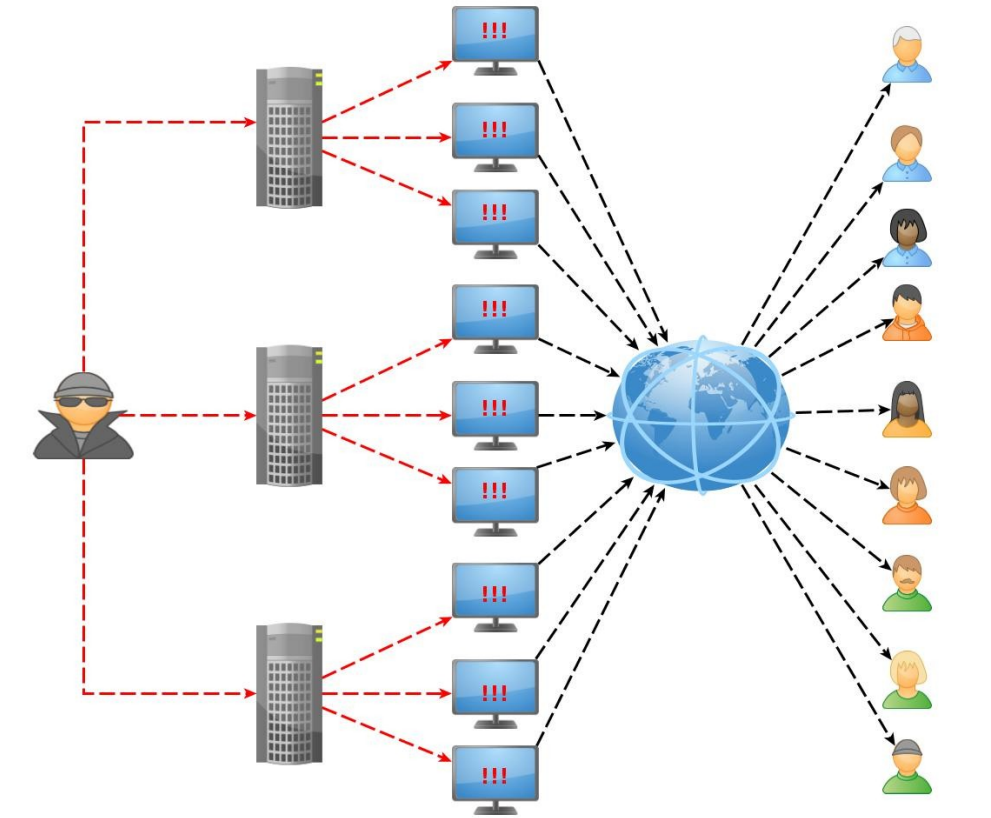
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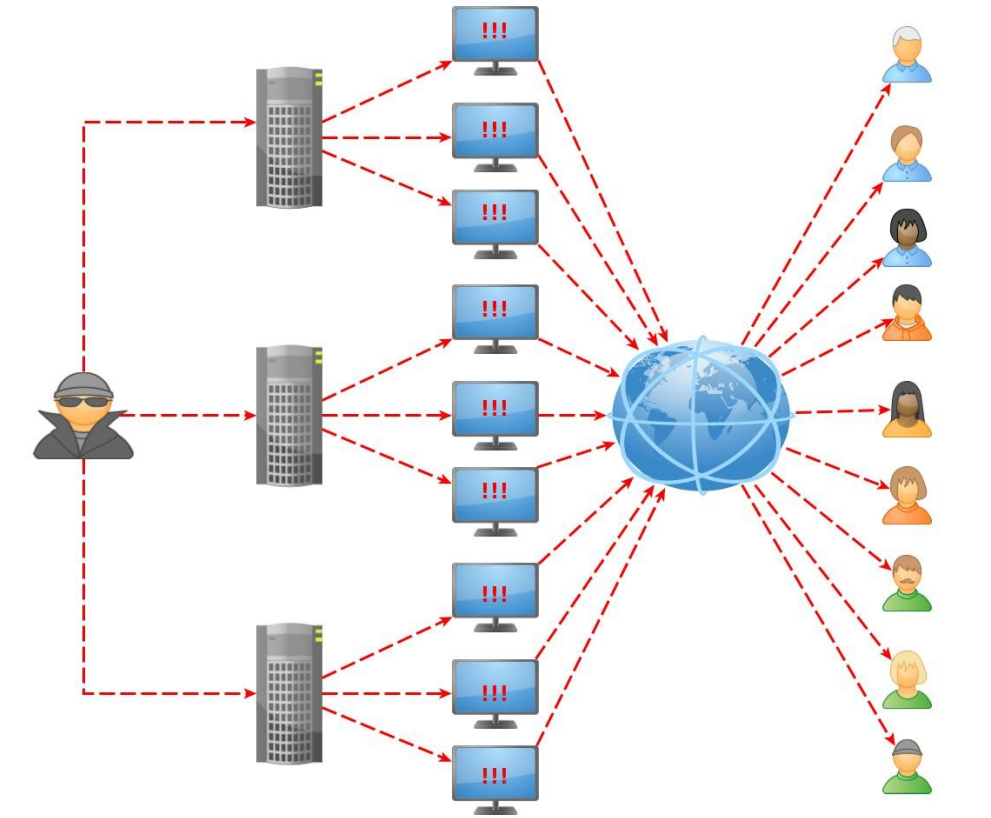
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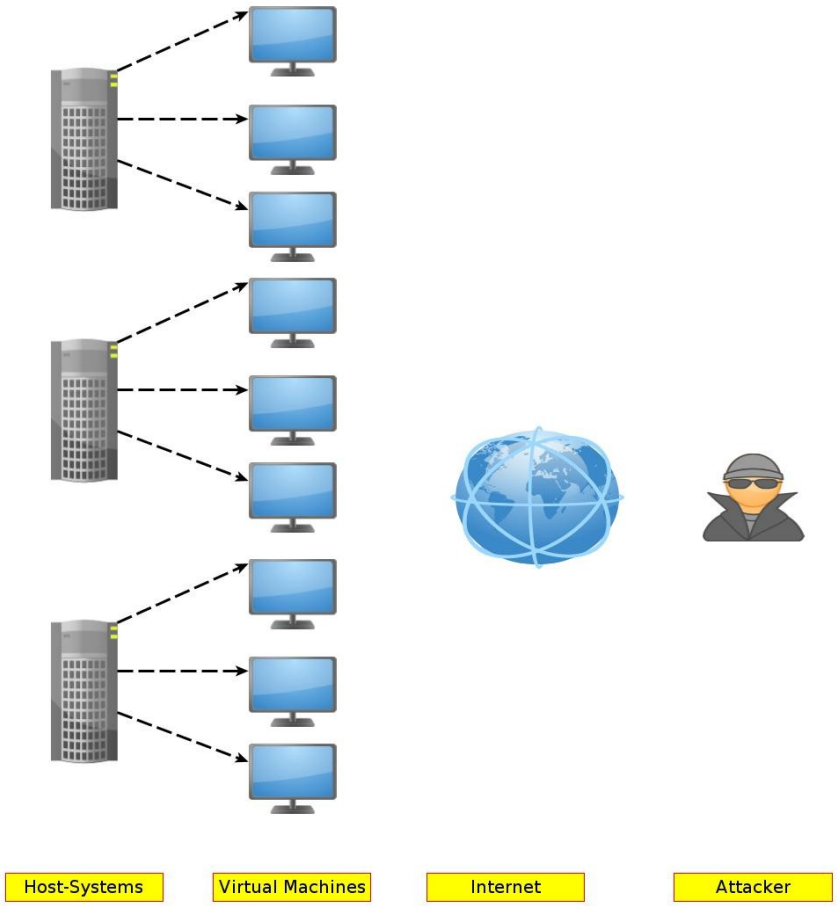
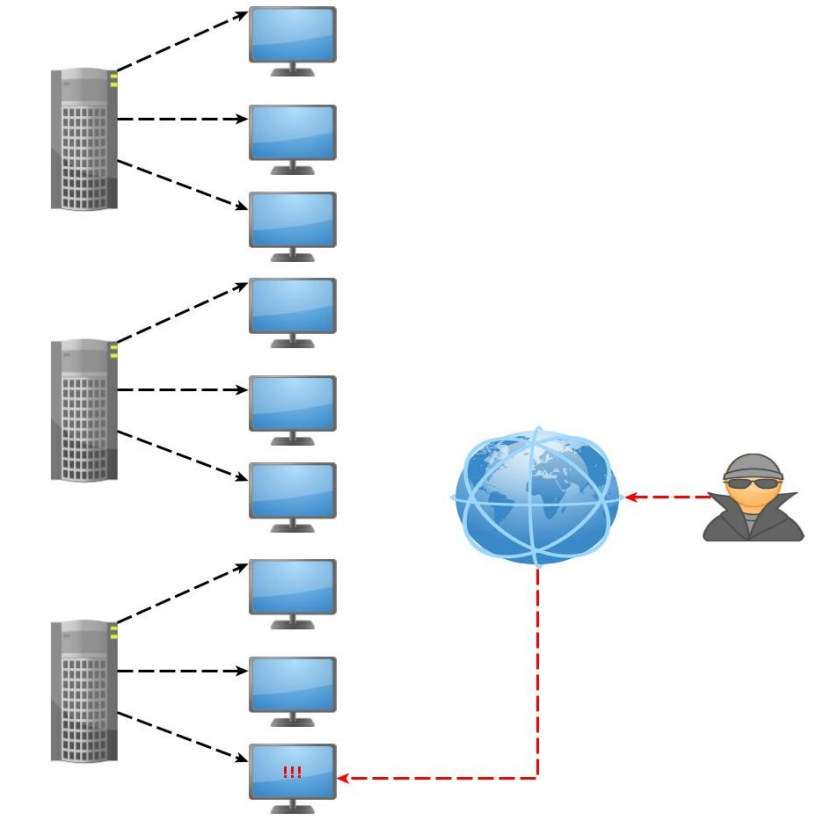
Cloud Computing: Breakout Scenario

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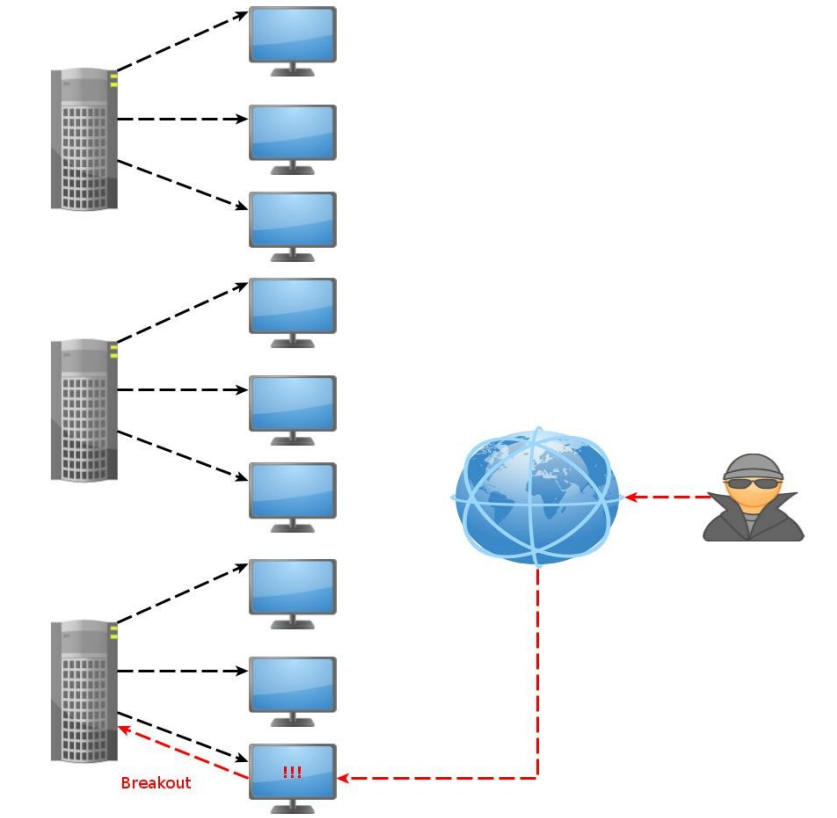
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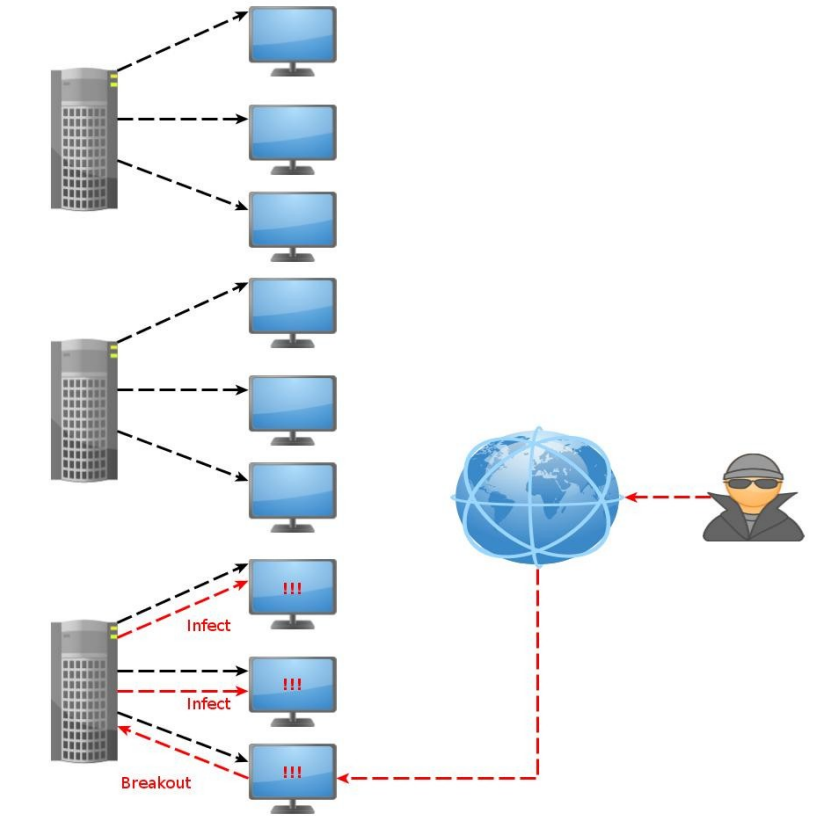
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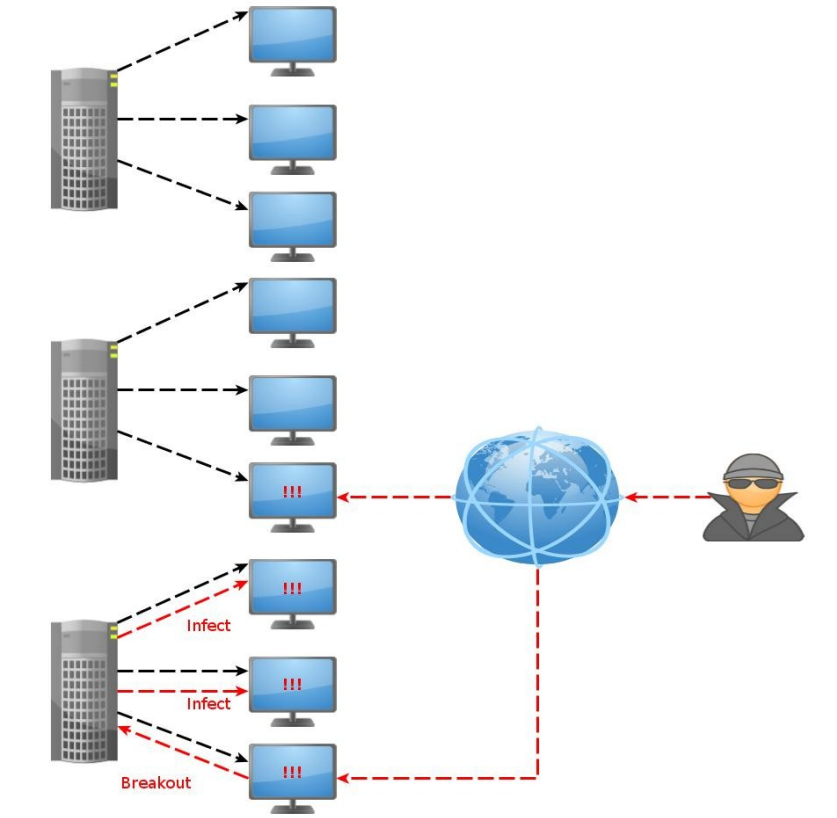
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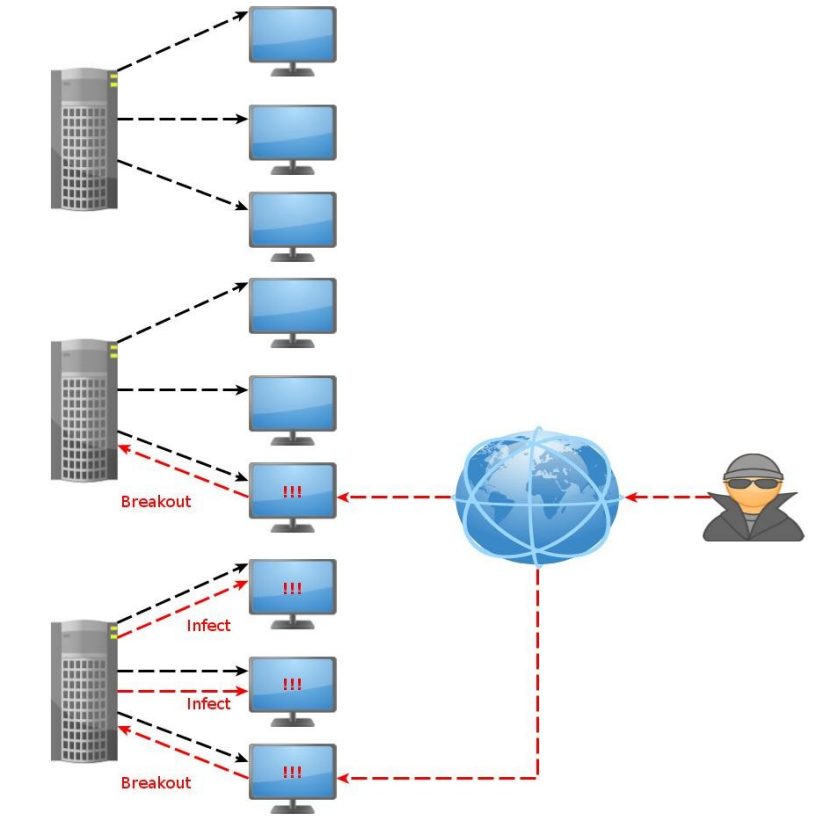
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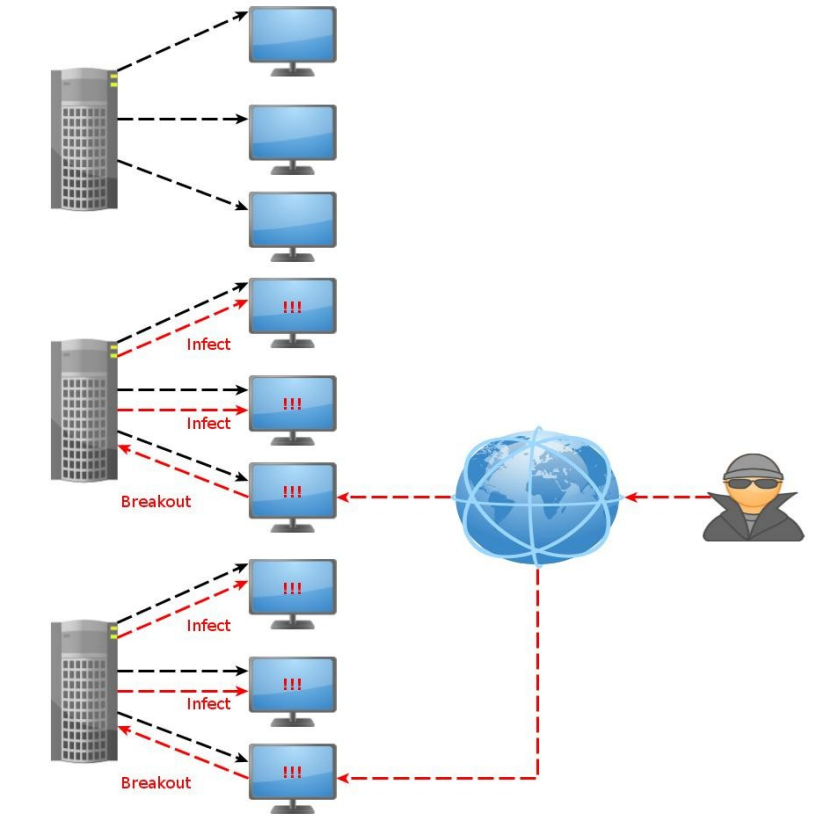
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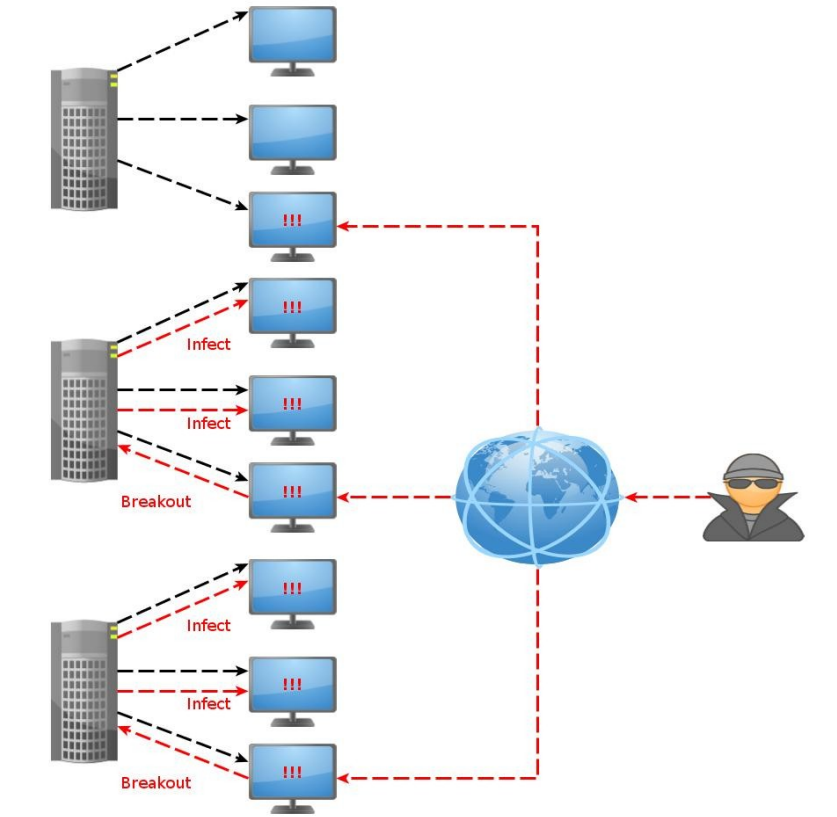
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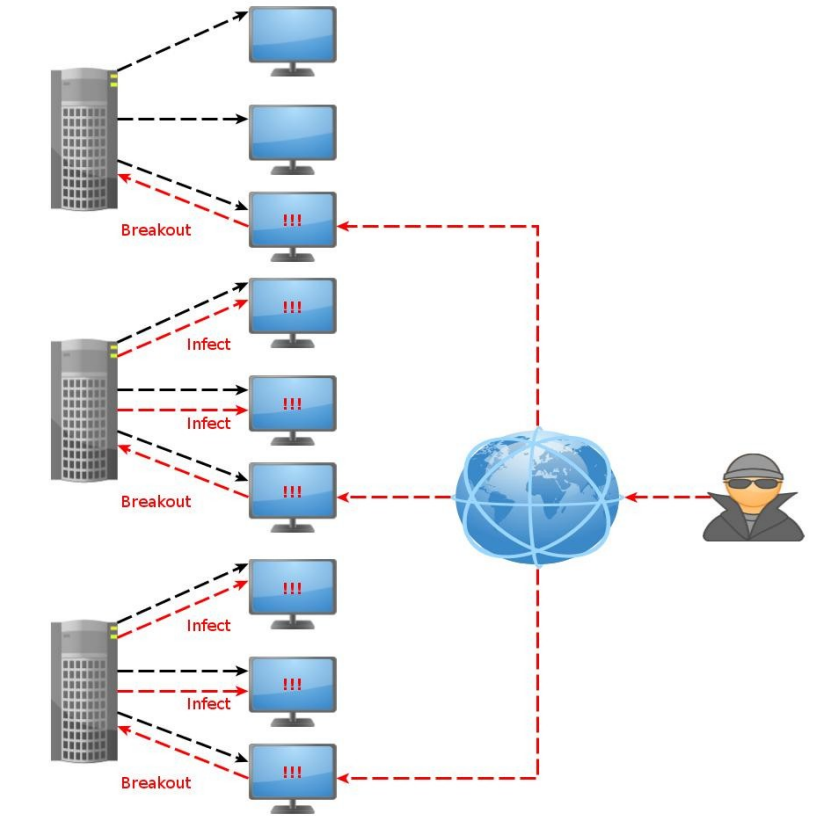
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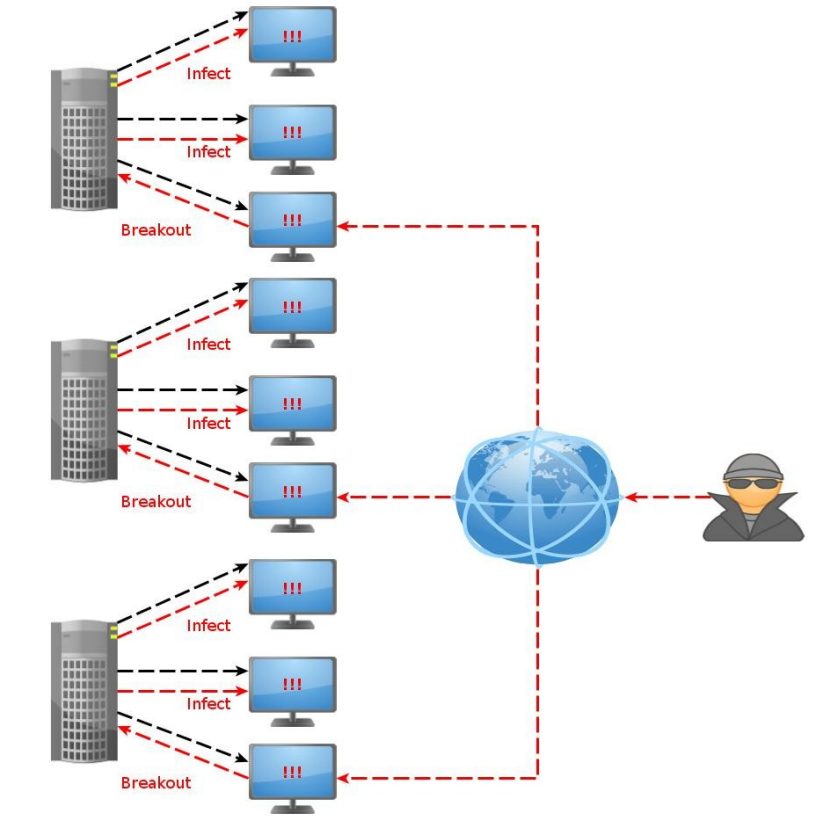
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Cloud Computing: Risiks

- **Only the customer knows its protection requirements**:
  All IT-Security aims are affected:
  confidentiality, integrity, availability
- Confidentiality
  - Data theft, blackmail
- Compliance / Data Protection
  - Place of data processing, mandatory deletion, contractors
- Availability
  - Provider insolvency, confiscation, network

Confidentiality, Integrity and Availability are in the Hands of the Provider!

Cloud Computing in a Secure Manner

- Choice and trustworthiness of provider are crucial! Check thoroughly!
  - Check IT-Security at provider against own requirements
  - Check compliance and data protection
- Plan the security of own infrastructure exactly and implement
  - Security of Cloud Computing also depends on the client
- Have an exit-strategy before you start
  - Re-migration, deletion

Secure Digitalization

Develop a Digitalization Strategy Tailored to the Enterprise

Thorough Technical and Legal Choice of the Right Offers and Technologies

Adjust, Further Develop and Implement Internal IT-Security accordingly.

Continuous Monitoring

Secure Digitalization

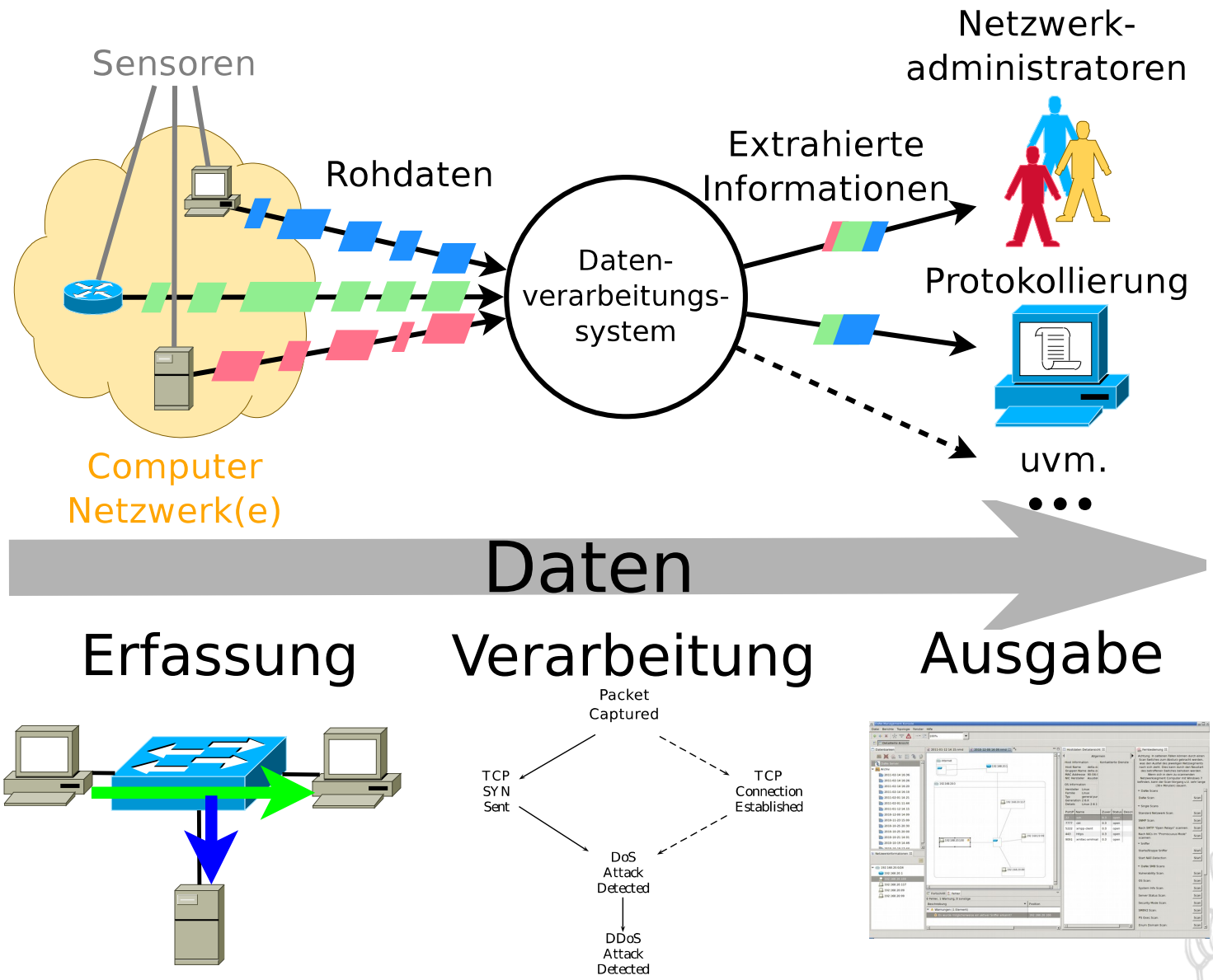
- Develop a digitalization strategy tailored to the enterprise
- Thorough technical and legal choice of the right offers and technologies
- Adjust, further develop and implement internal IT-Security accordingly
- Continuous monitoring

Information Security 2025

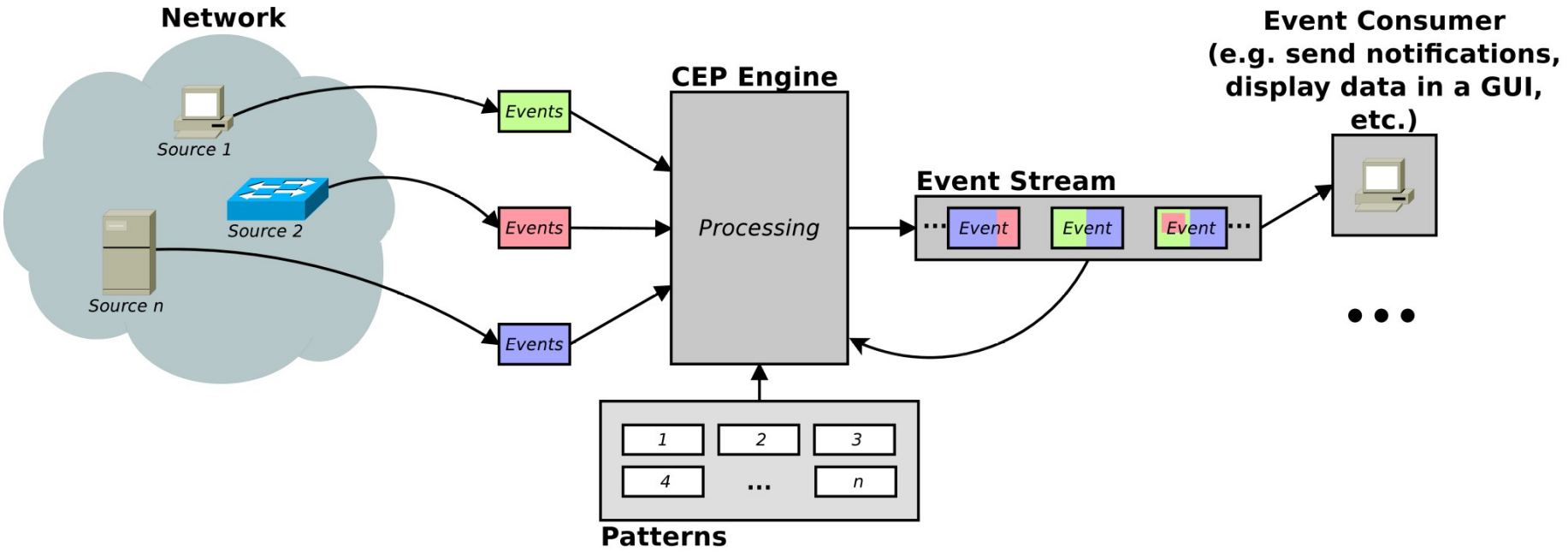
Outlook

Complex Event Processing as New Paradigm for Information Collection in Networks

Complex Event Processing



Complex Event Processing



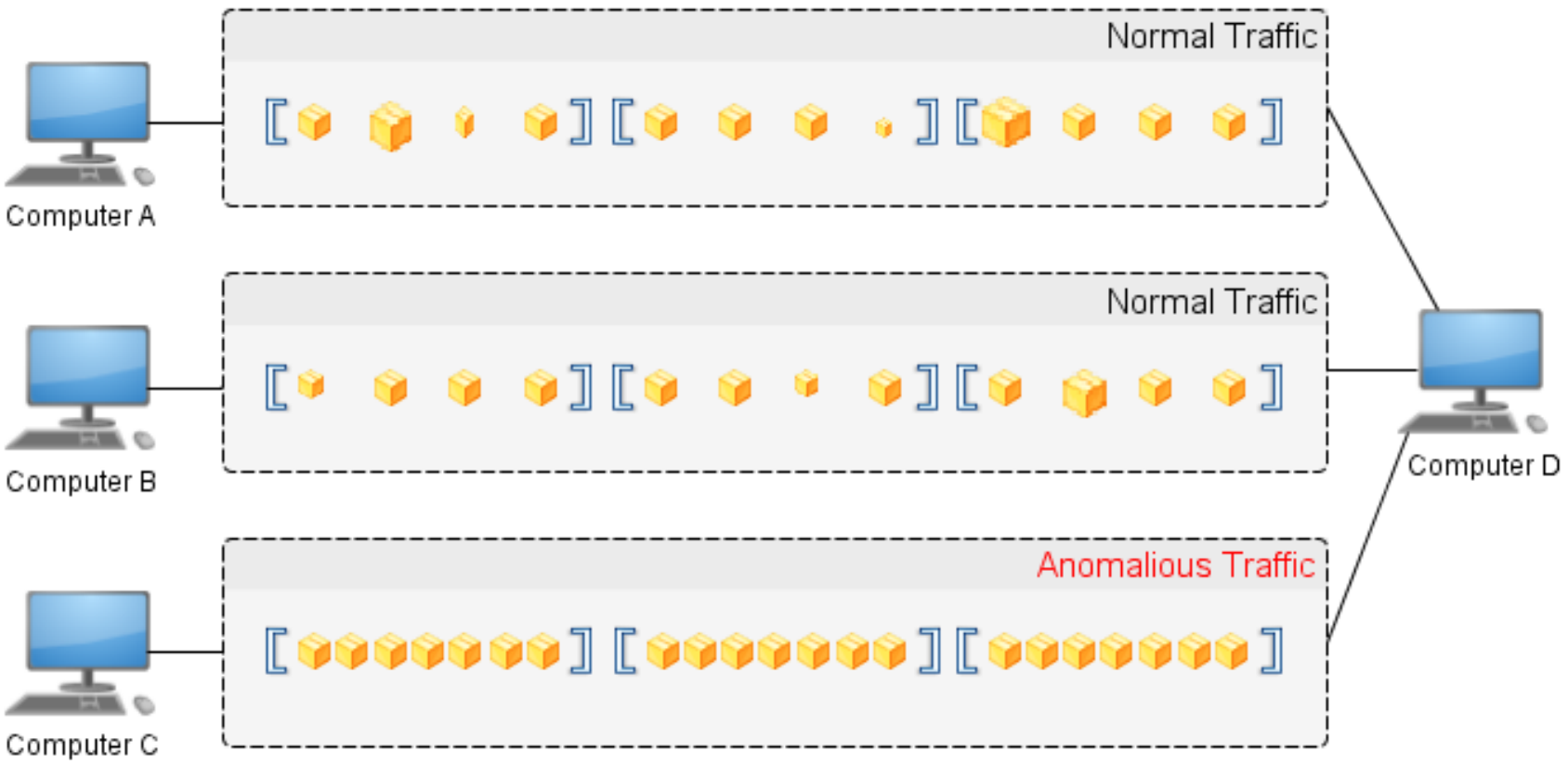
Outlook

Self-Adaptive Network Optimization

Outlook

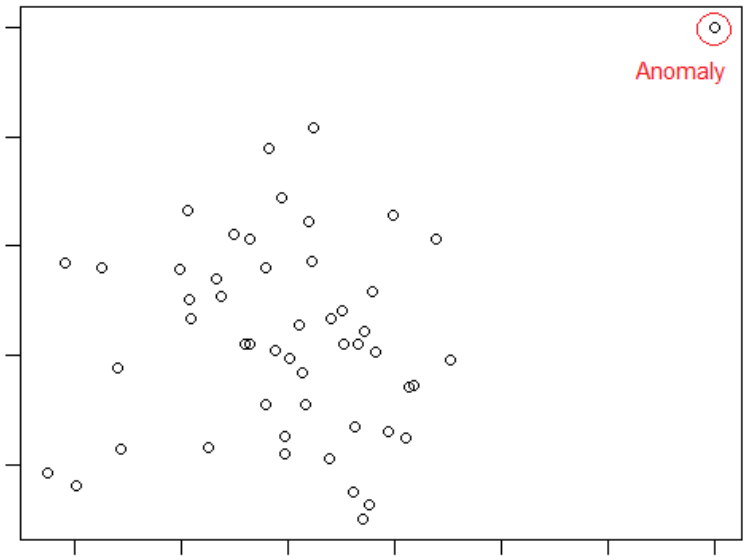
Measuring and Analyzing Traffic in Networks: Anomaly Detection

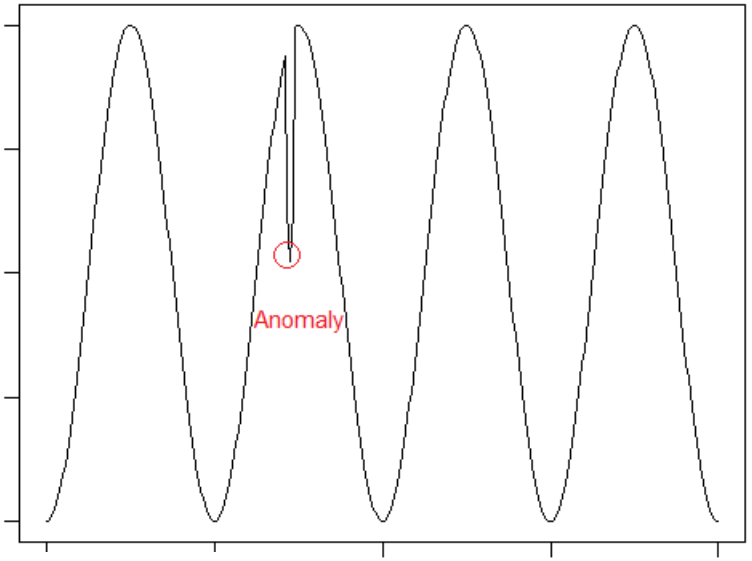
Anomaly Detection

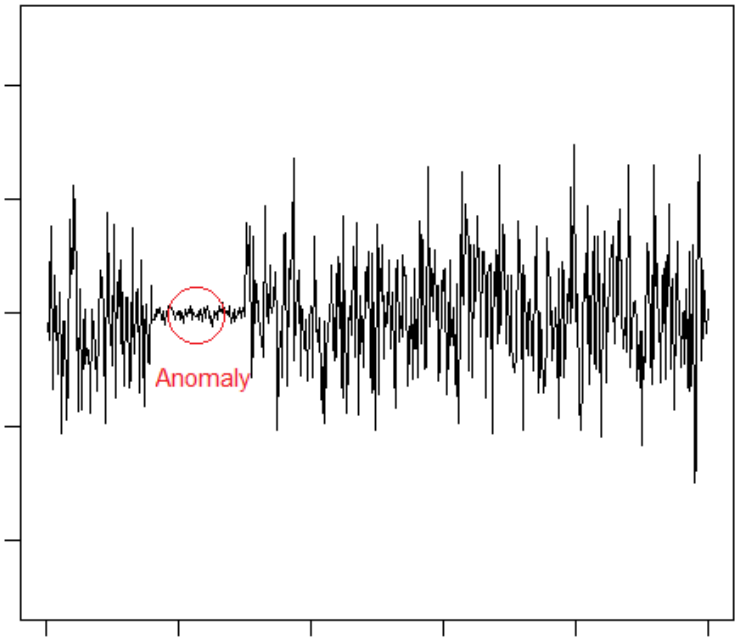


Detection of deviations from „normal“ behaviour

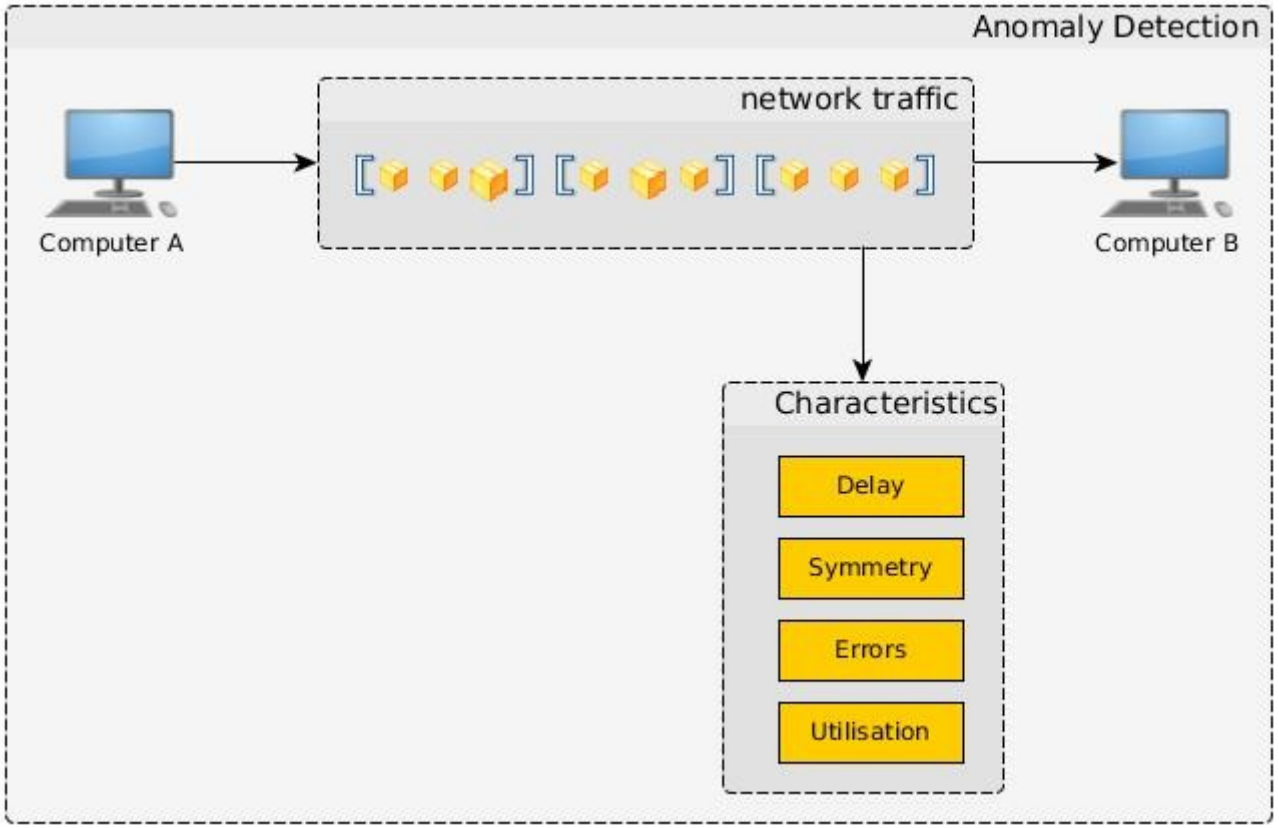
Examples for Anomalies



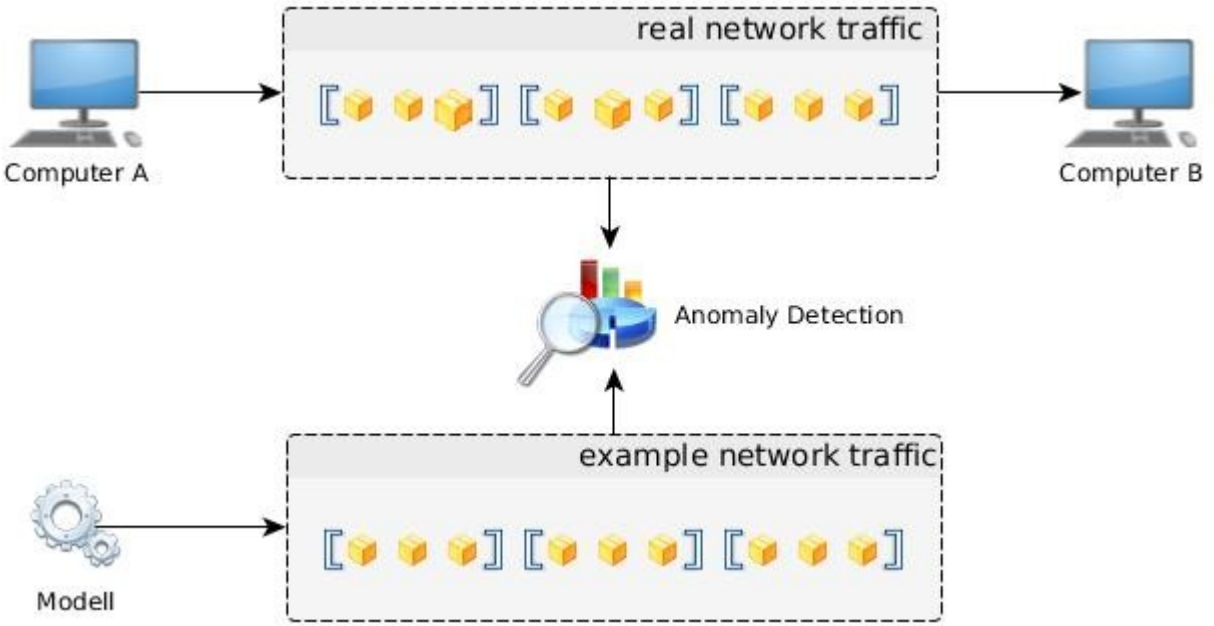




Anomaly Detection



Anomaly Detection



Thank You!

DEVELOPMENT AND APPLICATION OF SMART BRAKE FEATURING MR FLUID

Nguyen Quoc Hung, PhD

ABOUT THE SPEAKER

❖Education background

Level	*Time*	*Institution*	*Major/Specialty*
Engineer	1992-1997	Polytechnic University of Hochiminh City Vietnam	Mechanical Engineering
Master	1997-2000	Liege University Belgium	Mechanics of construction
Doctor	2005-2008	Inha University Korea	Solid Mechanics and Manufacturing Engineering

- ❖ **Profession: Associate Professor**
- ❖ **Position/title: Senior Lecturer in CompEng, VGU**
- ❖ **Main research directions**

  - ***Smart materials and structures***
  - ***Fluid Mechanics***
  - ***Structure Optimization***
  - ***Intelligent Control Systems***

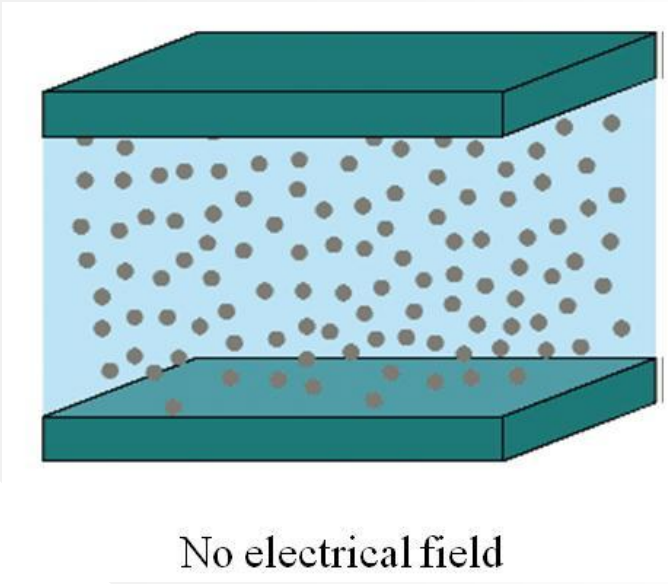
CONTENTS

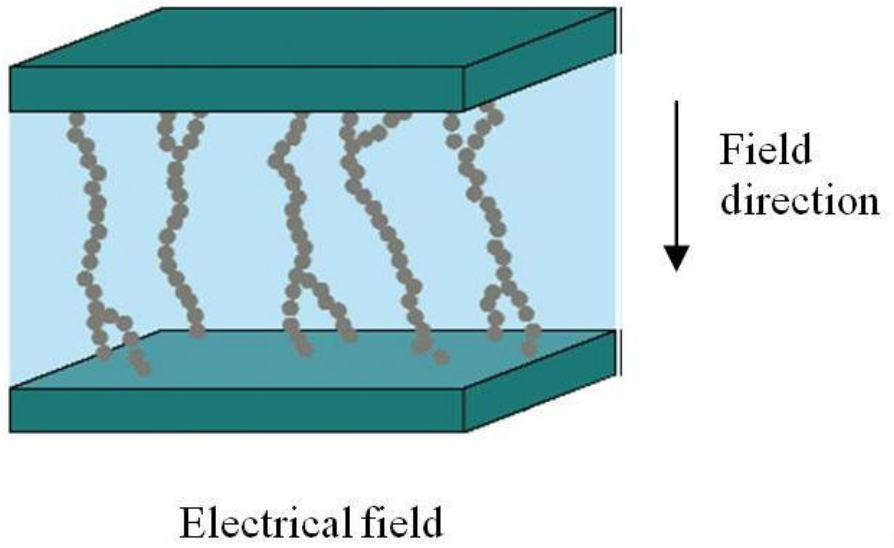
- INTRODUCTION TO MR FLUID
- MR BRAKE DEVELOPMENT
- MR BRAKE APPLICATION IN HAPTIC SYSTEM
- MR CLUTCH DEVELOPMENT
- MR CLUTCH APPLICATION IN SPEED CONTROL

INTRODUCTION TO SMART FLUID

❖ ER Fluid

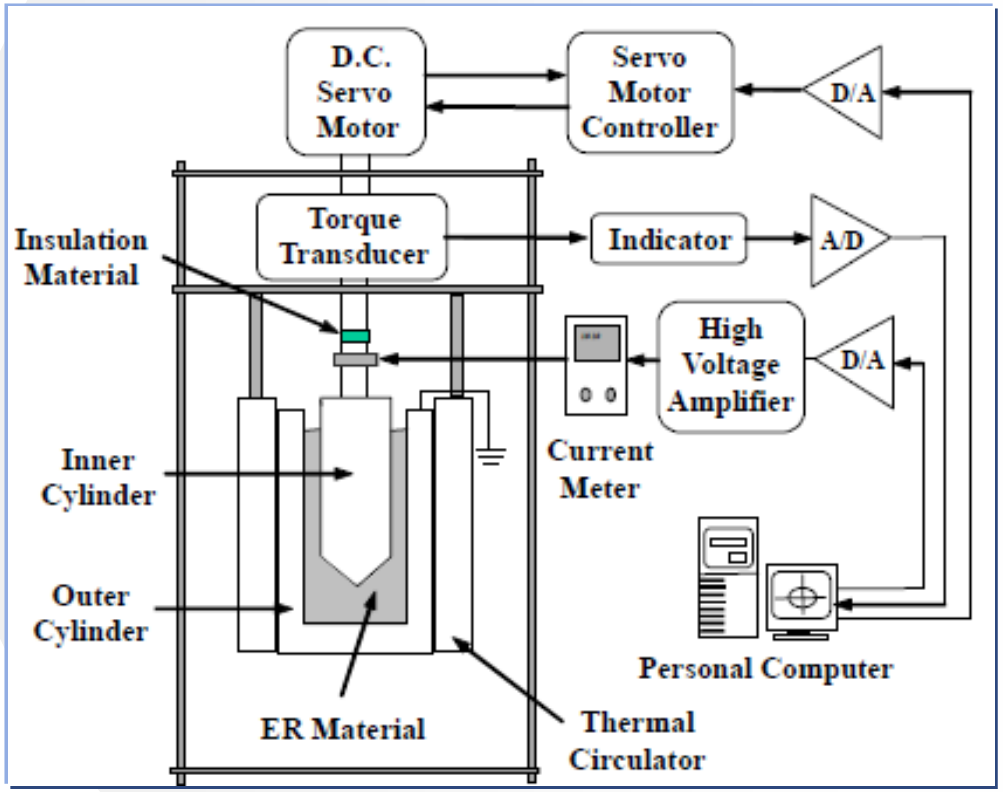
- **Colloidal electrorheological (ER) fluids are a suspension make of nano meter-sized dielectric particles in an insulating carrier liquid.**
- **The reversible liquid-solid transition happens in a several milliseconds when a external electric field exerted.**

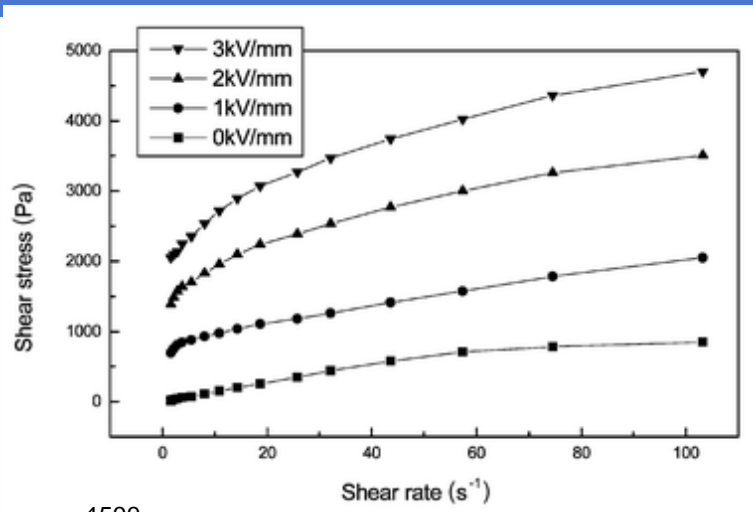


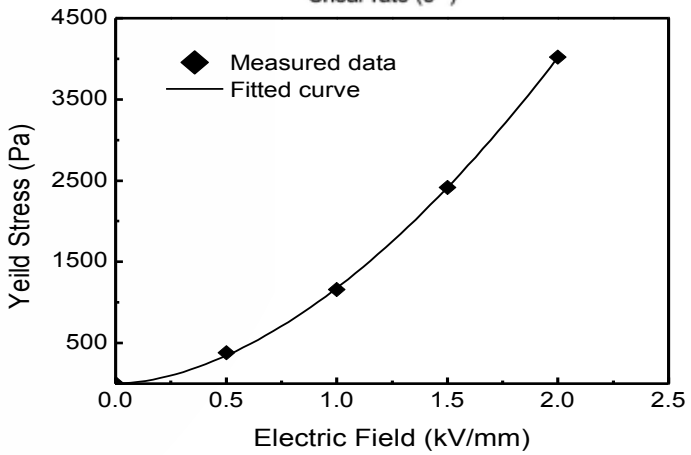


INTRODUCTION TO SMART FLUID

❖ ER Fluid



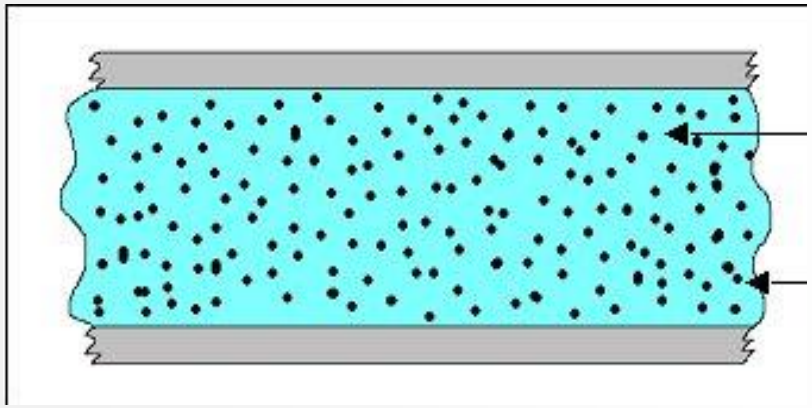


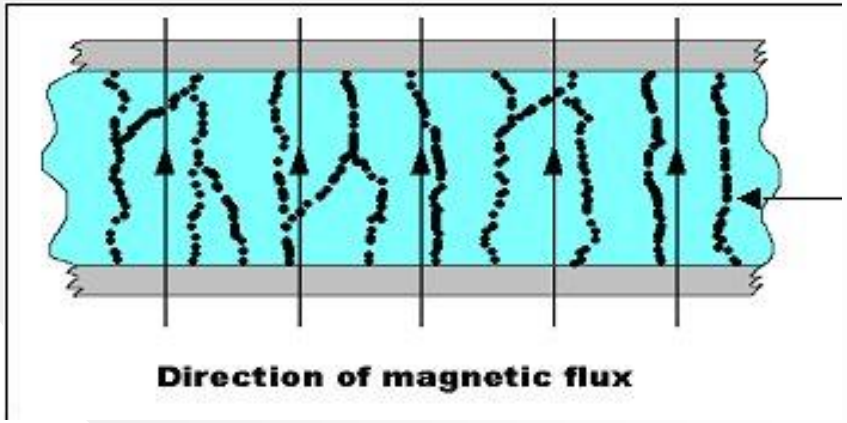


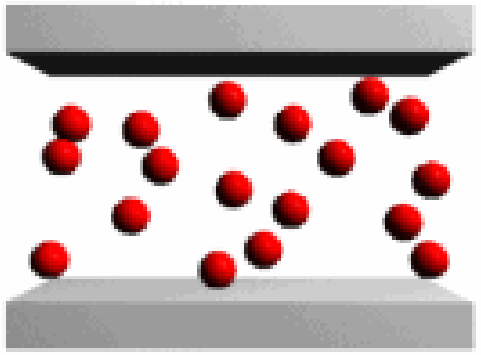
Bingham plastic model $\tau = \eta\dot{\gamma} + \tau_y(E); \quad \tau_y(E) = \alpha E^{\beta}$

INTRODUCTION TO SMART FLUID

- MR Fluid





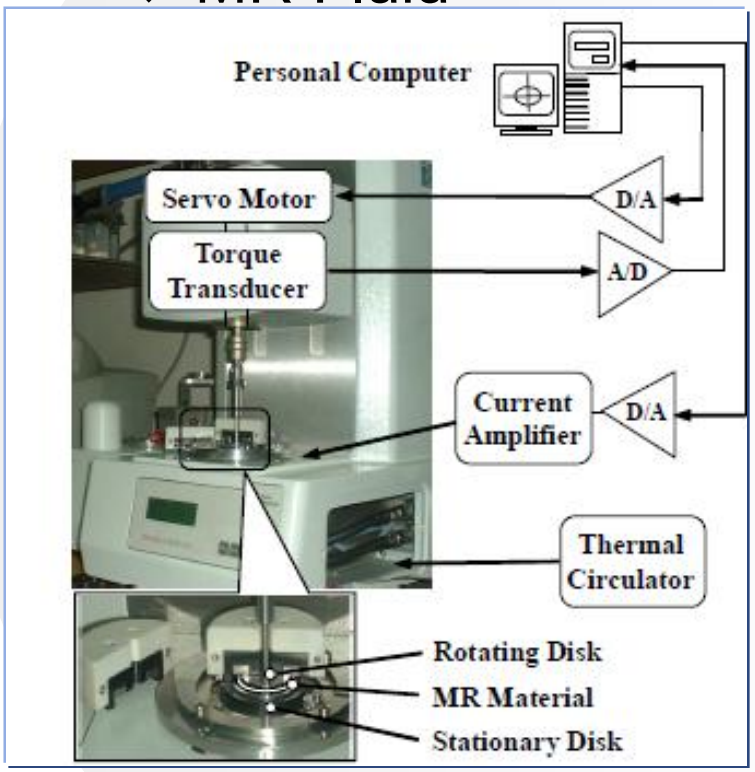


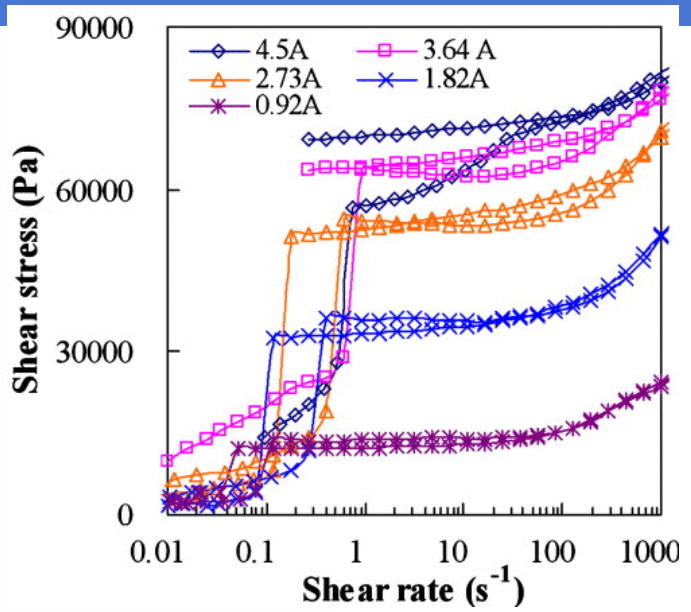
Typically, the iron particles comprise between 20 and 40 percent of the **fluid's** volume. The particles are tiny, measuring between 3 and 10 microns

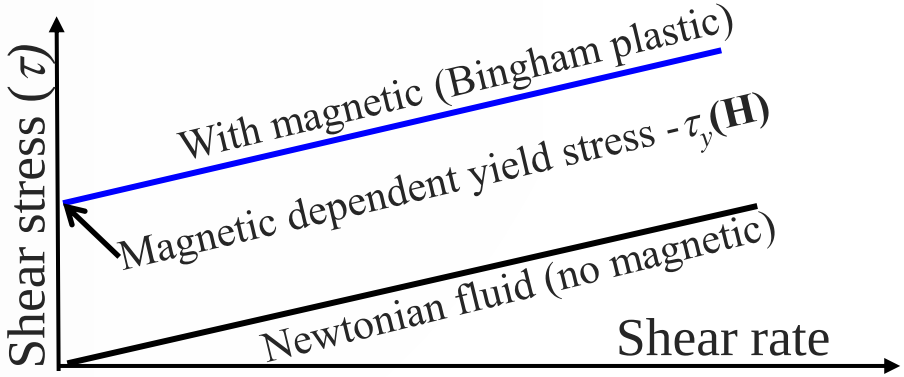
This process is reversible and the **response time** is in the order of milliseconds

INTRODUCTION TO SMART FLUID

❖ MR Fluid







Herschel-Bulkley plastic model

$$\tau = (\tau_y(H)\,\mathrm{sgn}(\dot{\gamma}) + K\left|\dot{\gamma}\right|^{1/m})\,\mathrm{sgn}(\dot{\gamma})$$

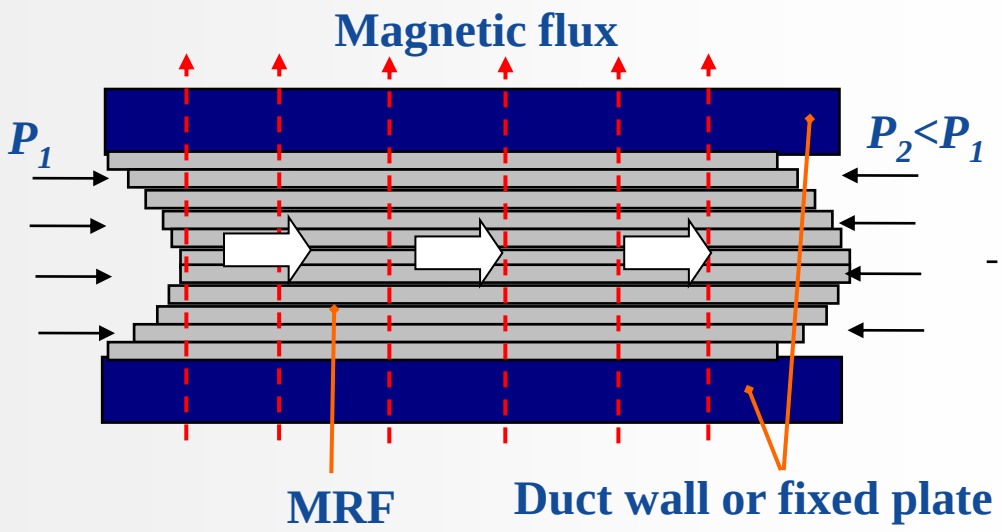
Bingham plastic model

$$\tau = \tau_y(H)\,\mathrm{sgn}(\dot{\gamma}) + \eta\dot{\gamma}$$

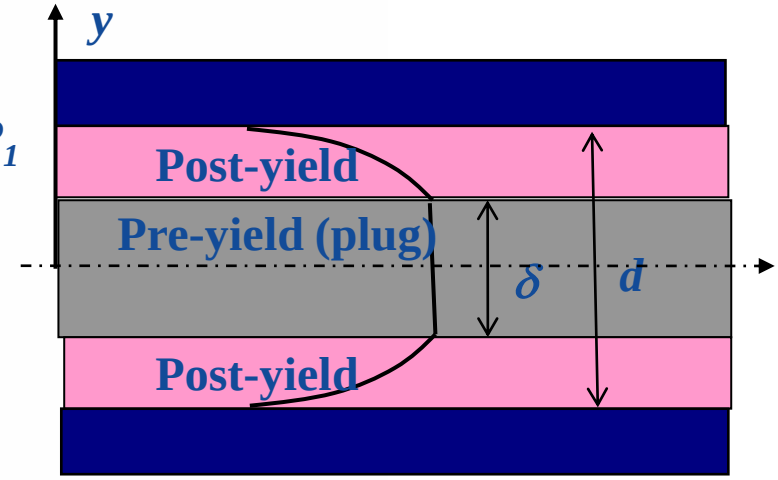
INTRODUCTION TO SMART FLUID

❖Working Mode of MR fluid

➢ **Valve mode (MR valve, MR damper)**



(a) concept of valve mode

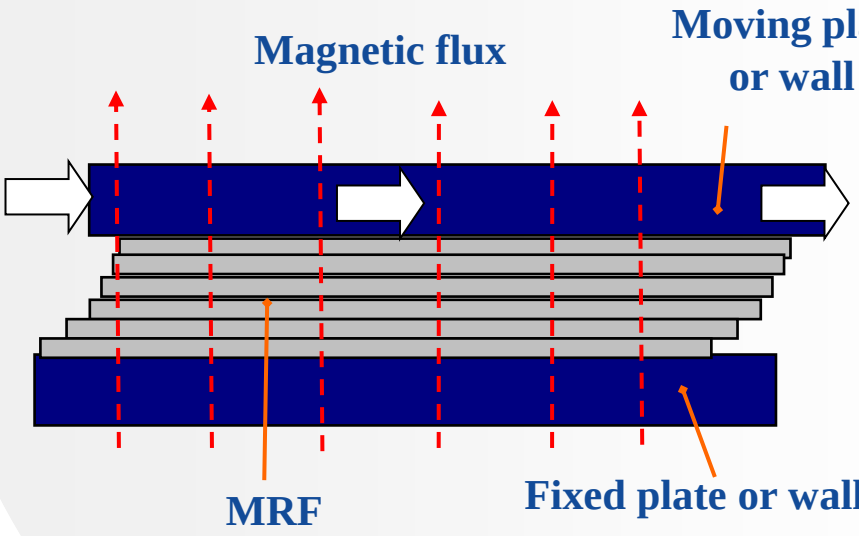


(b) velocity profile

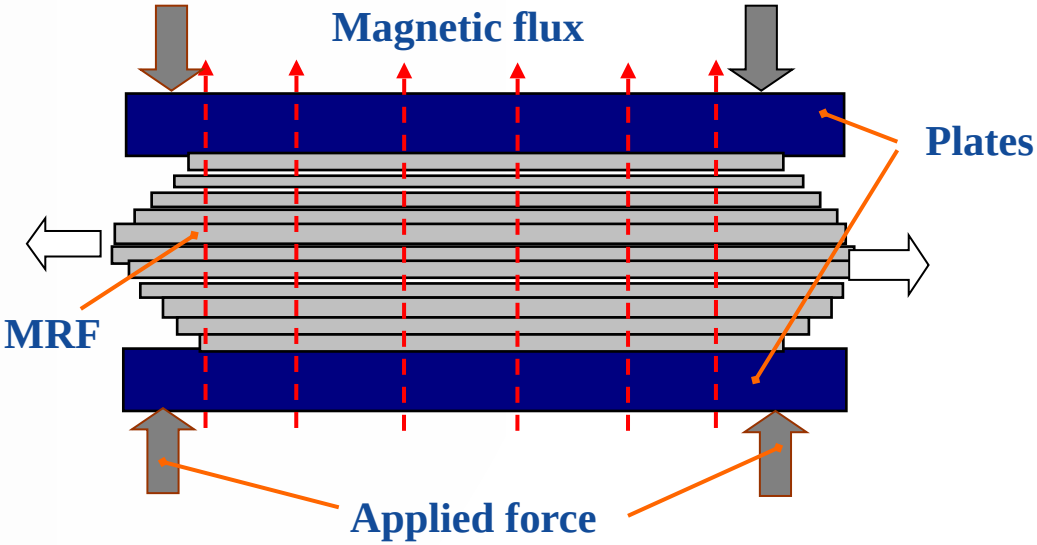
INTRODUCTION TO MR FLUID

❖Working Mode

➢ **Shear Mode (MR brake & clutch, Shear damping)**



➢**Squeeze Mode (MR mount)**

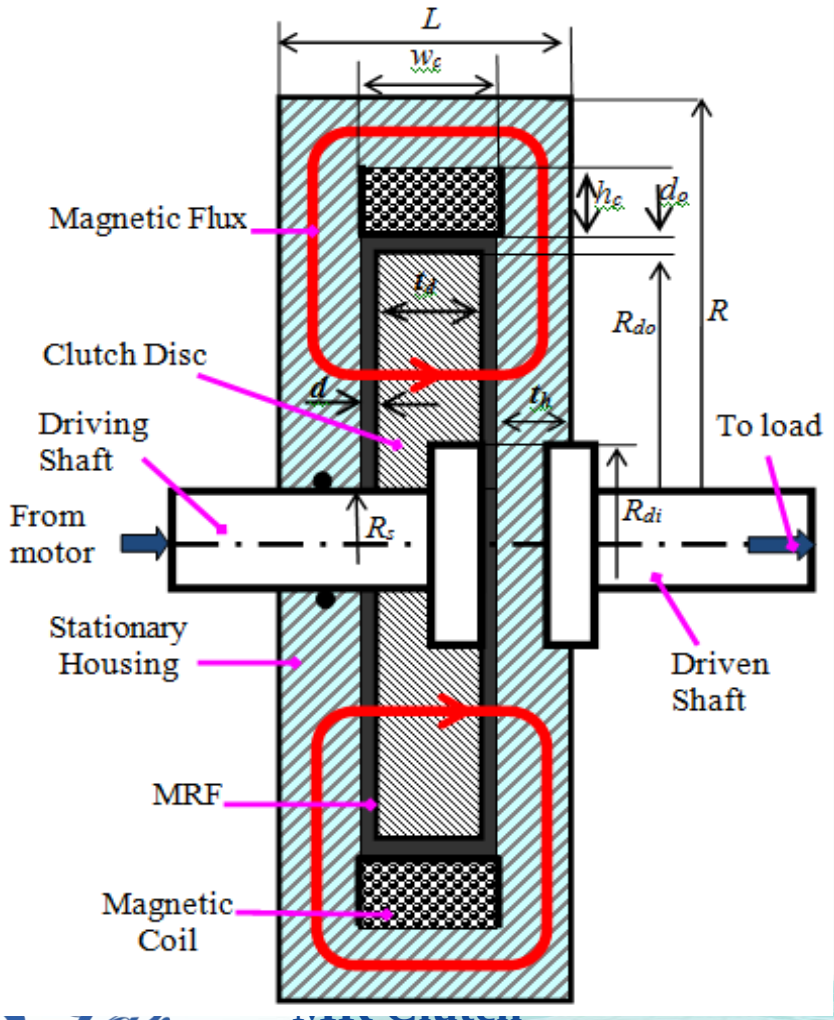


INTRODUCTION TO MR FLUID

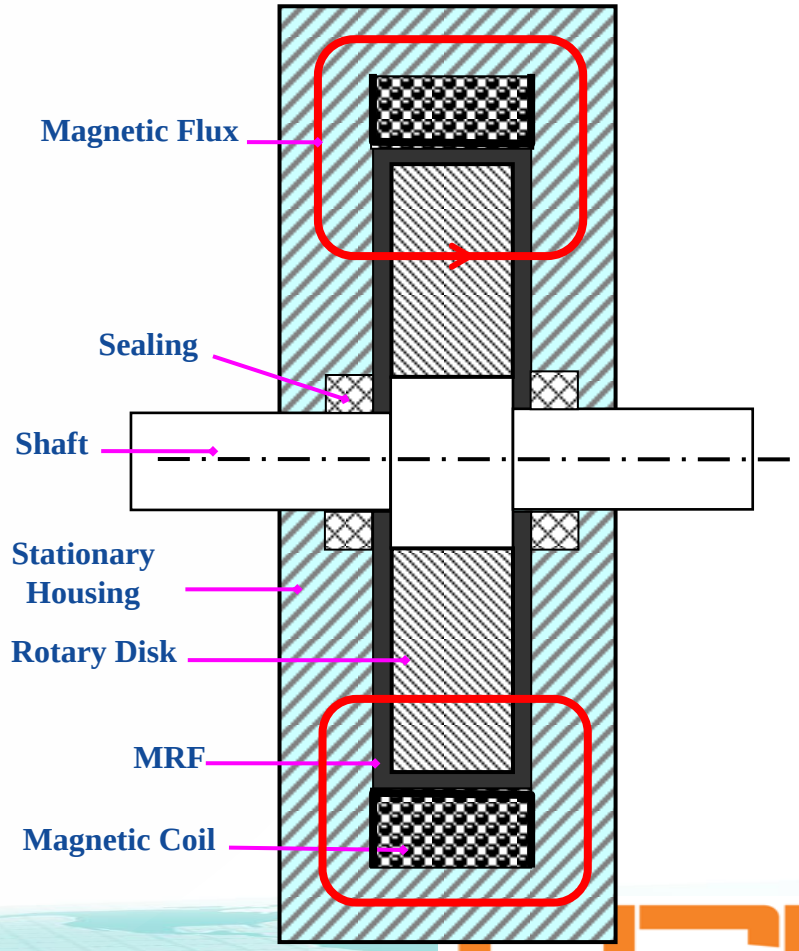
- Applications of Smart Fluid

INTRODUCTION TO MR FLUID

➢ MR Clutch

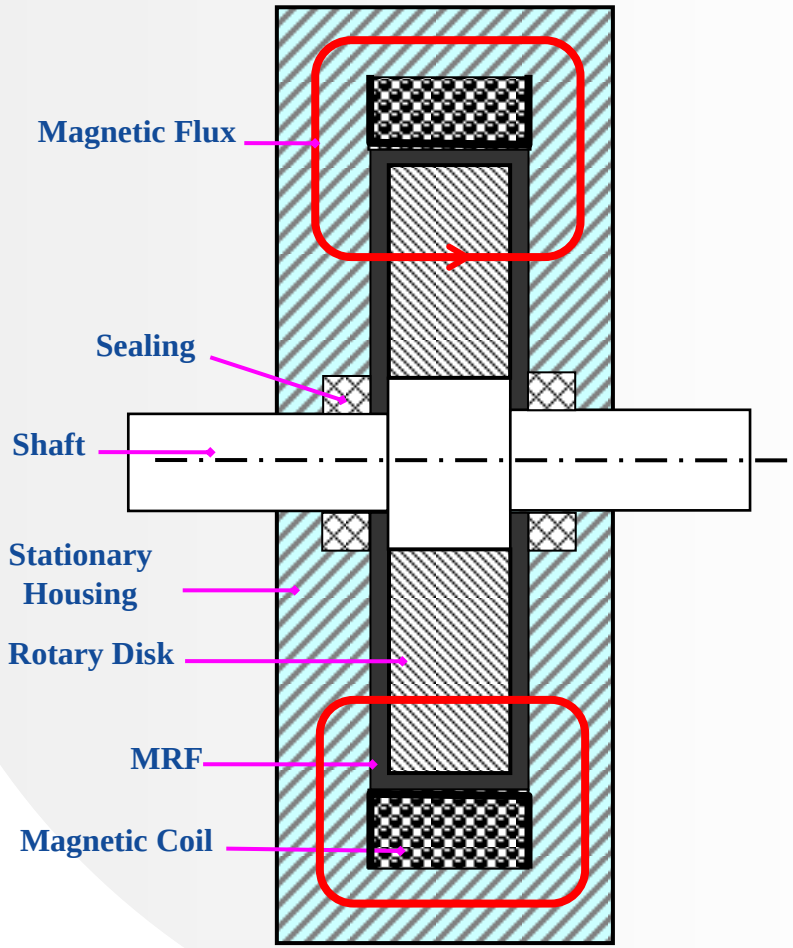


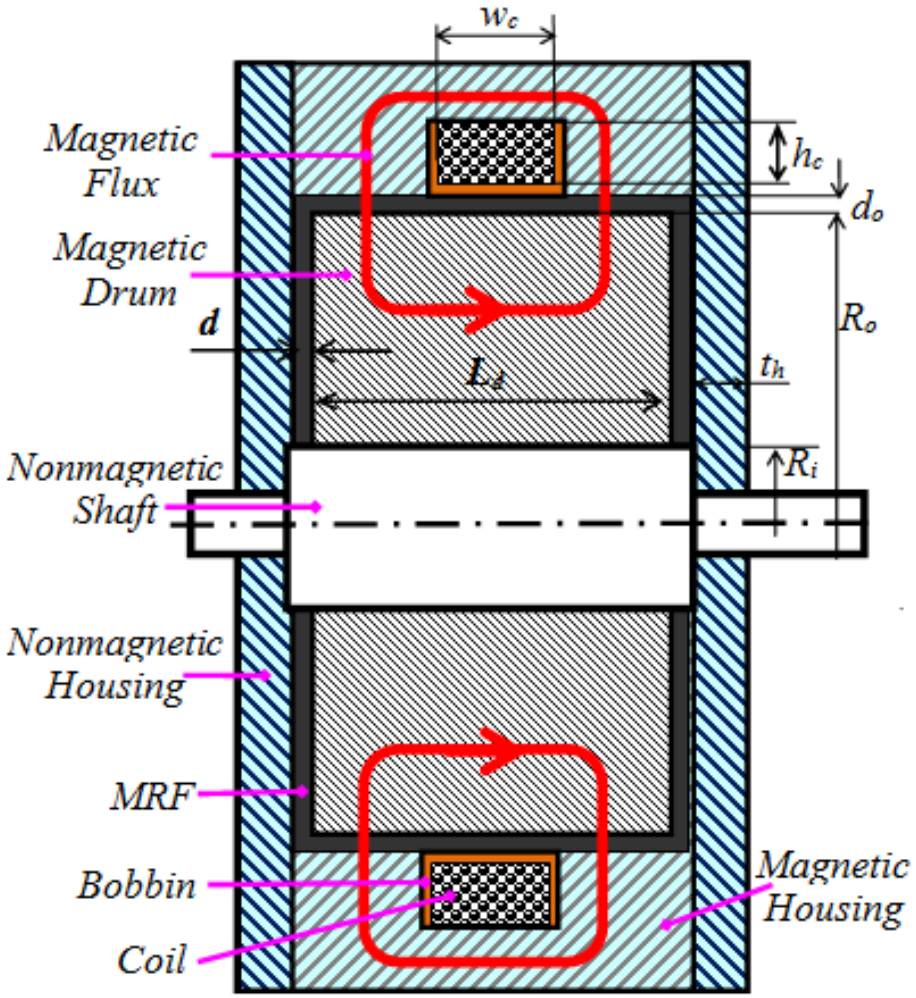
MR Brake



MR BRAKE DEVELOPMENT

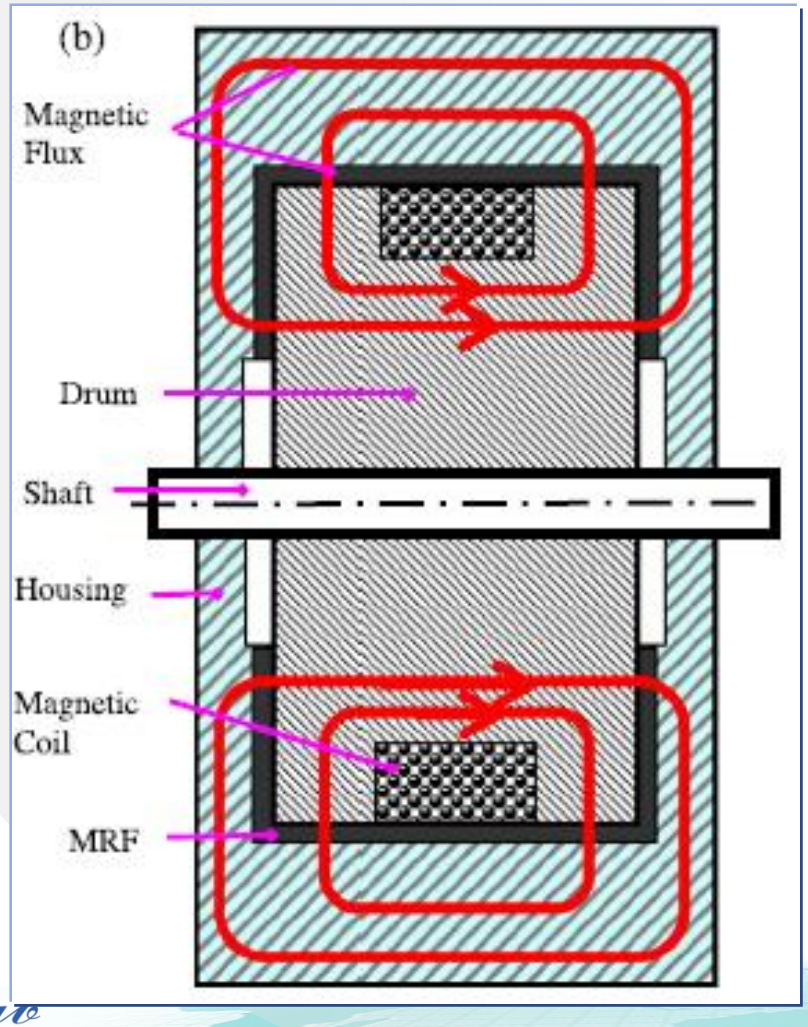
Disc Type



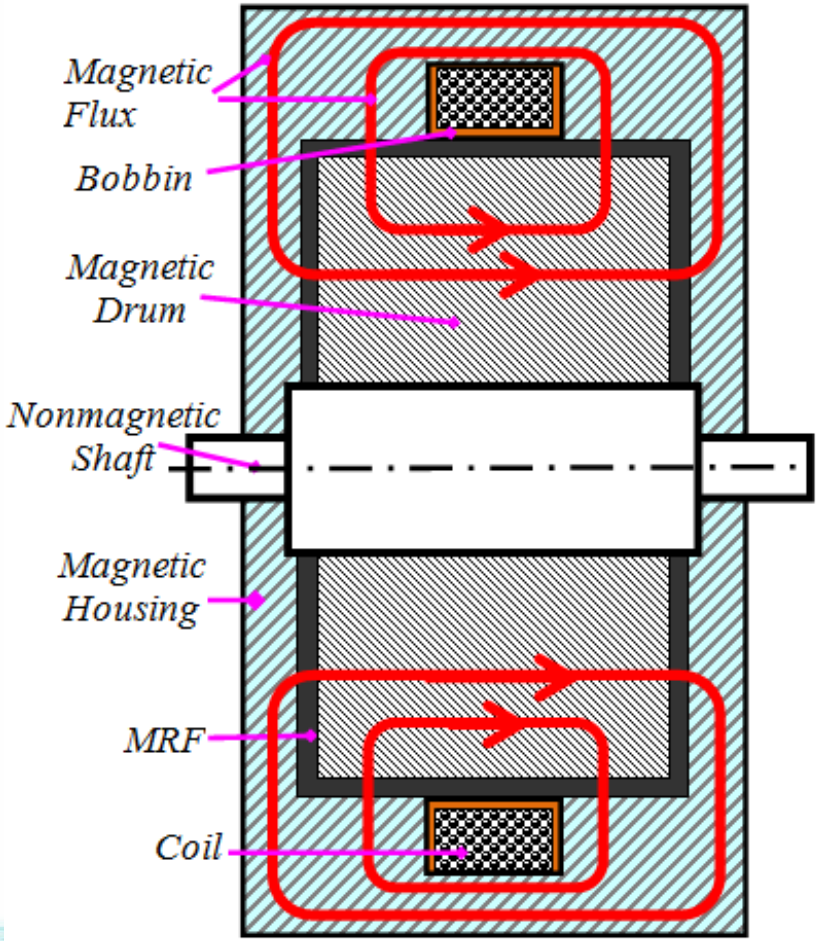


MR BRAKE DEVELOPMENT

Inverted Drum

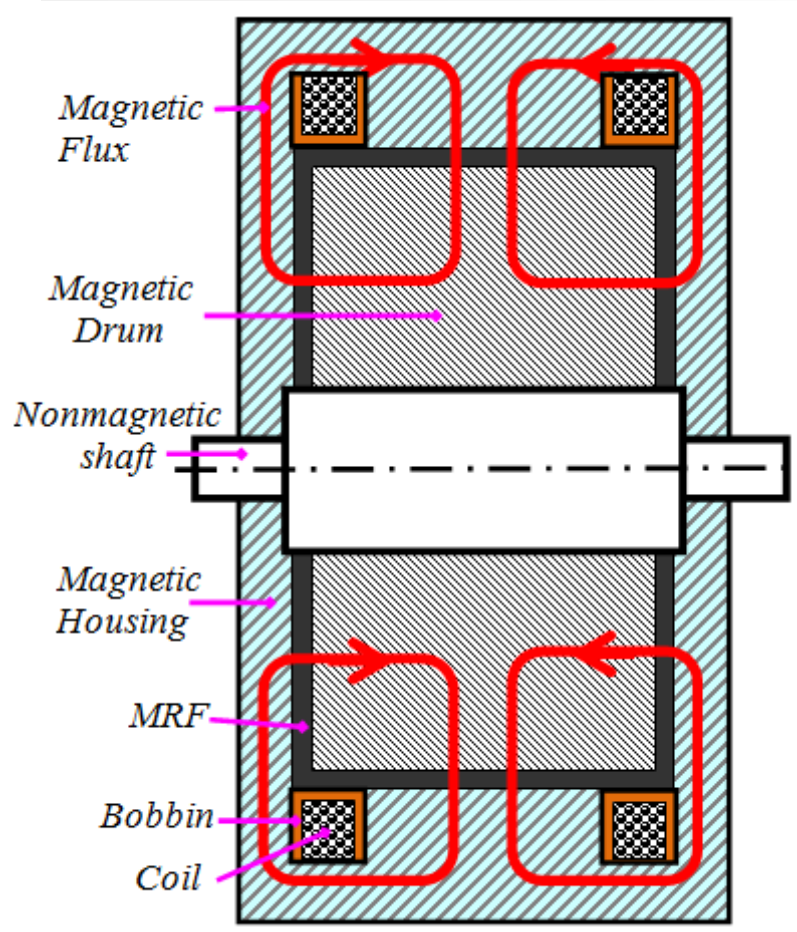


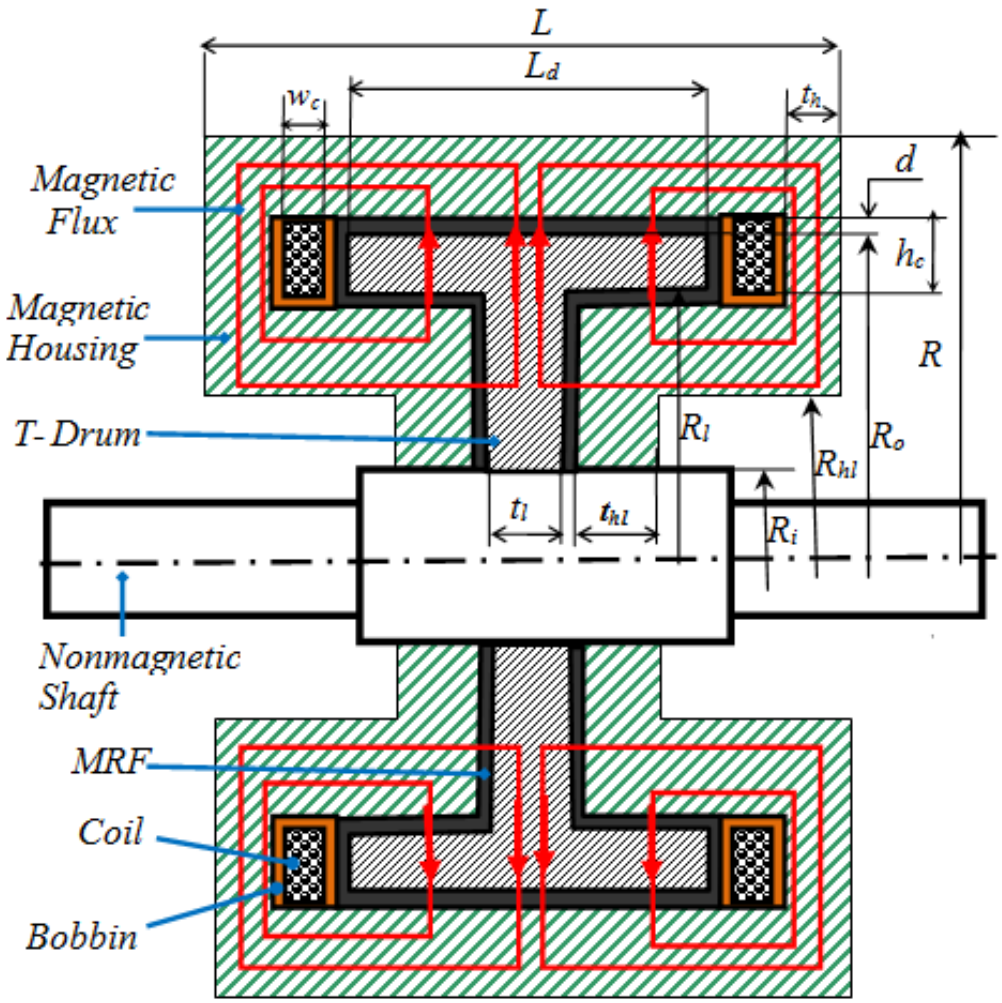
Hybrid Type



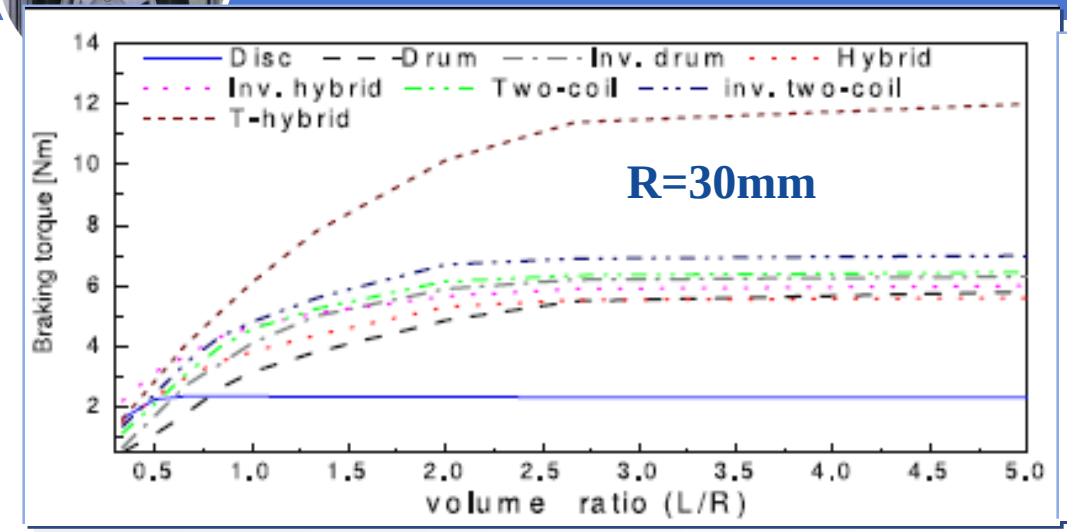
MR BRAKE DEVELOPMENT

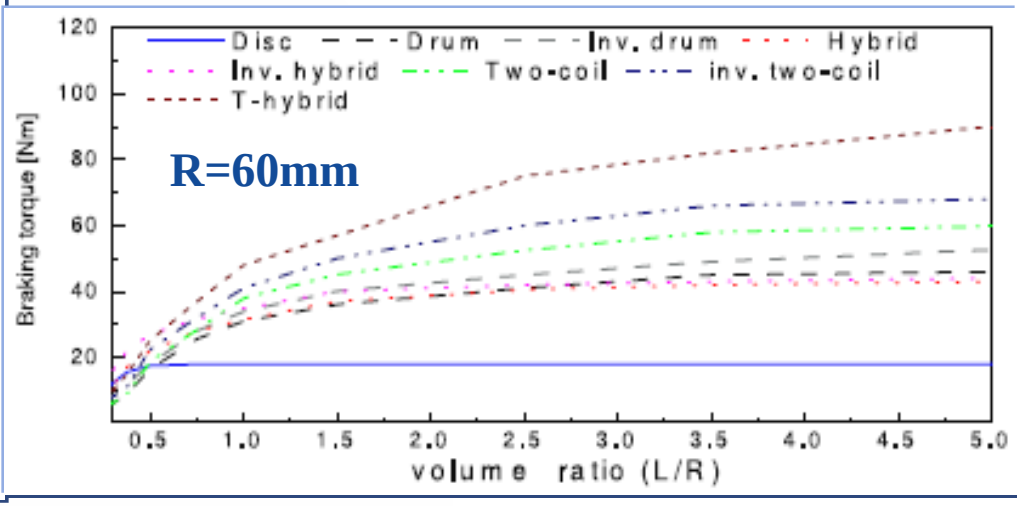
Hybrid Type (two coils)

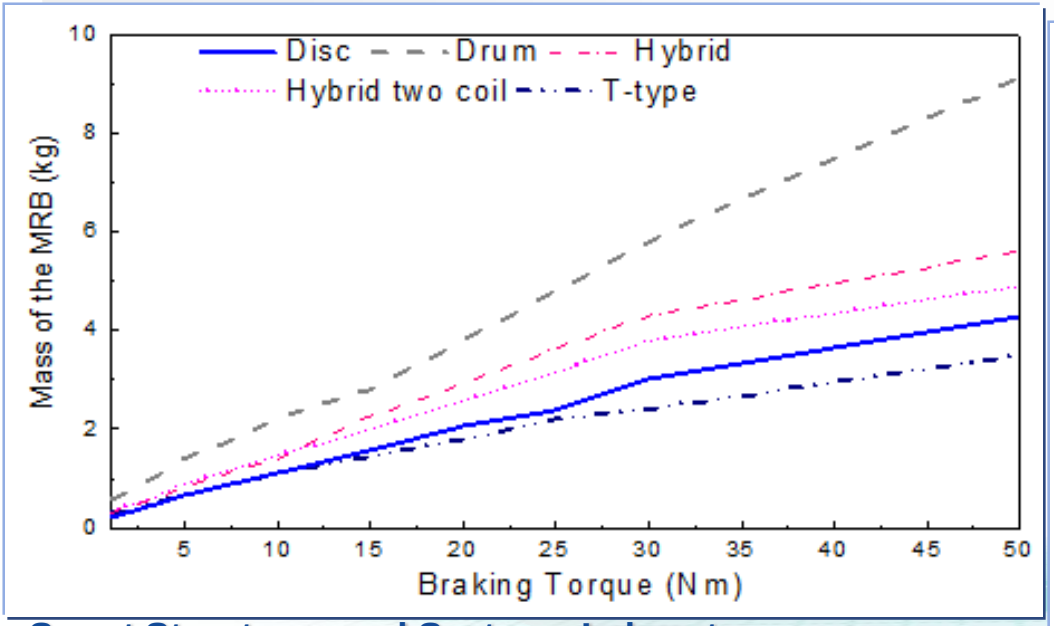


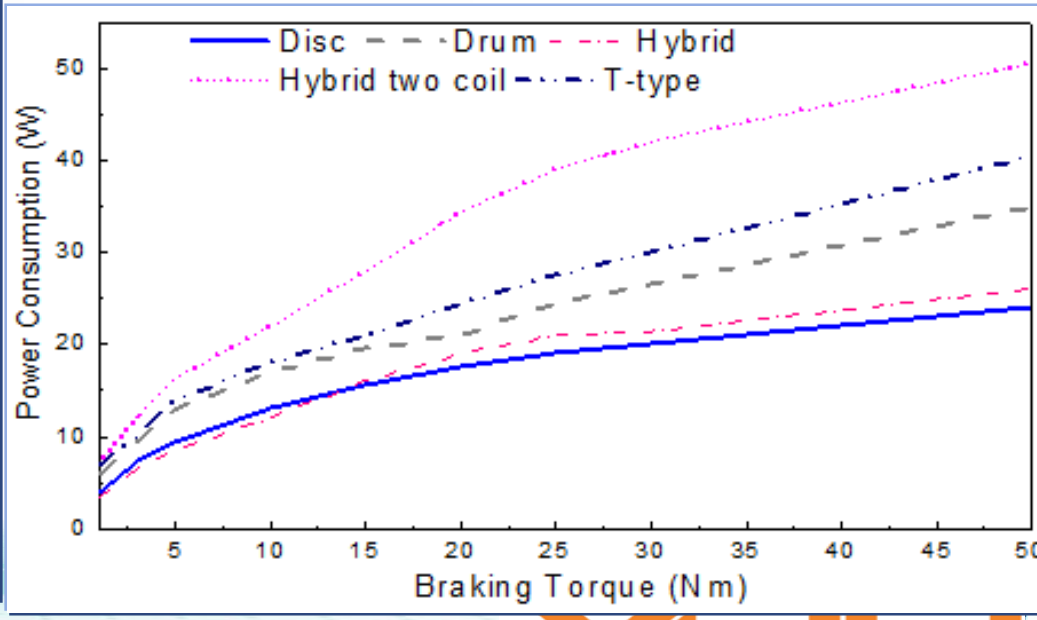


MR BRAKE DEVELOPMENT



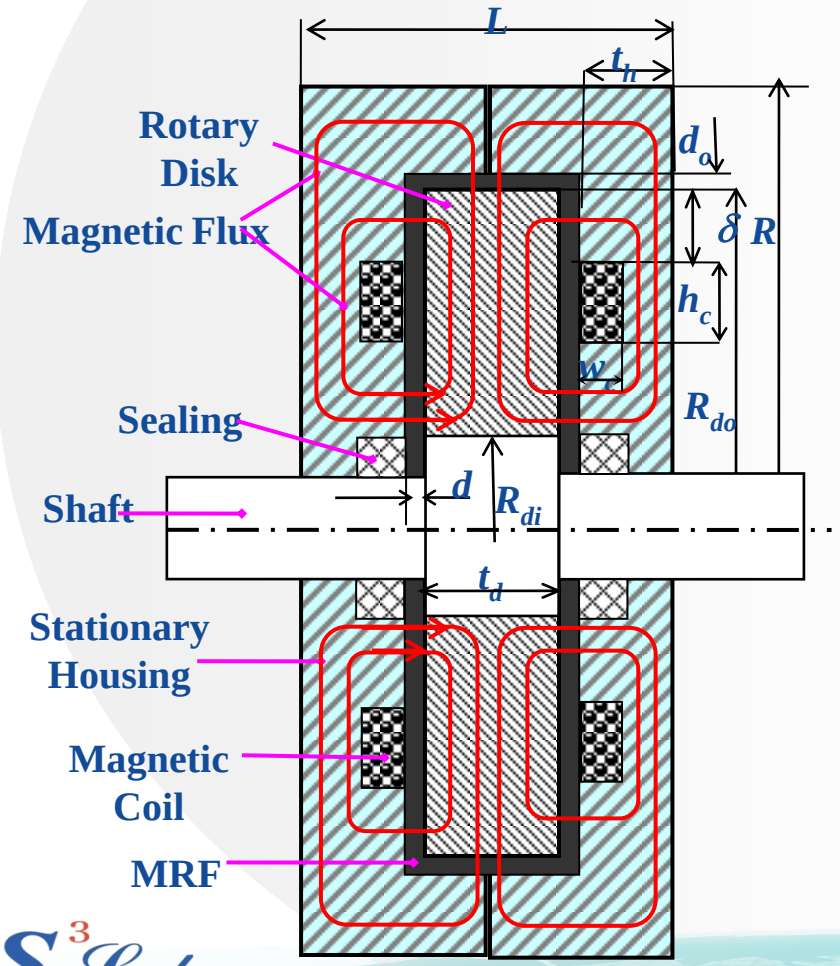


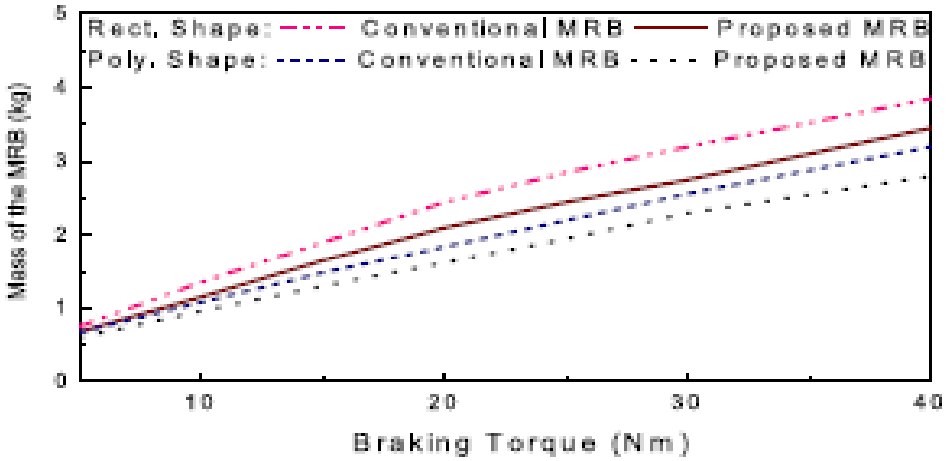




MR BRAKE DEVELOPMENT

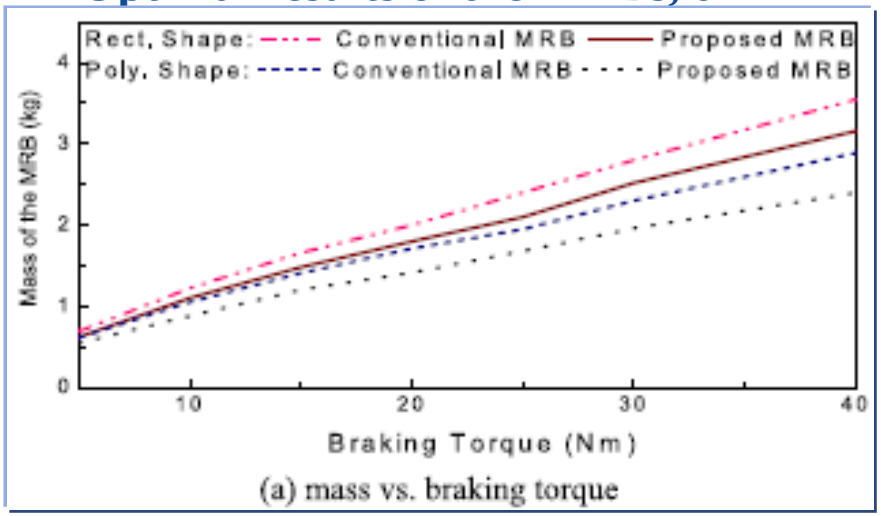
➢ Side-coil Type





(a) mass vs. braking torque

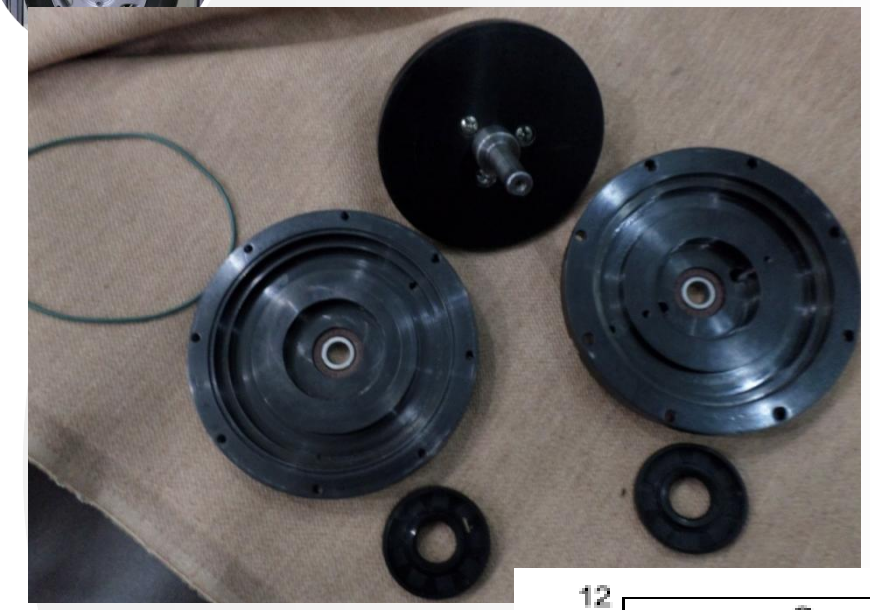
Optimal results of the MRBs, d = 1 mm

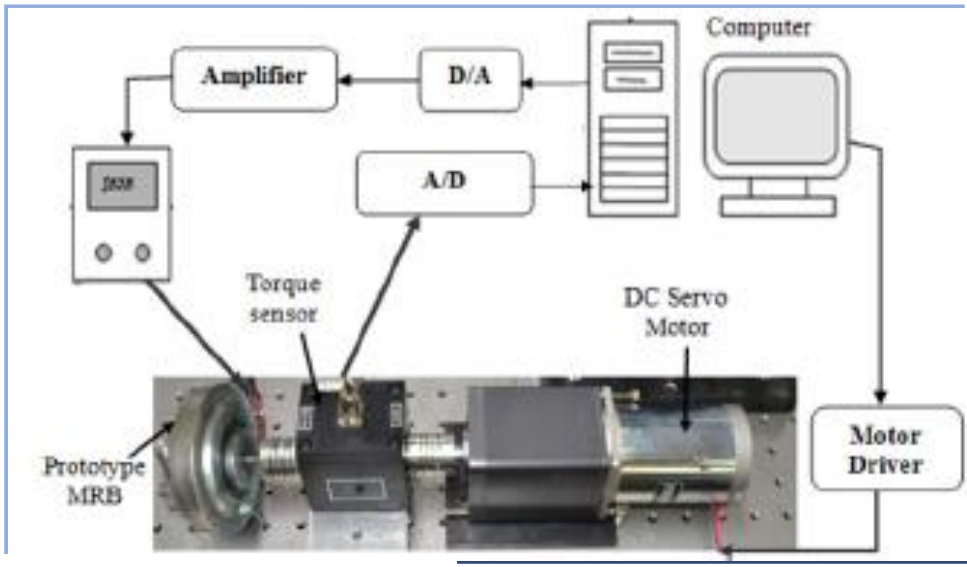


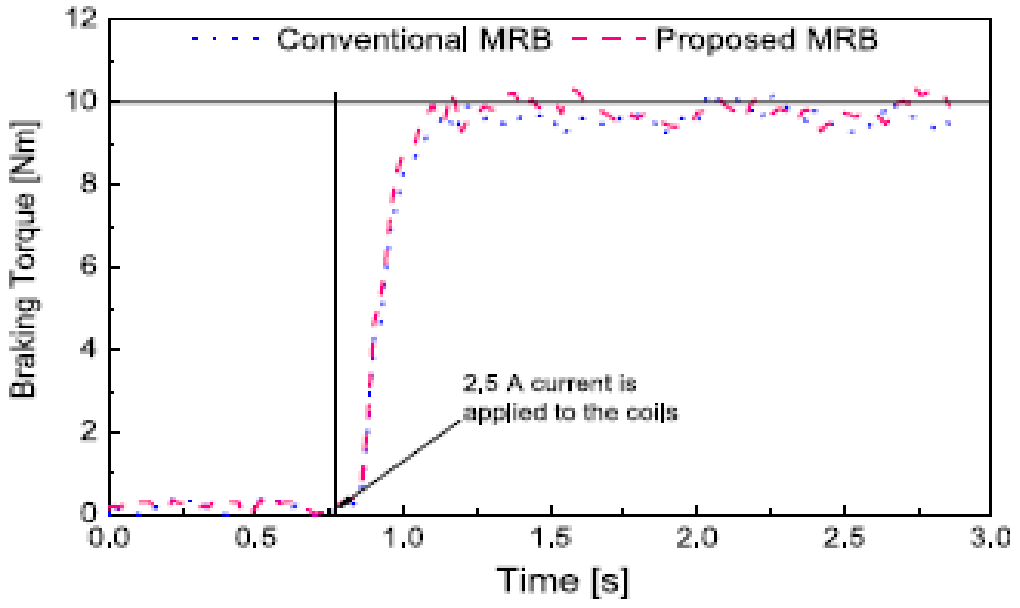
(a) mass vs. braking torque

Optimal results of the MRBs, d = 0.8 mm

MR BRAKE DEVELOPMENT



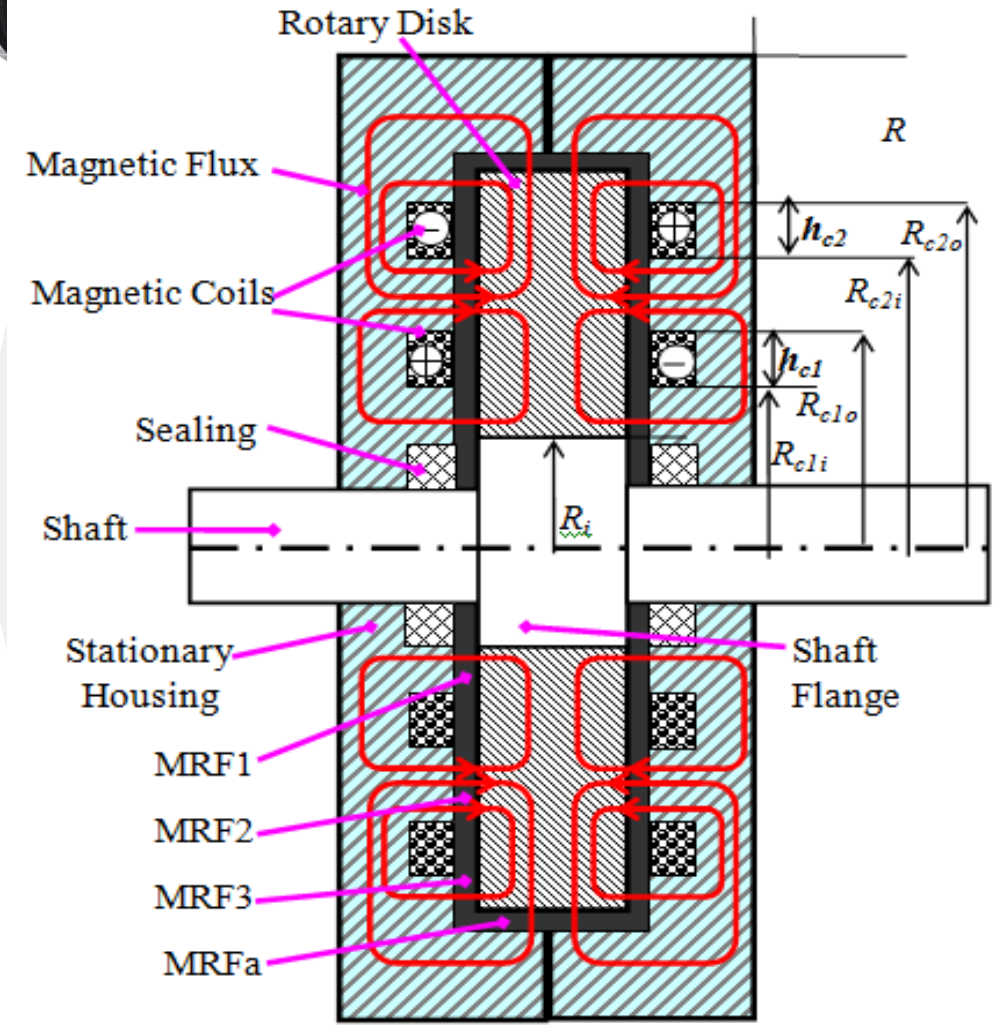




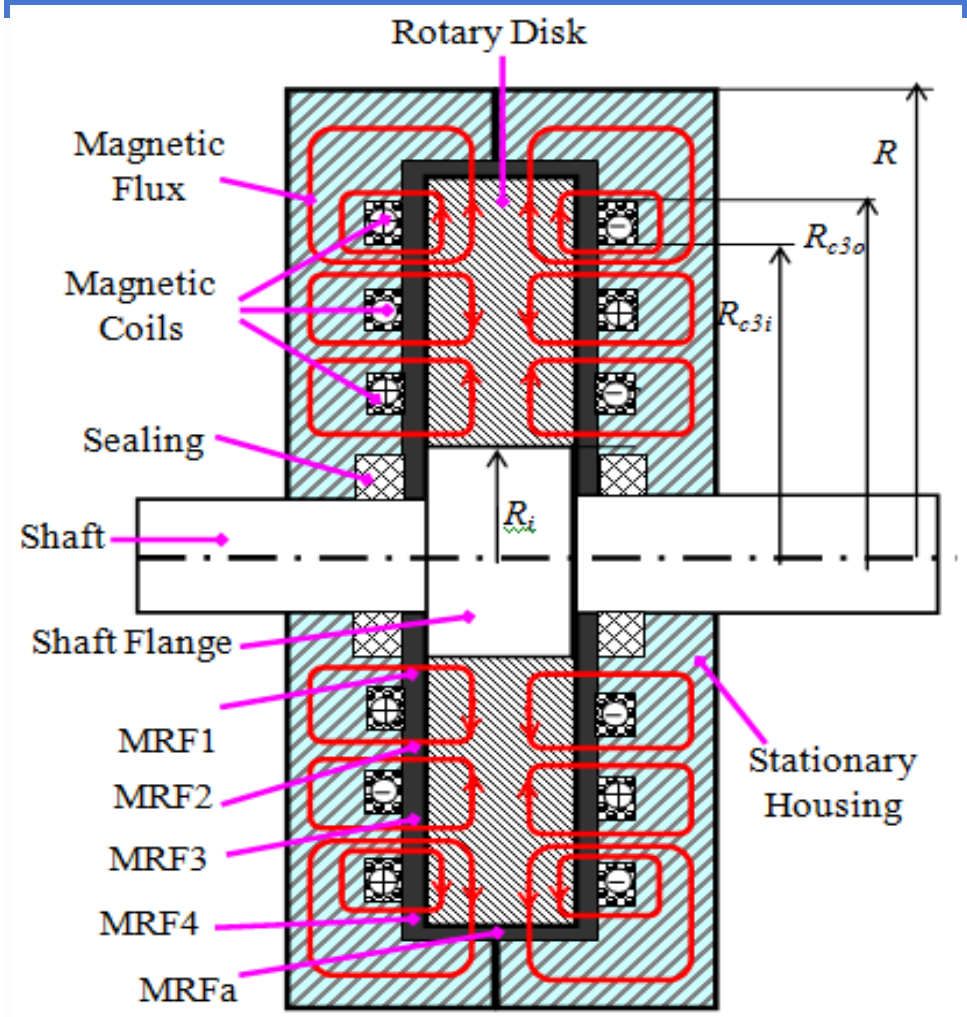
S3 Lab
Smart Structures and Systen

VGU

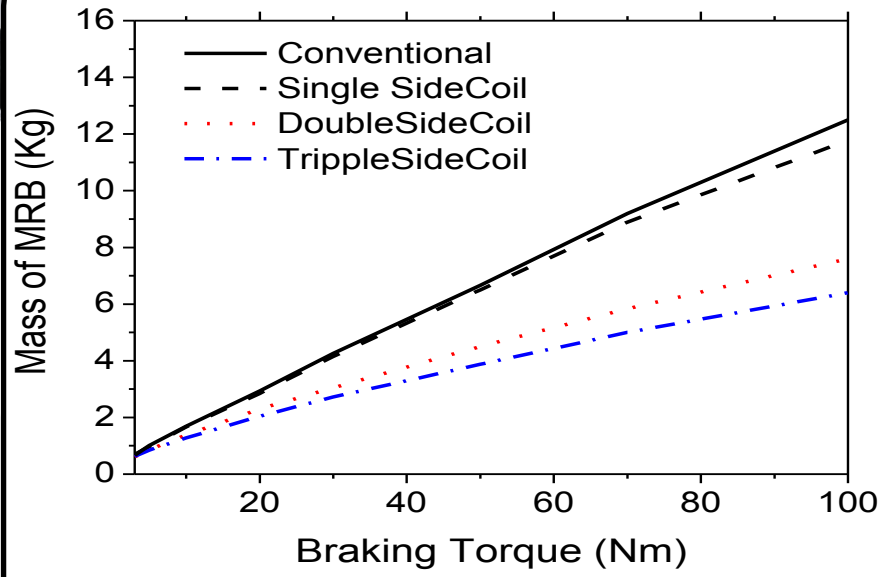
MR BRAKE DEVELOPMENT

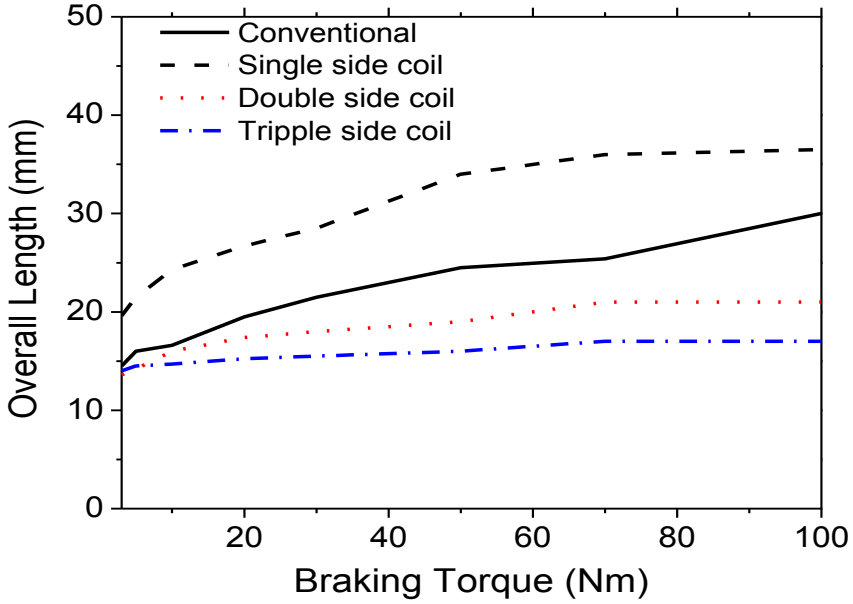


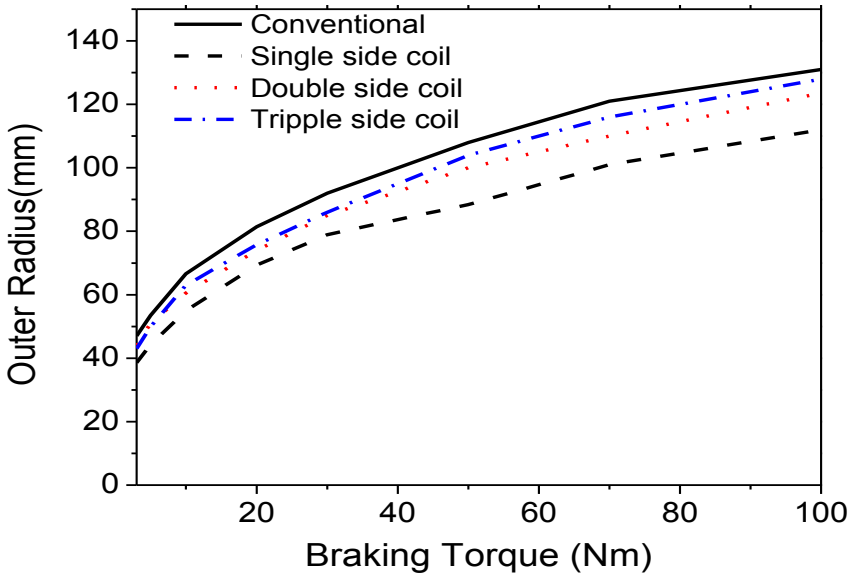
Two coils on each side

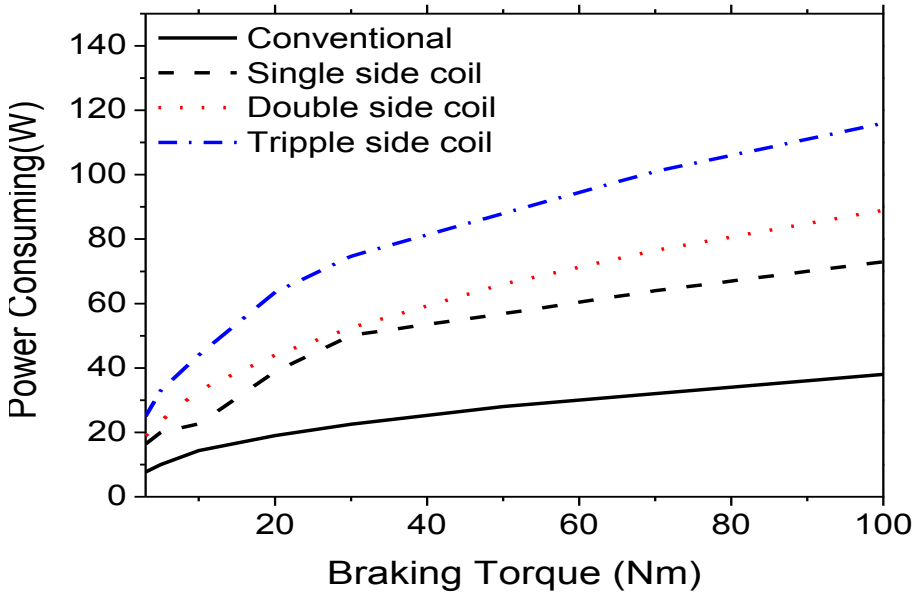


Three coils on each side

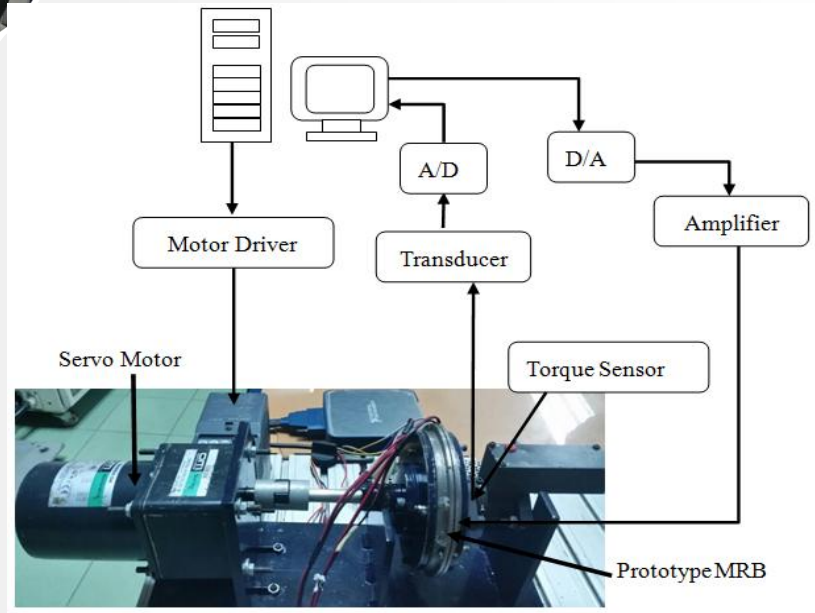

Conventional
Single SideCoil
DoubleSideCoil
TrippleSideCoil
Mass of MRB (Kg)
Braking Torque (Nm)
0
2
4
6
8
10
12
14
16
20
40
60
80
100

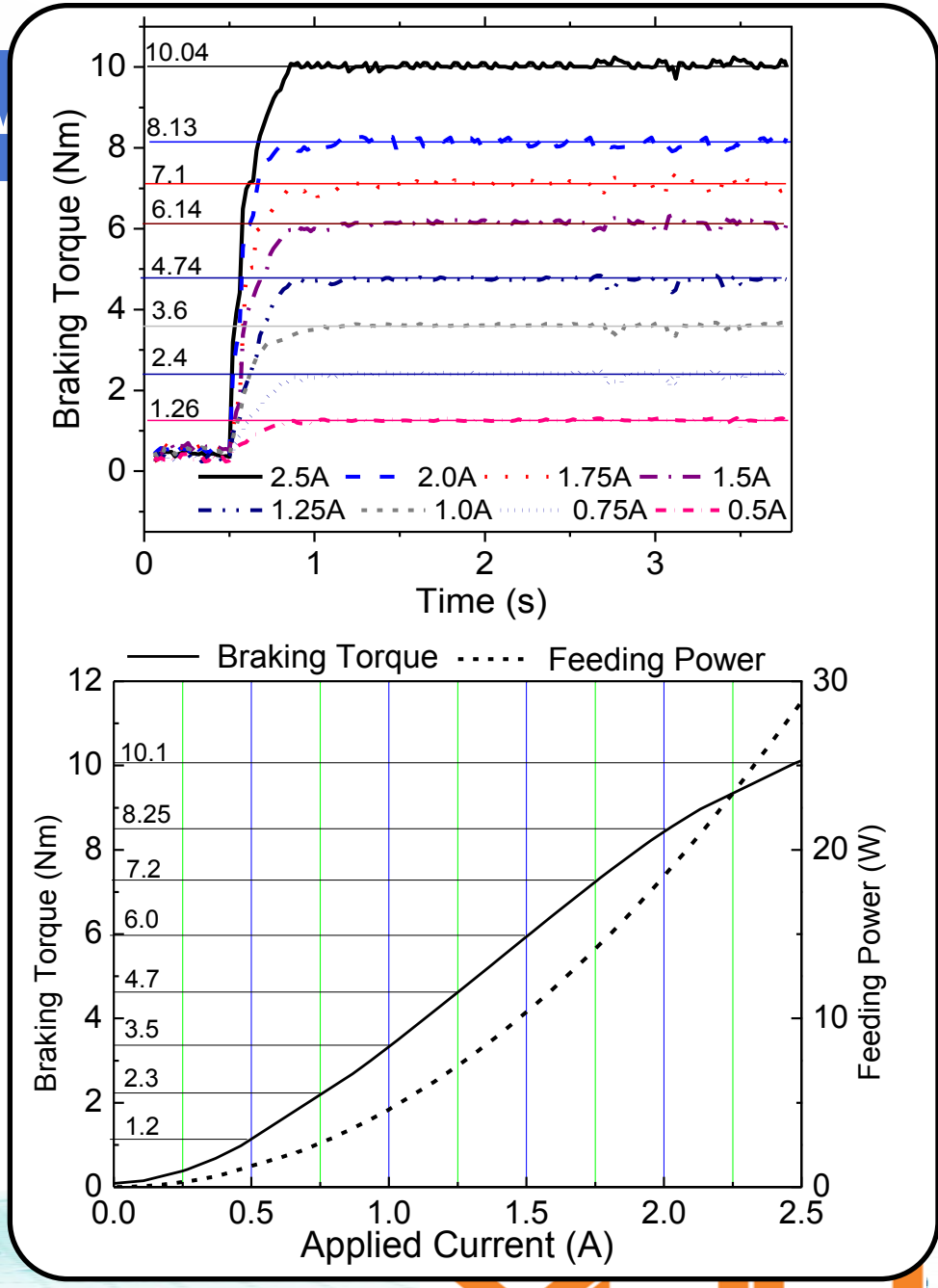

Conventional
Single side coil
Double side coil
Tripple side coil
Overall Length (mm)
Braking Torque (Nm)
0
10
20
30
40
50
20
40
60
80
100

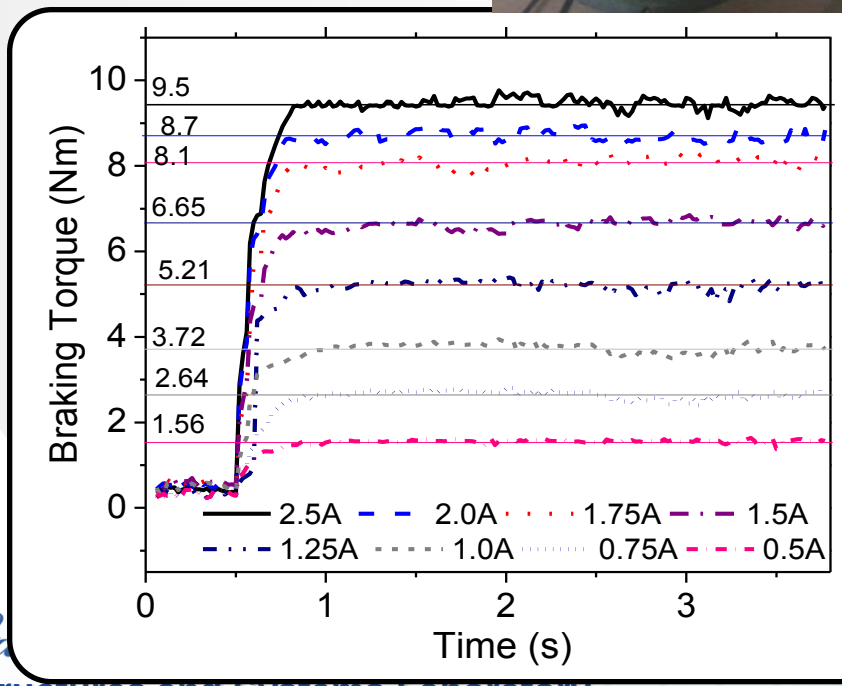

Conventional
Single side coil
Double side coil
Tripple side coil
Outer Radius(mm)
Braking Torque (Nm)
0
20
40
60
80
100
120
140
20
40
60
80
100

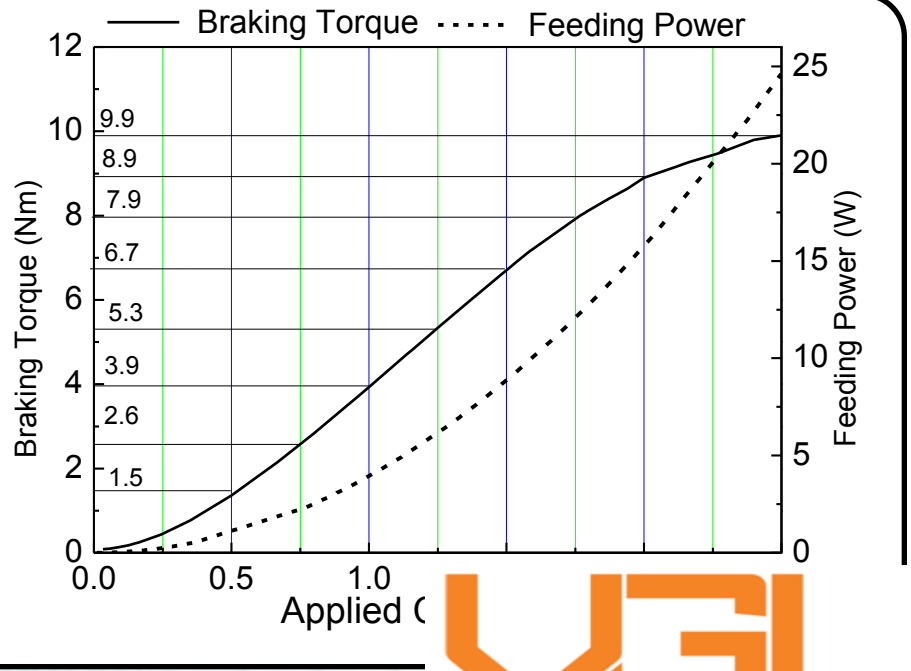

Conventional
Single side coil
Double side coil
Tripple side coil
Power Consuming(W)
Braking Torque (Nm)
0
20
40
60
80
100
120
140
20
40
60
80
100

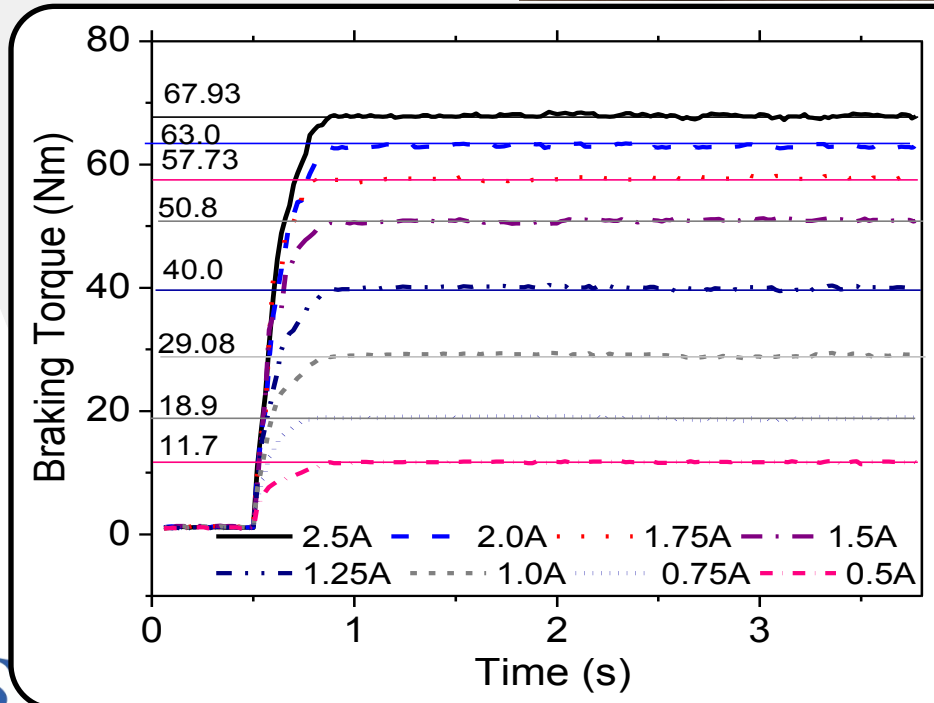
MR BRAKE DEV

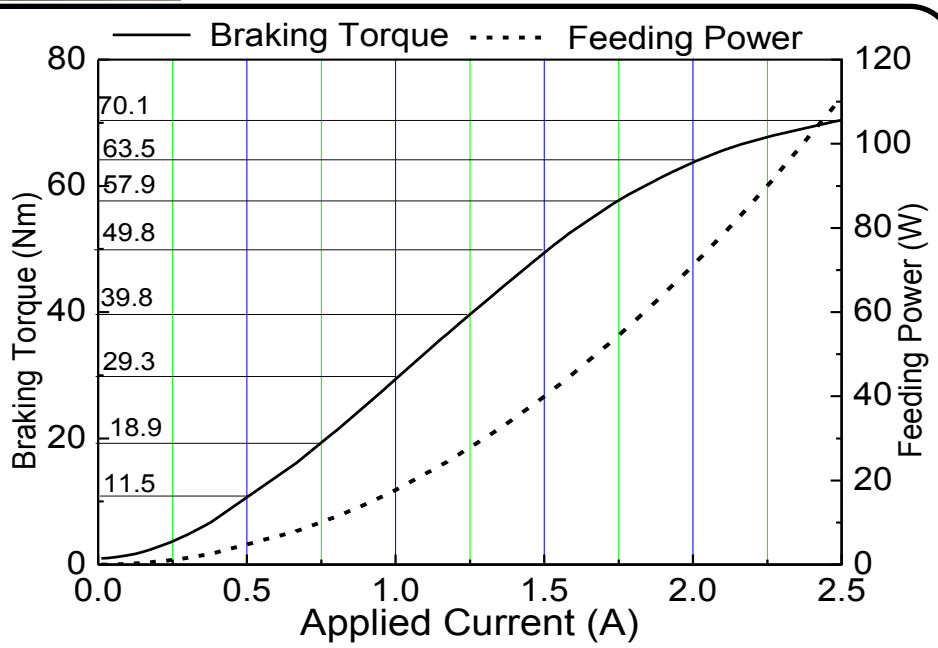

A/D
D/A
Motor Driver
Transducer
Amplifier
Servo Motor
Torque Sensor
Prototype MRB


Braking Torque (Nm)
Time (s)
10.04
8.13
7.1
6.14
4.74
3.6
2.4
1.26
2.5A
2.0A
1.75A
1.5A
1.25A
1.0A
0.75A
0.5A
Braking Torque
Feeding Power
10.1
8.25
7.2
6.0
4.7
3.5
2.3
1.2
Applied Current (A)
Feeding Power (W)


Braking Torque (Nm)
Time (s)
9.5
8.7
8.1
6.65
5.21
3.72
2.64
1.56
2.5A
2.0A
1.75A
1.5A
1.25A
1.0A
0.75A
0.5A

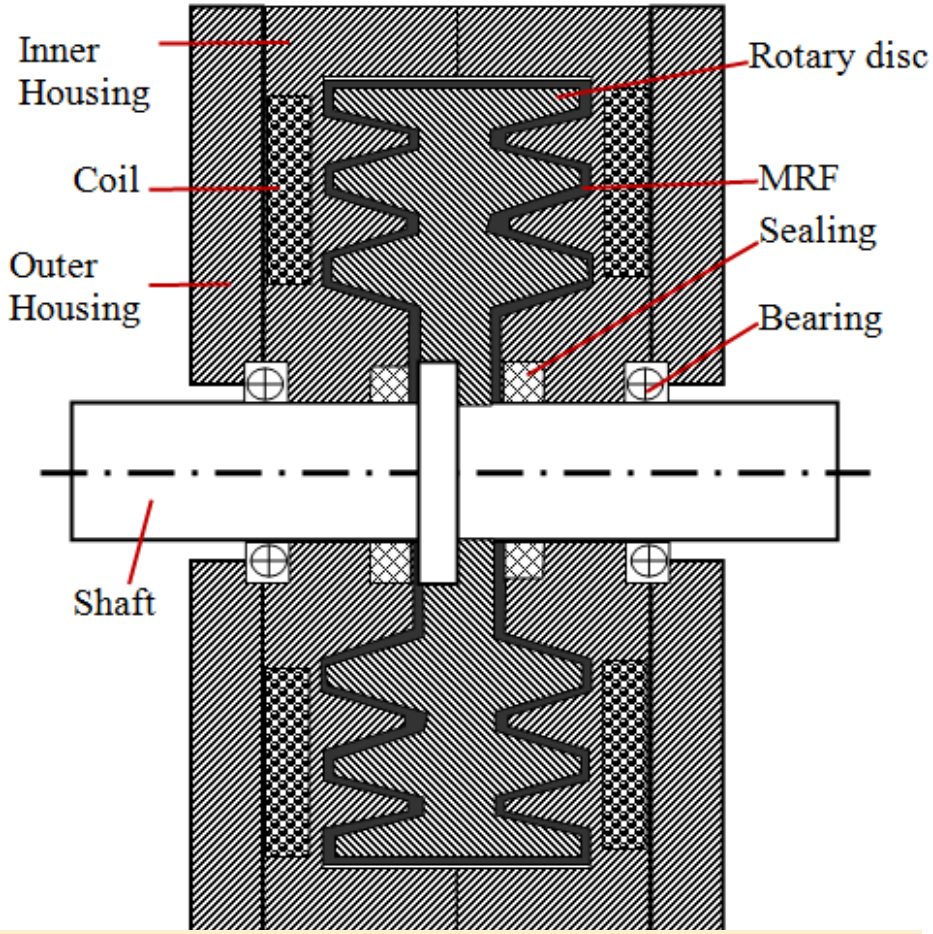

Braking Torque
Feeding Power
Braking Torque (Nm)
Feeding Power (W)
Applied
9.9
8.9
7.9
6.7
5.3
3.9
2.6
1.5

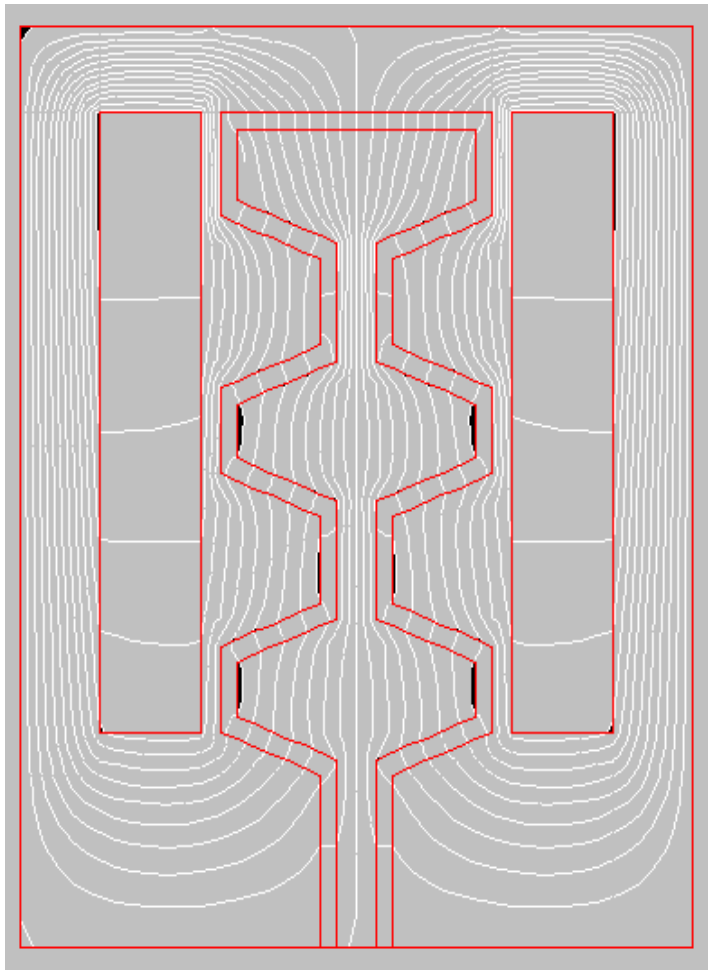

Braking Torque (Nm)
Time (s)
67.93
63.0
57.73
50.8
40.0
29.08
18.9
11.7
2.5A
2.0A
1.75A
1.5A
1.25A
1.0A
0.75A
0.5A


Braking Torque
Feeding Power
Braking Torque (Nm)
Feeding Power (W)
Applied Current (A)
70.1
63.5
57.9
49.8
39.8
29.3
18.9
11.5

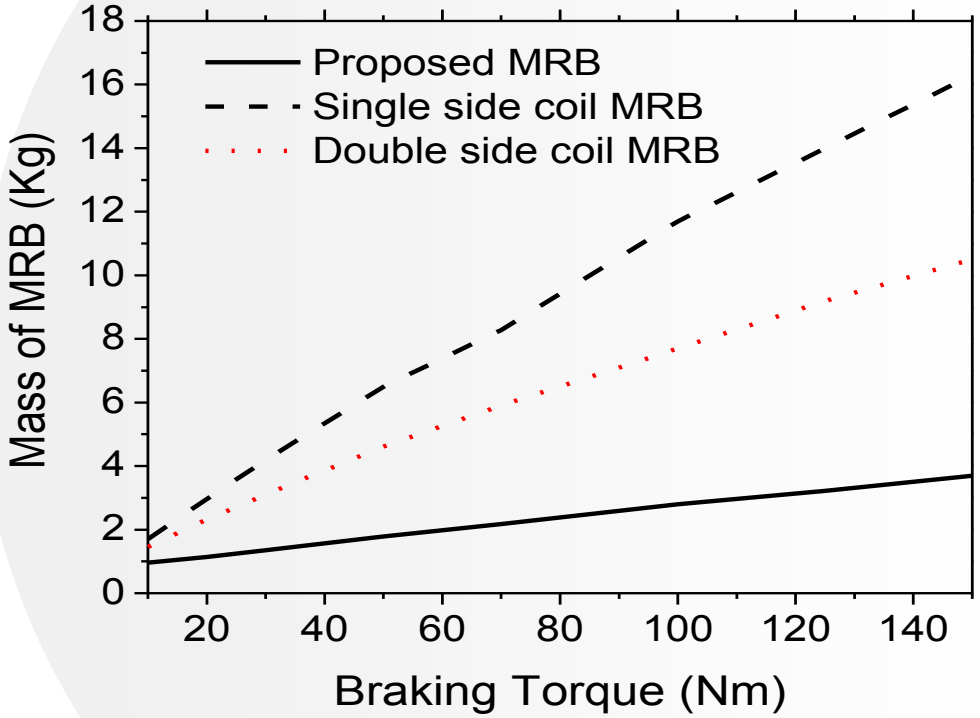
MR BRAKE DEVELOPMENT

➢ Tooth Shaped Rotor

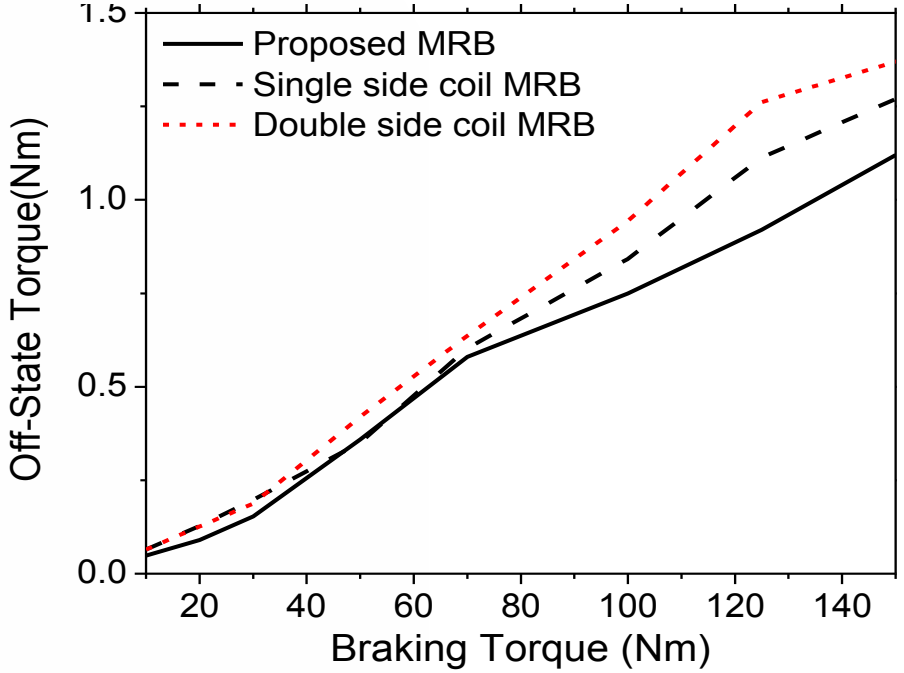




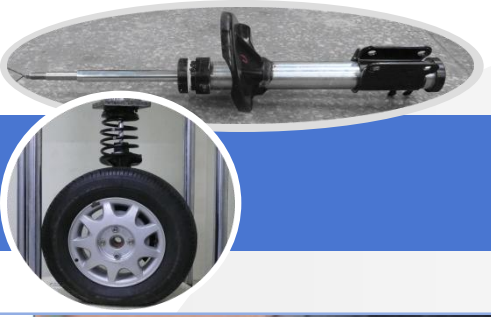
MR BRAKE DEVELOPMENT



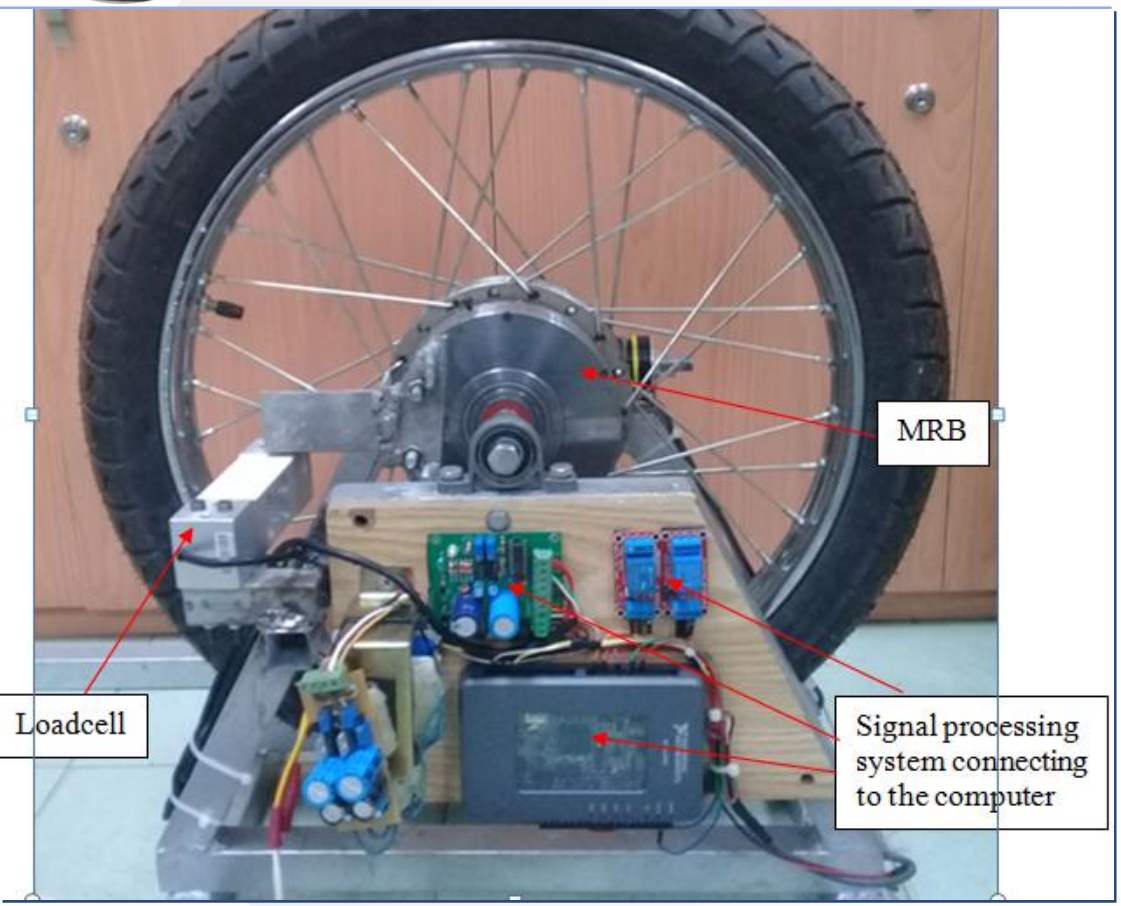
(a) mass vs. braking torque

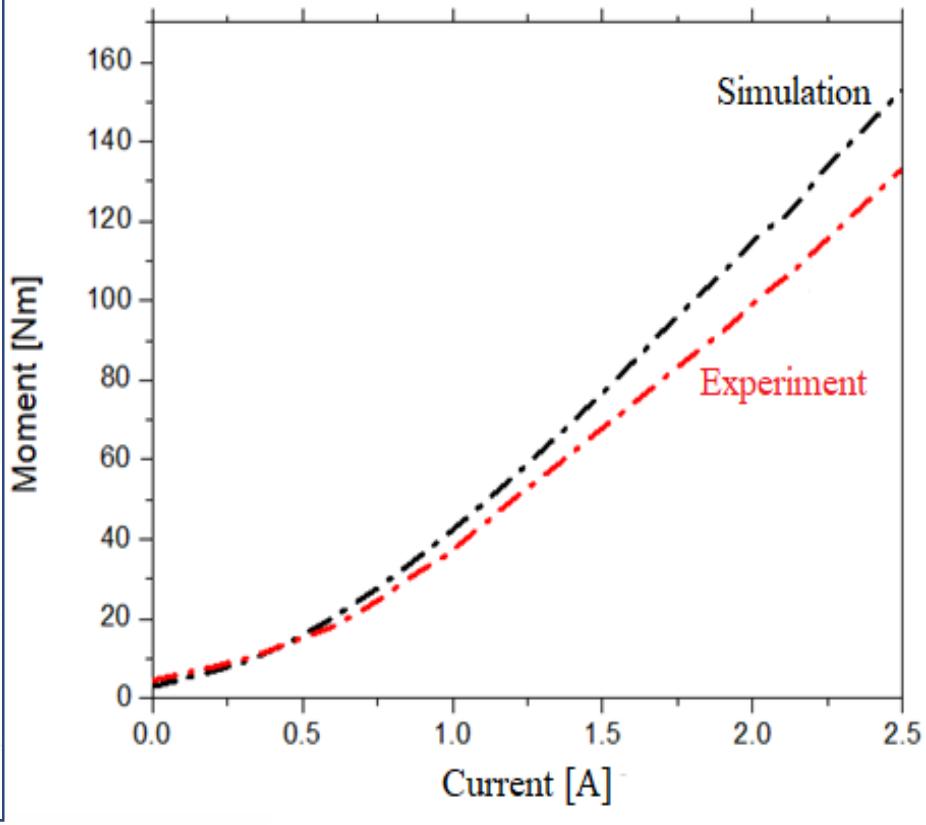


(b) off-state torque vs. braking torque



MR BRAKE DEVELOPMENT





MR BRAKE DEVELOPMENT

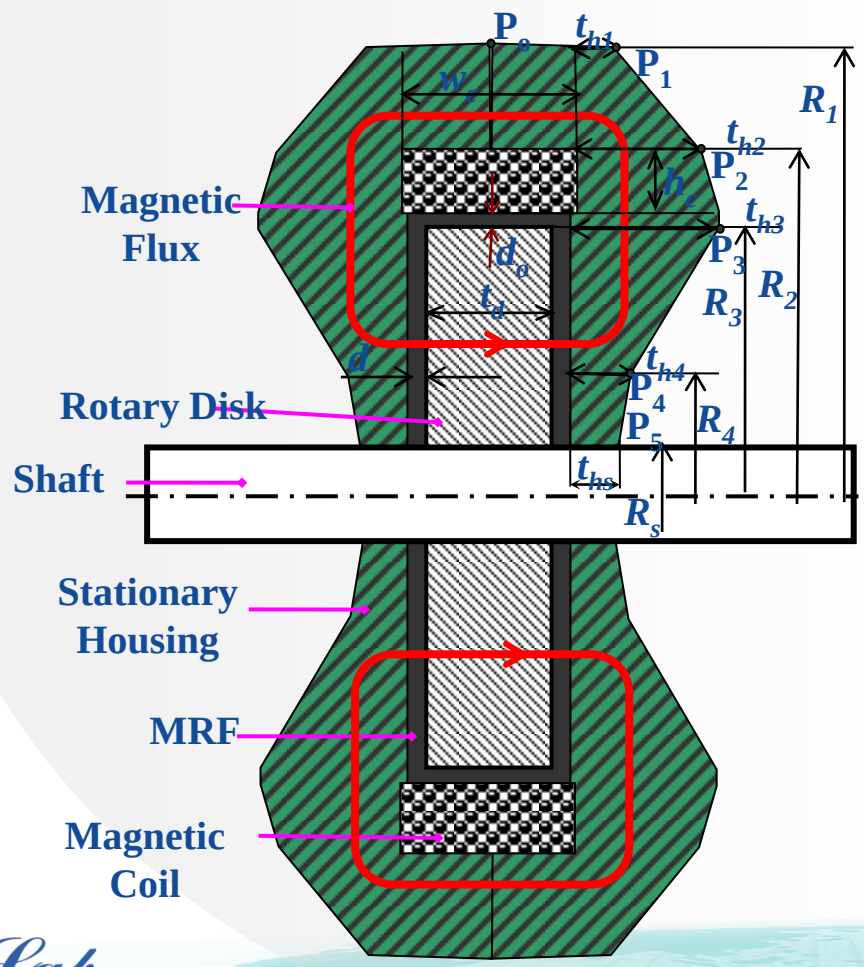
Field test with cruising speed at 60km/h

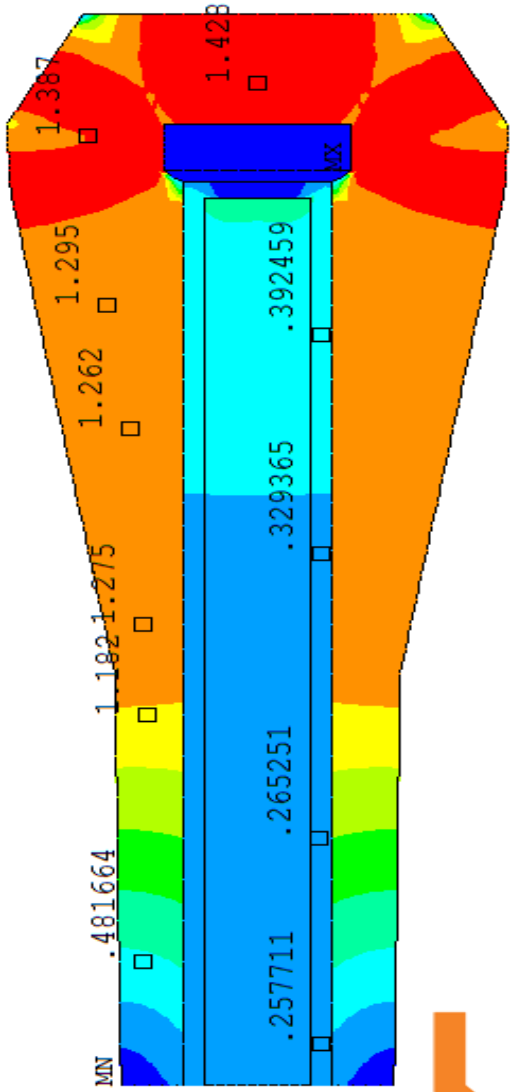
Braking test	Measured braking distance [m]
1st	16.7
2nd	17.0
3rd	16.5
4th	16.2
5th	16.0

Test nmber	Measured MRB housing temperature [^{0}C]
1st	66.4
2nd	65.6
3rd	67.2

MR BRAKE DEVELOPMENT

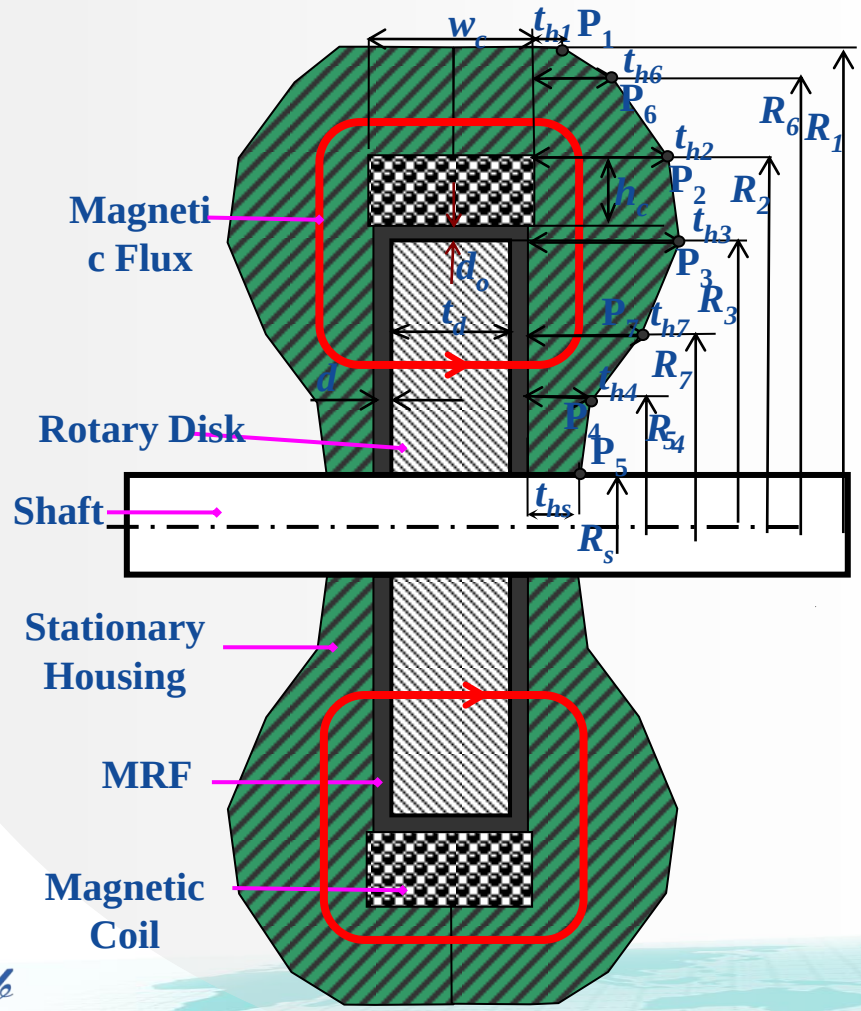
5 segment polygon Shape

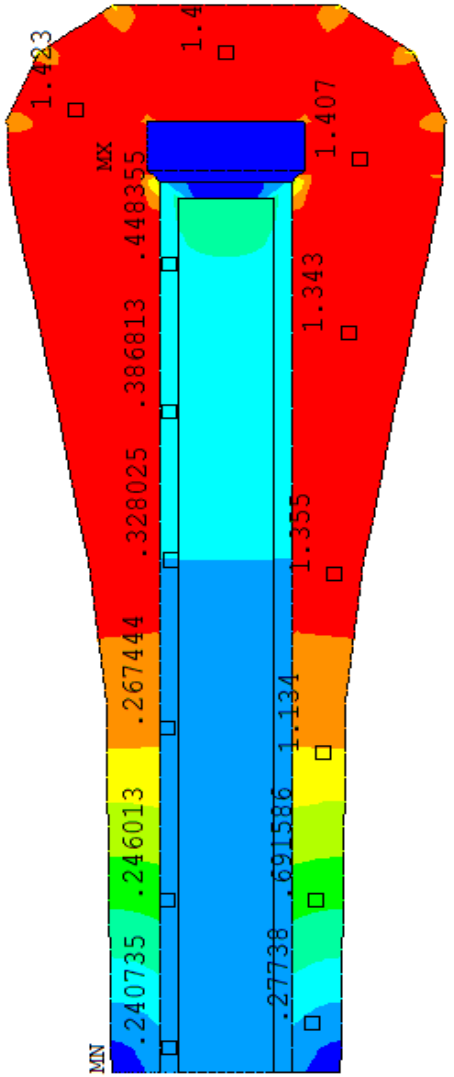




MR BRAKE DEVELOPMENT

7-segment polygon/Spline Shape

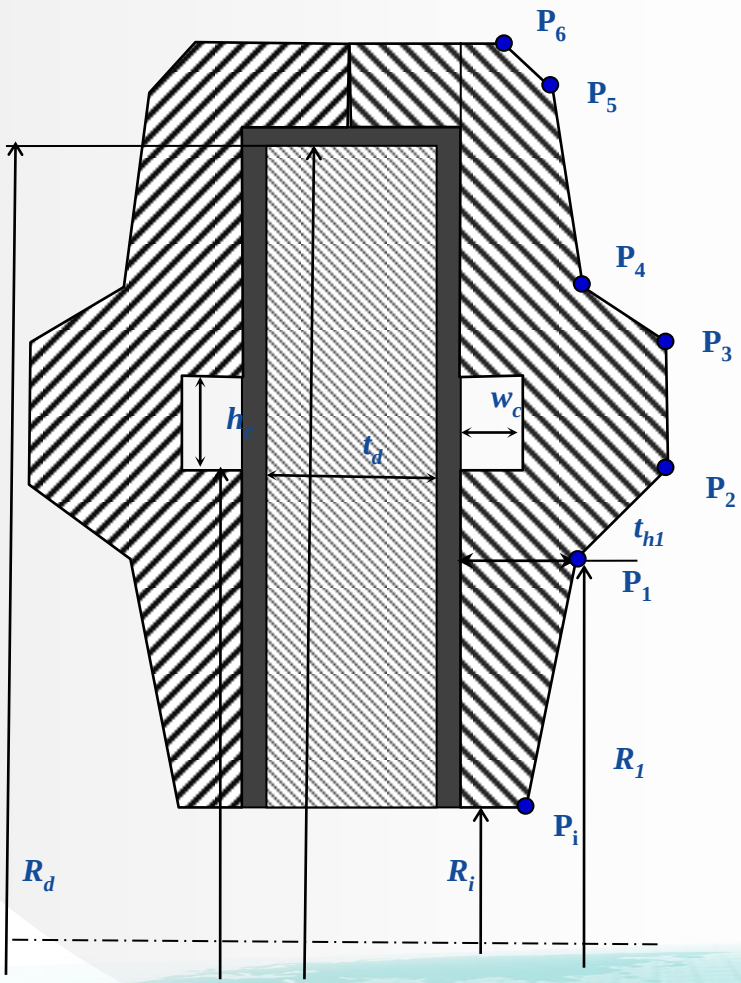


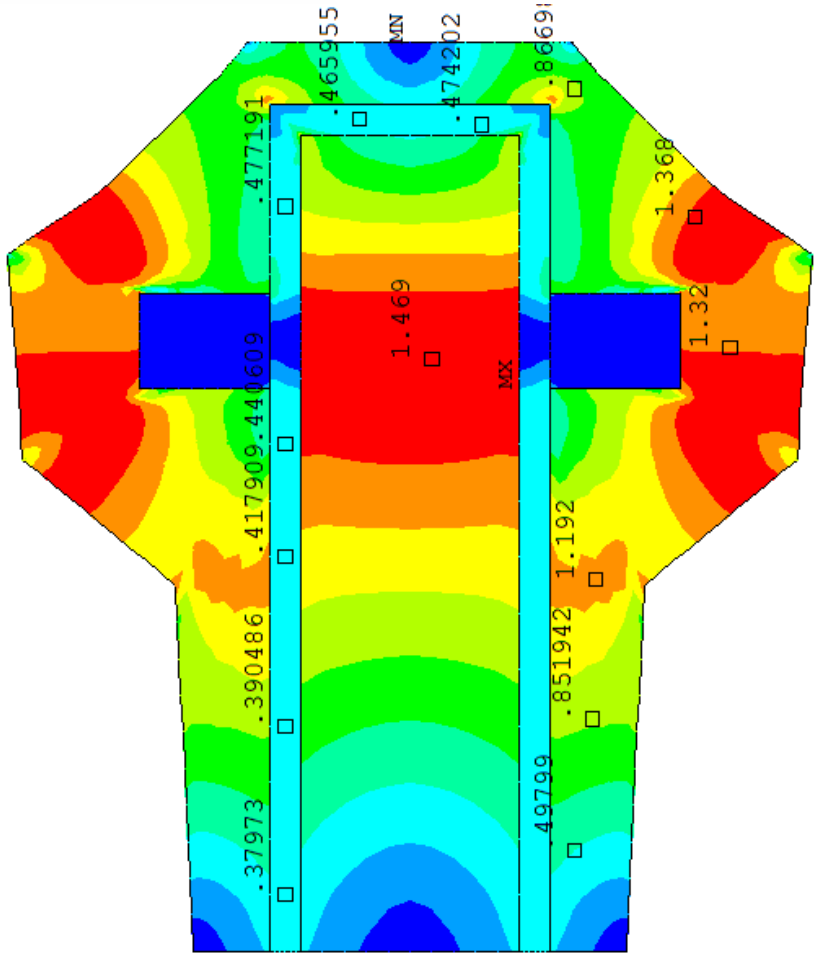


S³ Lab
Smart Structures and Systems Laboratory

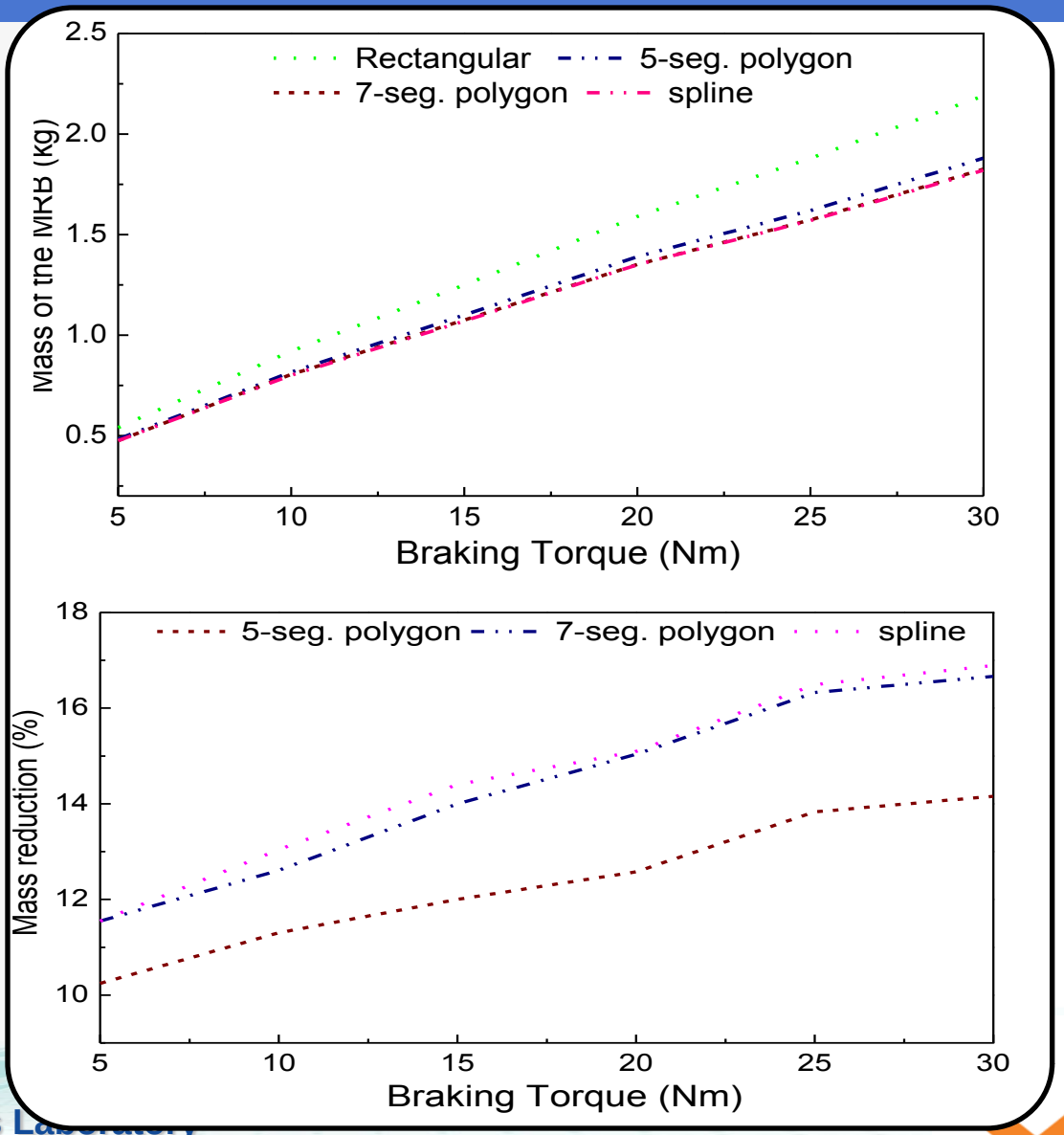
MR BRAKE DEVELOPMENT

7-segment polygon/Spline Shape

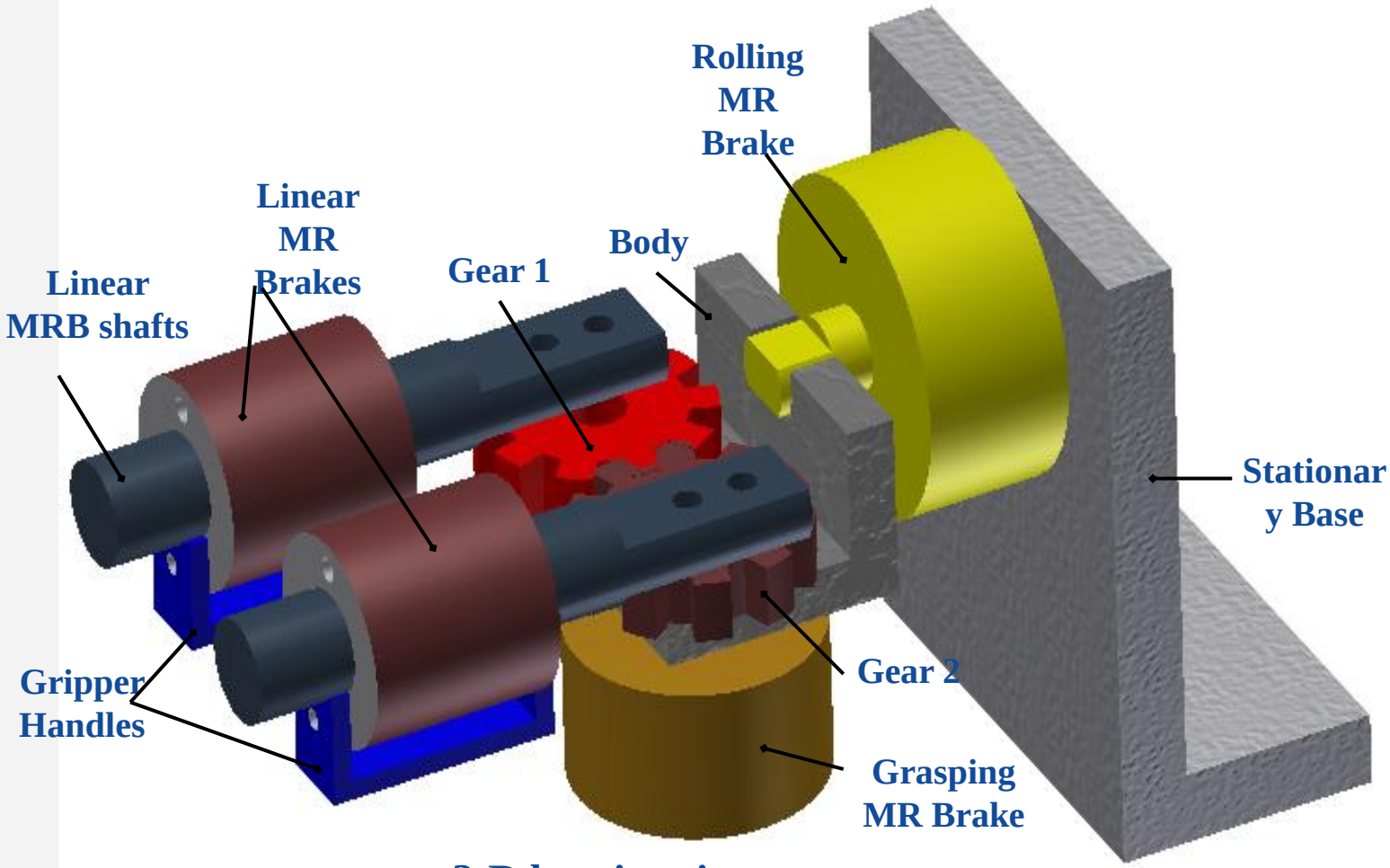




MR BRAKE DEVELOPMENT

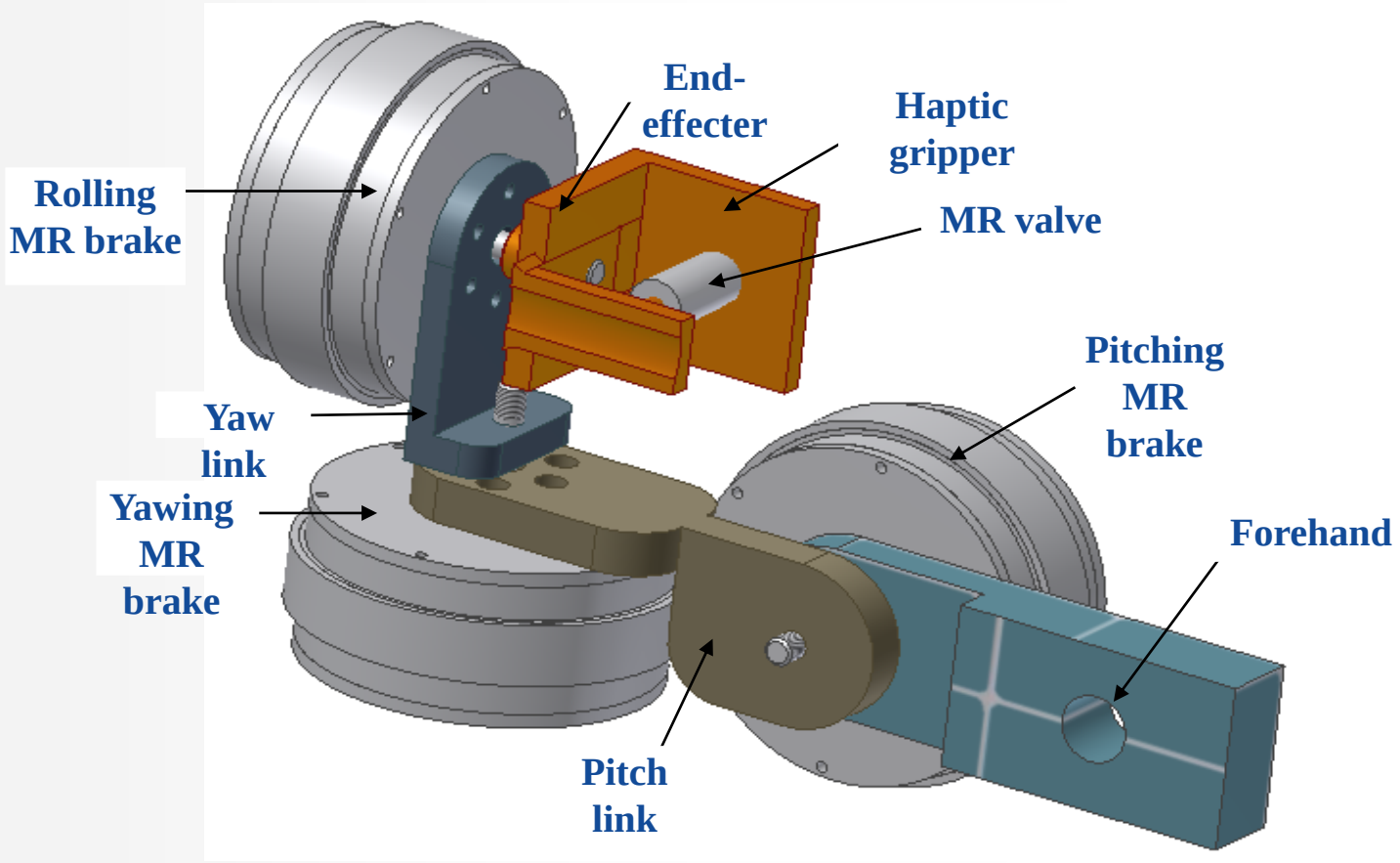


Applications of MR Brake in Haptic Systems



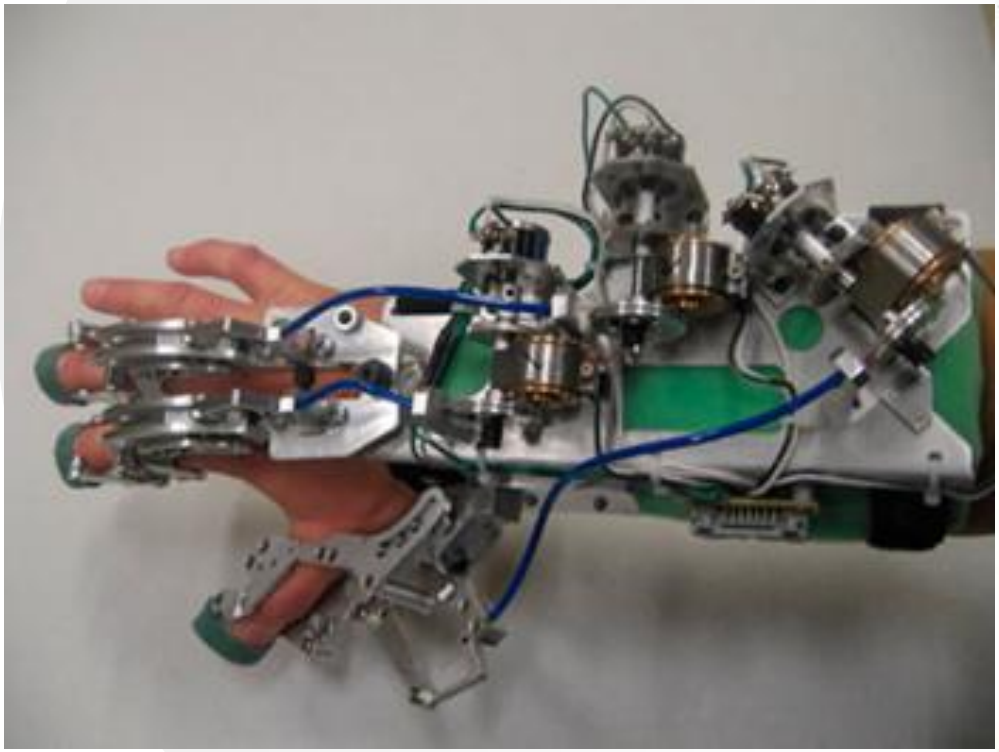
3-D haptic gripper

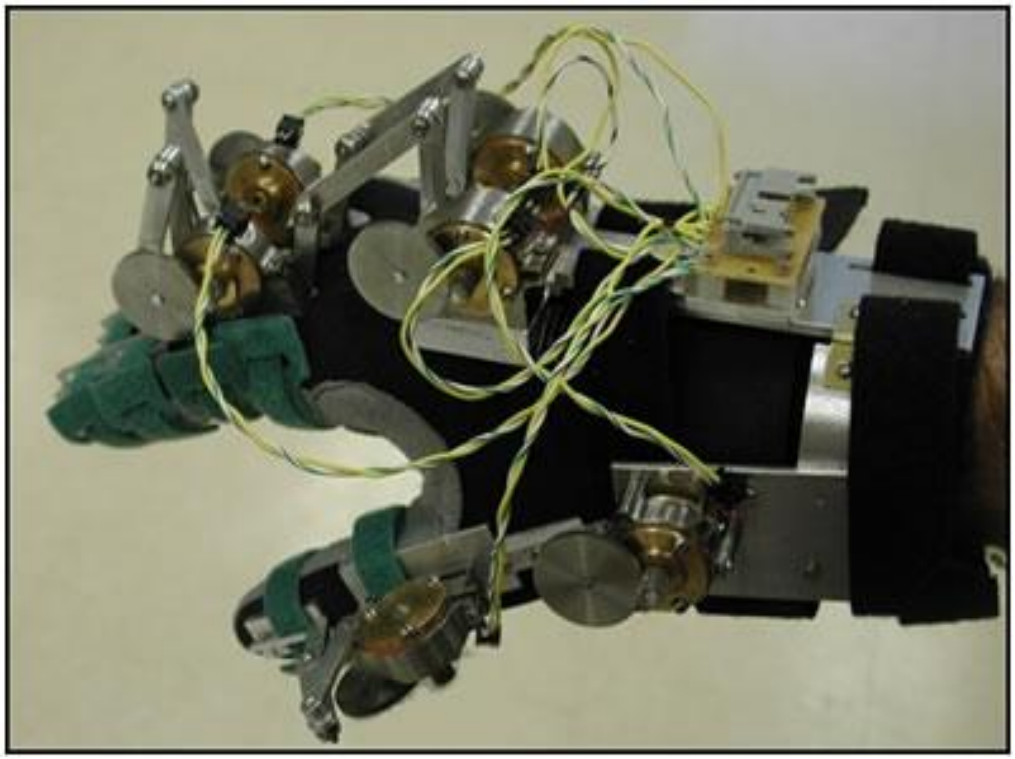
Applications of MR Brake in Haptic Systems



Haptic Wrist

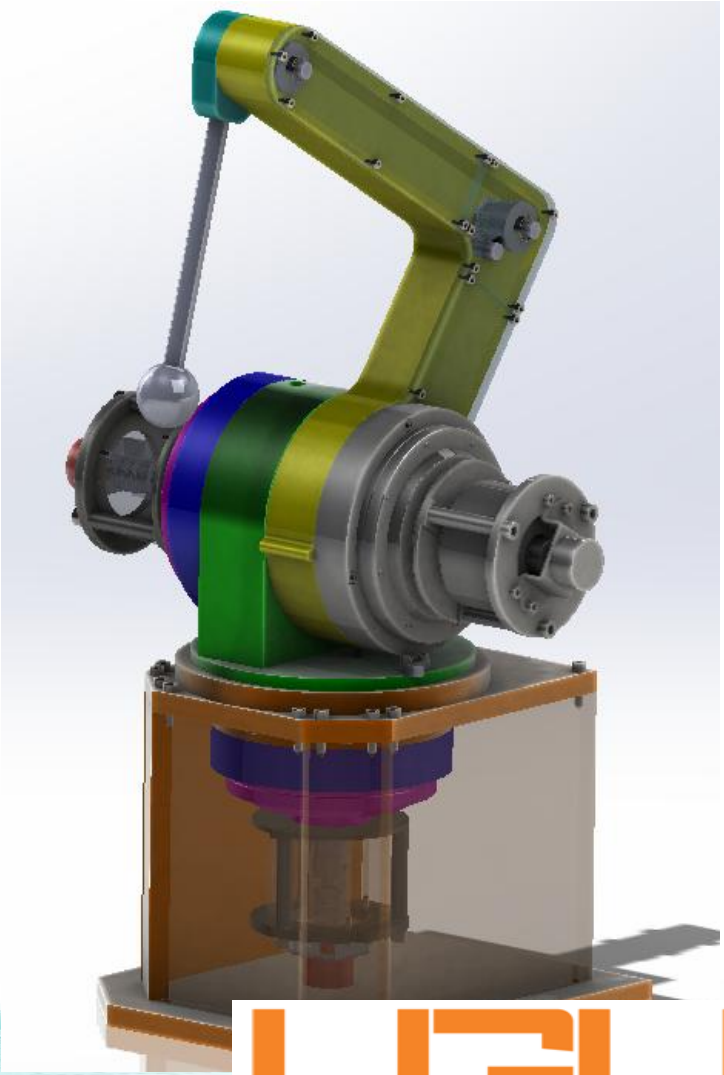
Applications of MR Brake in Haptic Systems





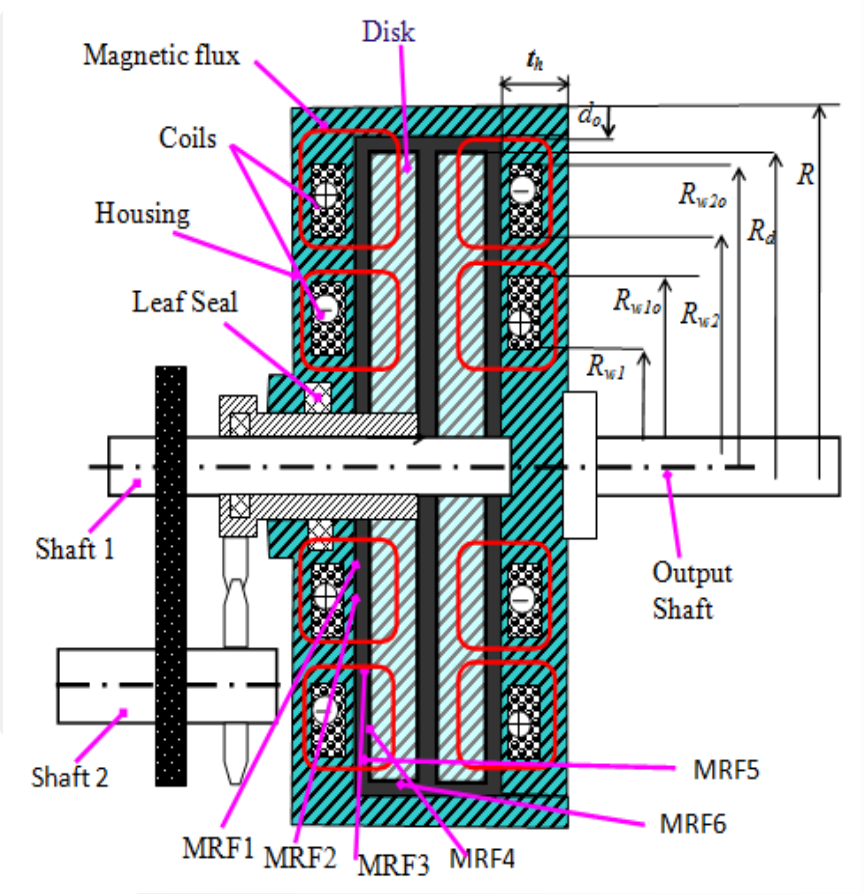
Haptic Fingers

Applications of MR Brake in Haptic Systems

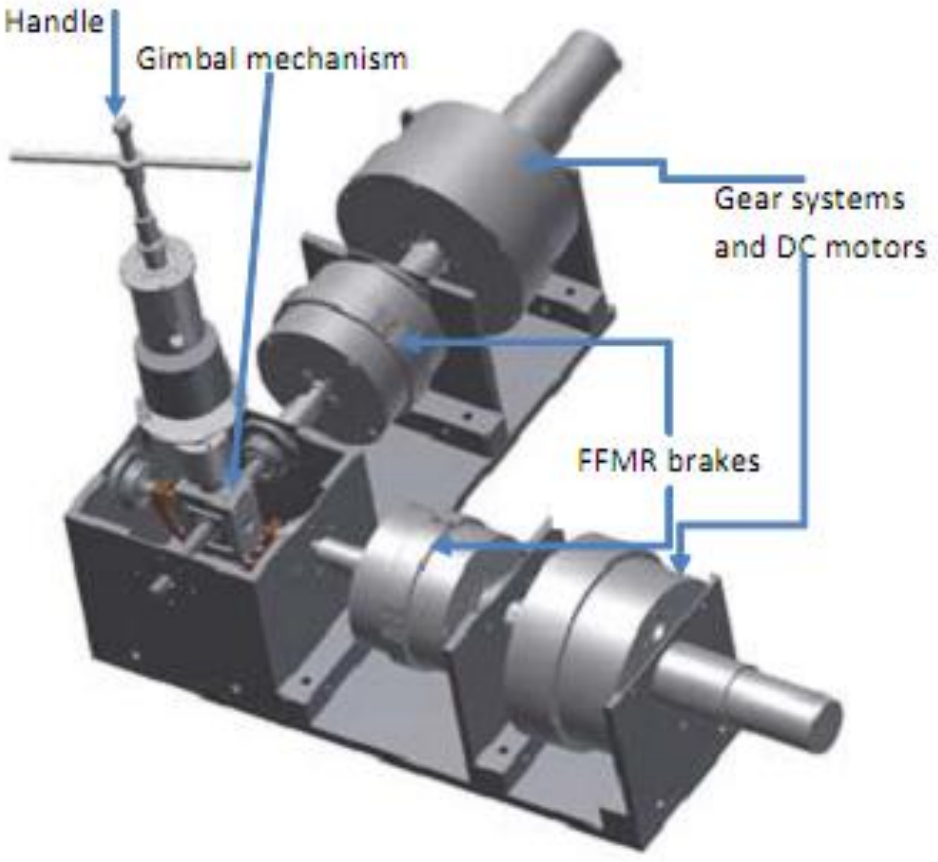


3-DOF Haptic Manipulator

Applications of MR Brake in Haptic Systems

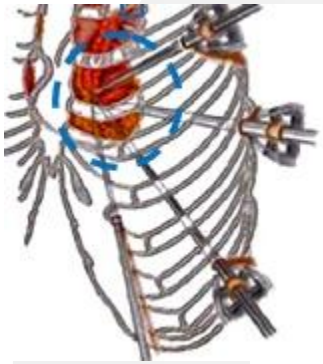


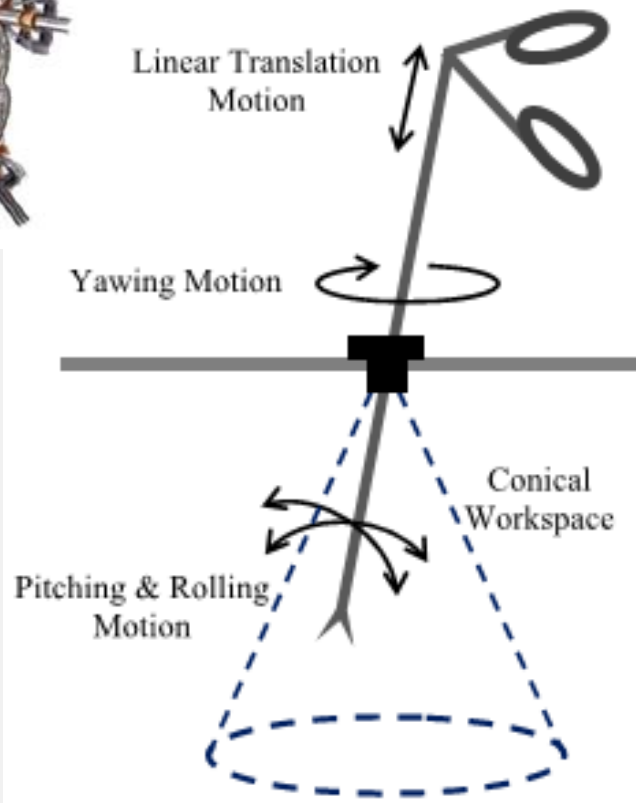
Bi directional MR Actuator

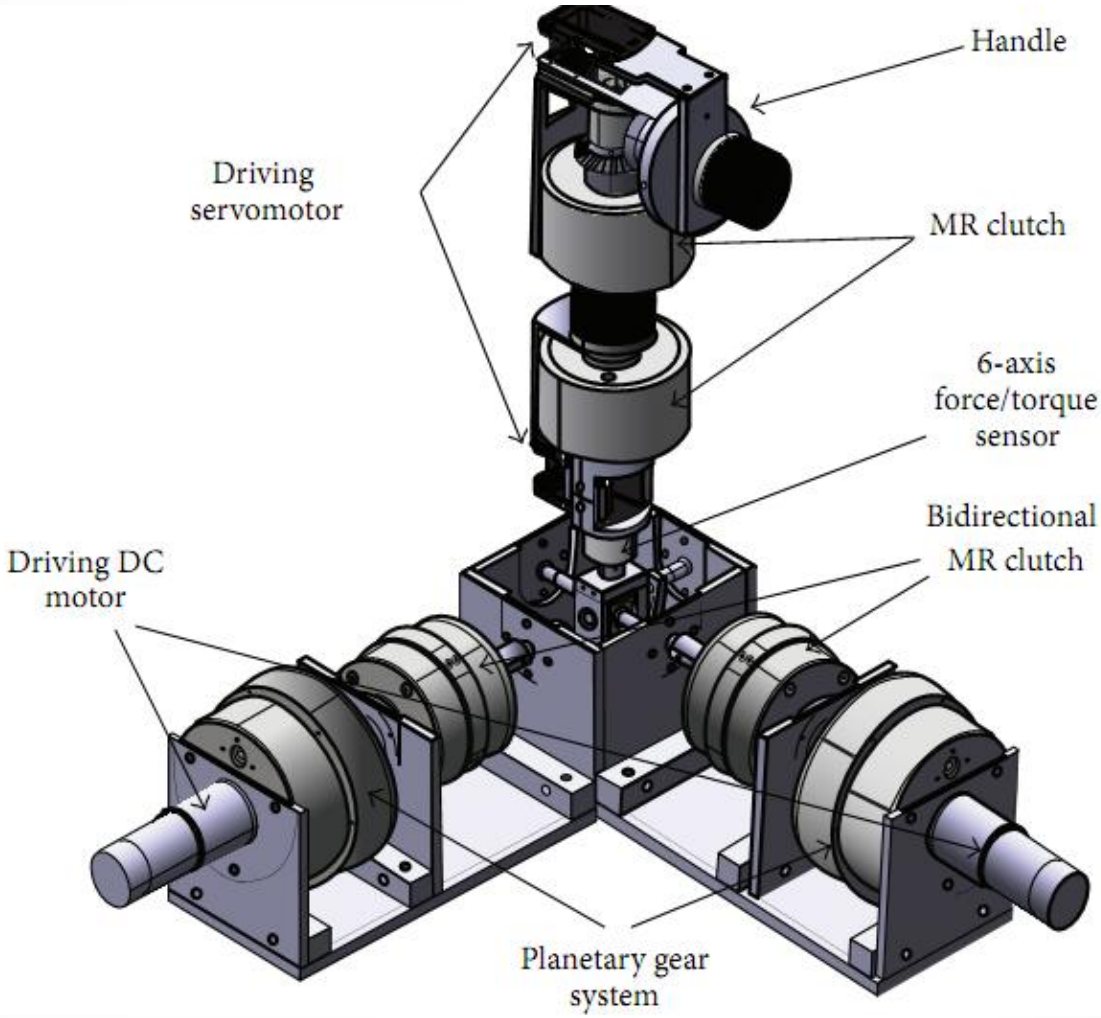


2D MR Haptic Master

Applications of MR Brake in Haptic Systems







4D Haptic Master for Surgeon Robot

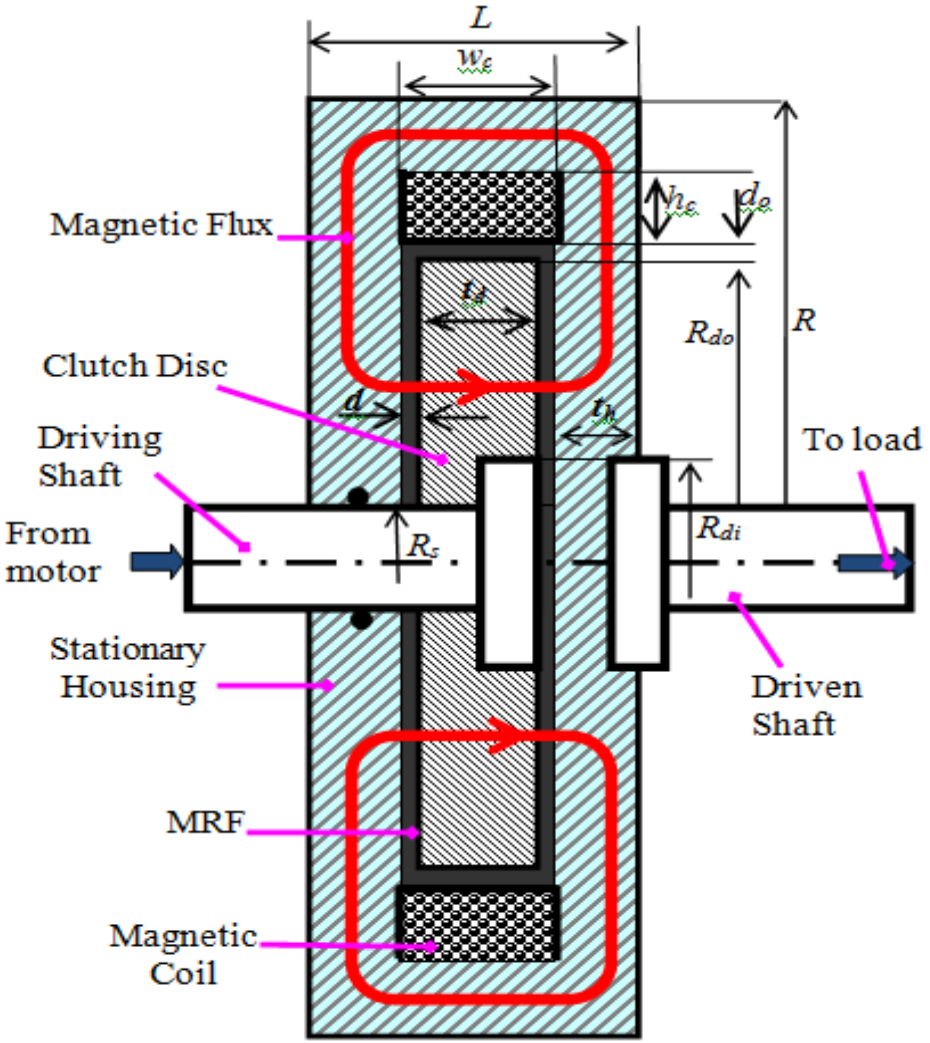
MR CLUTCH DEVELOPMENT

➢ Conventional MR Clutch

In conventional MR clutches, coils are placed on a cylindrical housing of the clutch

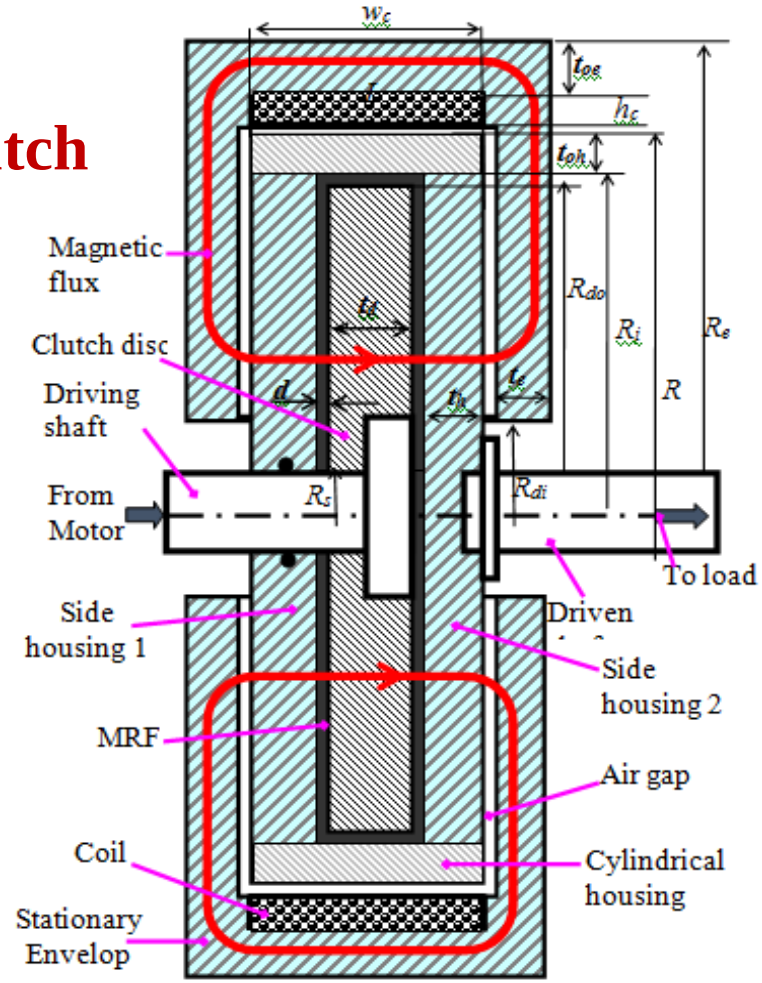
⇒This causes many disadvantages such as difficulties in manufacturing, the "bottle-neck" problem of the clutch magnetic circuit, high friction and unsteady applied current due to brushes.

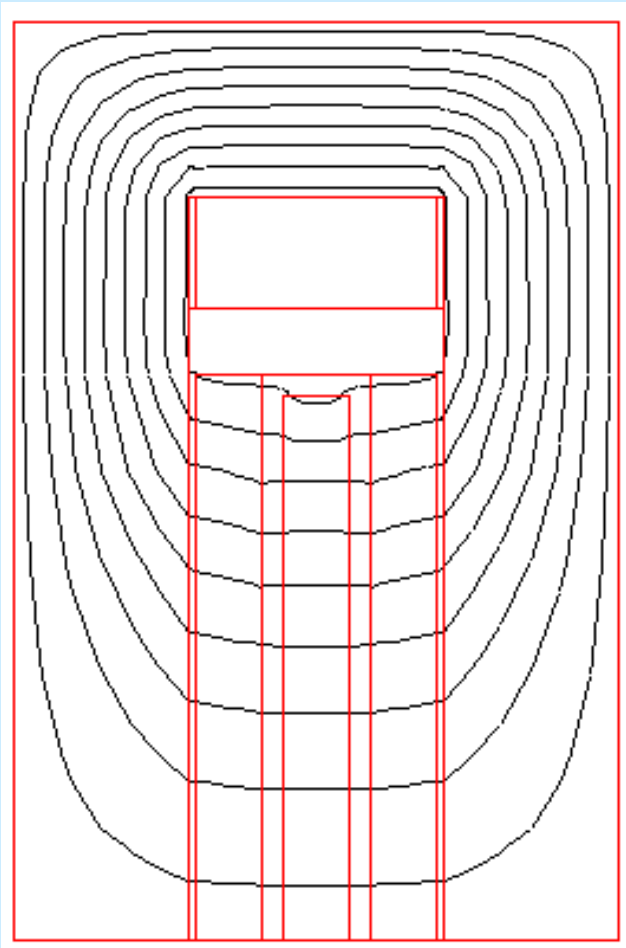
⇒ A new configuration of MR clutch



MR CLUTCH DEVELOPMENT

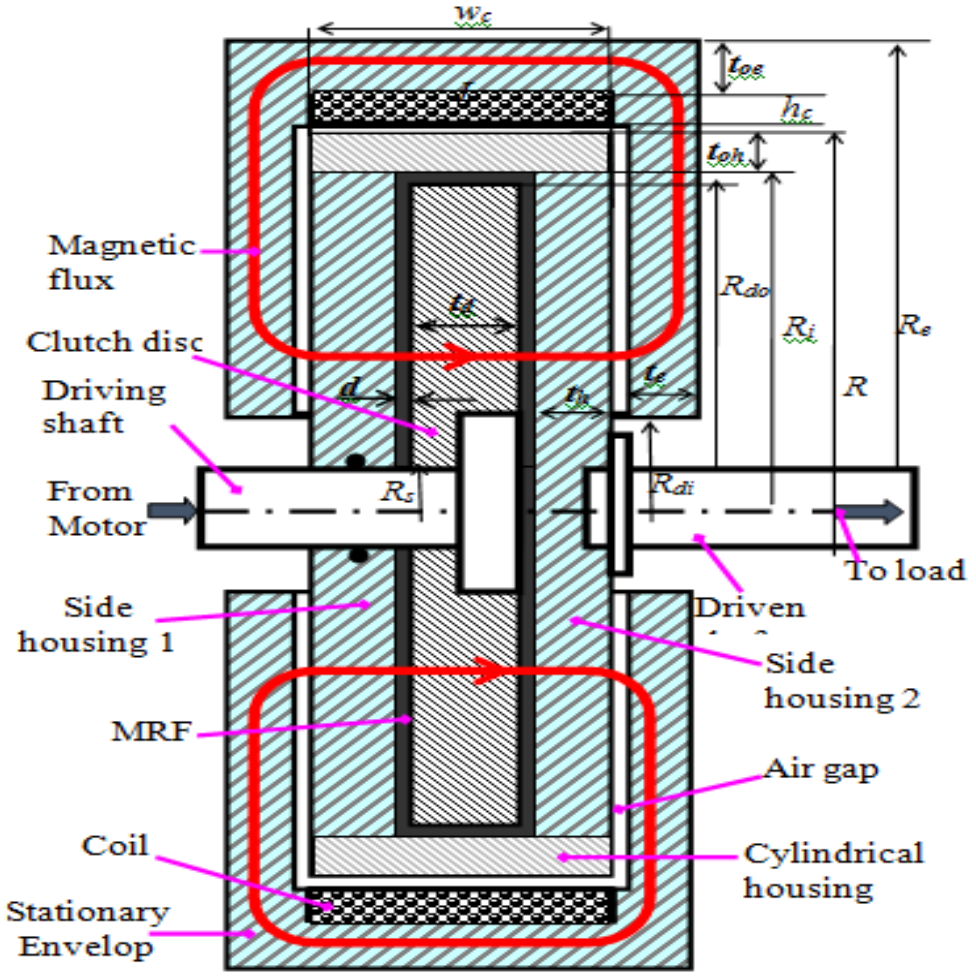
➢ Stationary Winding MR Clutch





MR CLUTCH DEVELOPMENT

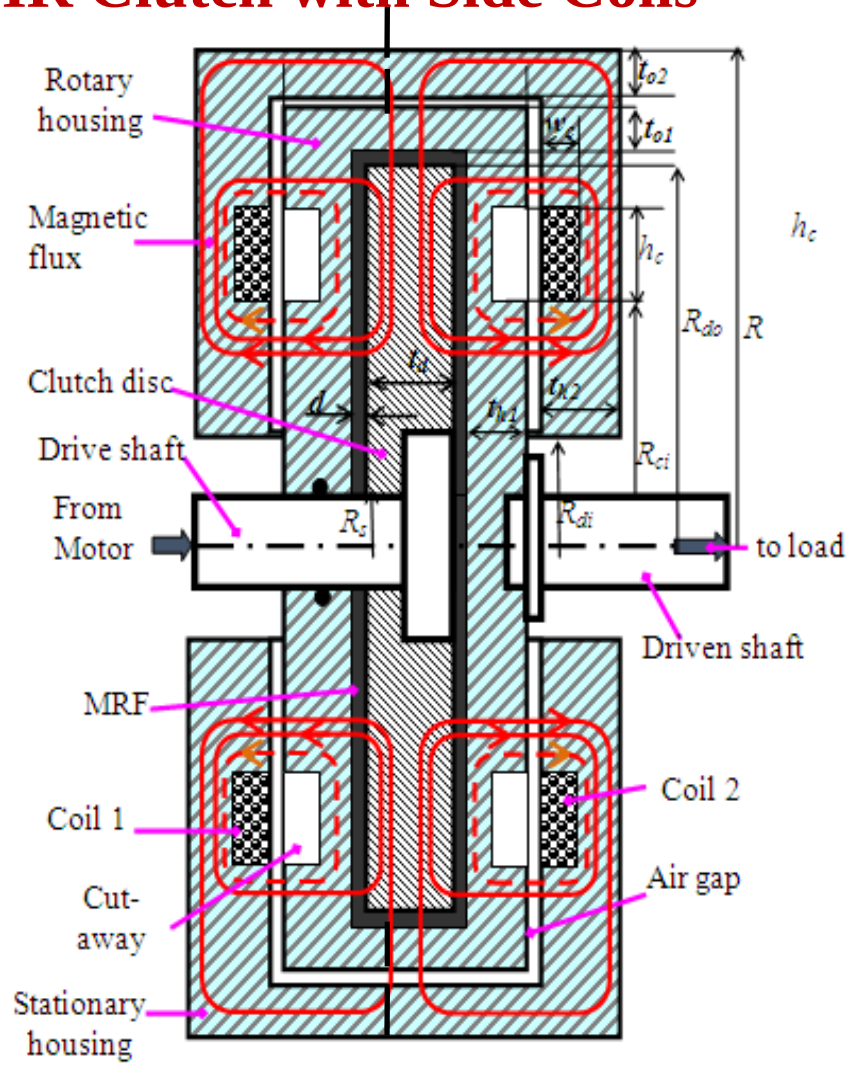
➢ Stationary Winding MR Clutch



- The coils are fixed and brushes are eliminated.
- Moment of inertia of the output part was significantly smaller than that in case of the conventional one
- Disadvantages: A a nonmagnetic cylindrical housing was used and it was difficult to adjust the air gap between the stationary housing (the winding housing) and the rotary housing of the clutch.

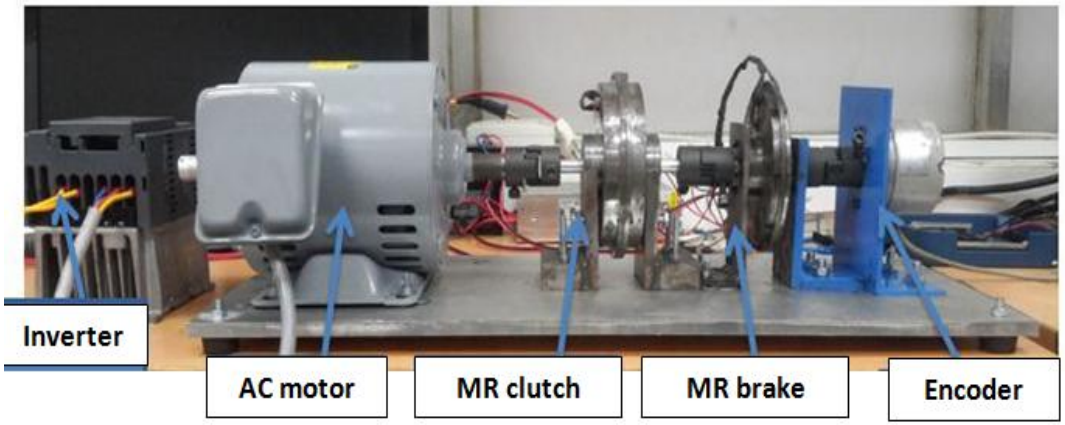
MR CLUTCH DEVELOPMENT

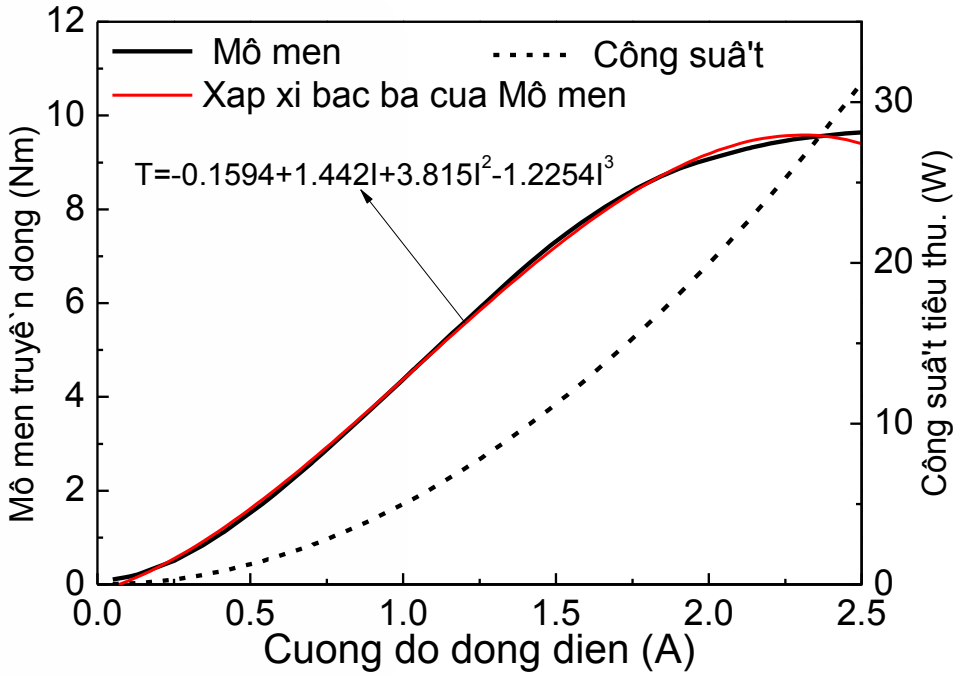
➢MR Clutch with Side Coils



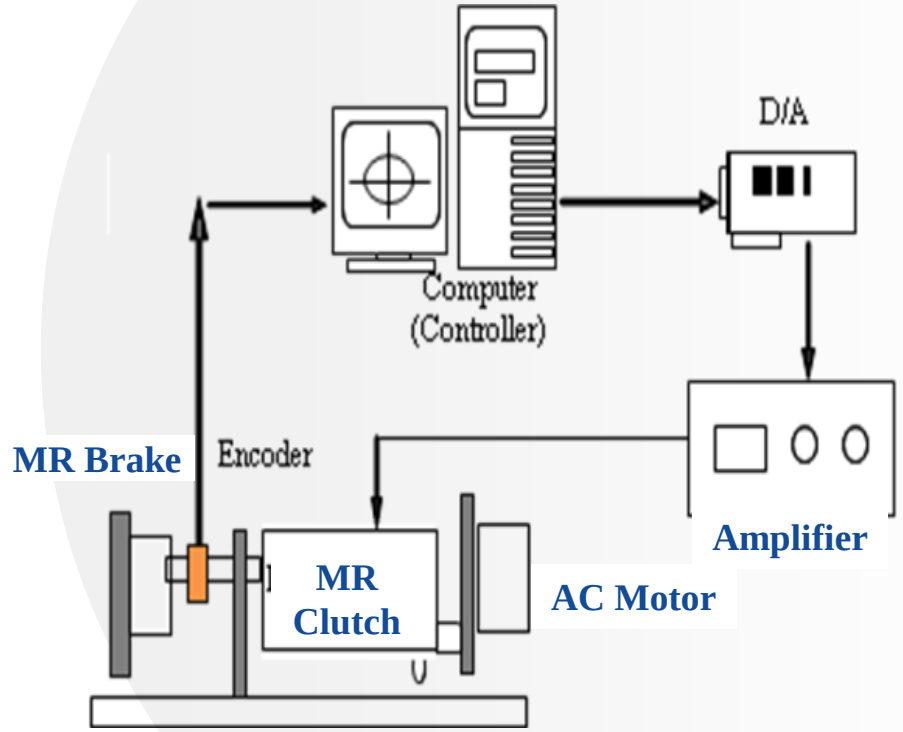
- Two mutual coils placed each side of a stationary housing
- In side the stationary housing, an MR clutch is placed
- The gap between the stationary housing and MR clutch is set 0.3mm
- No nonmagnetic housing and bobbin are needed
- A gasket can be employed between the two parts of the winding housing.
- Much easier for manufacturing, assemble and maintenance

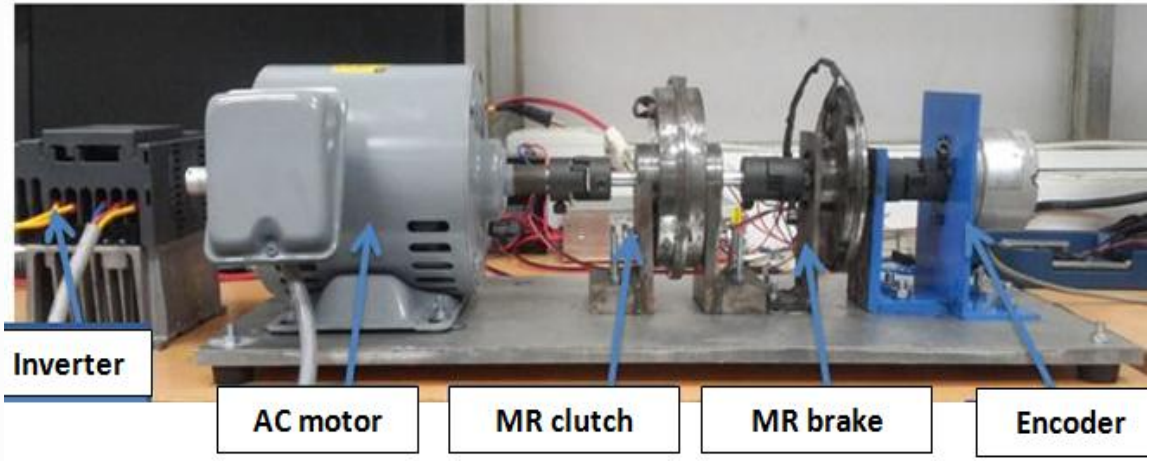
MR CLUTCH DEVELOPMENT





APPLICATION OF MR CLUTCH IN SPEED CONTROL

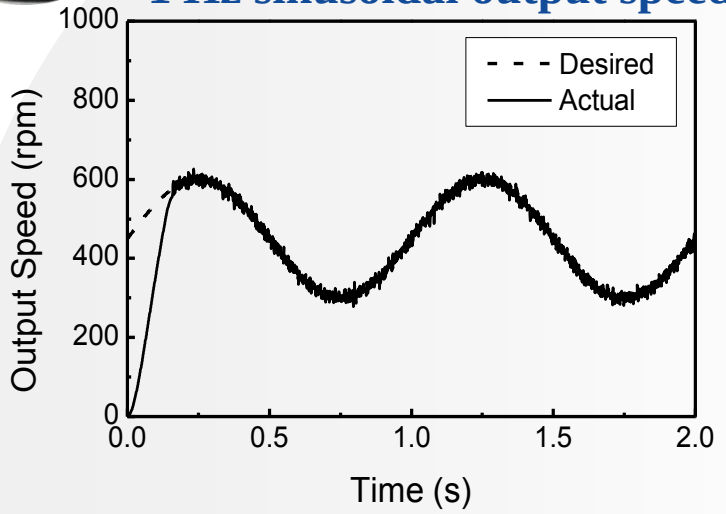


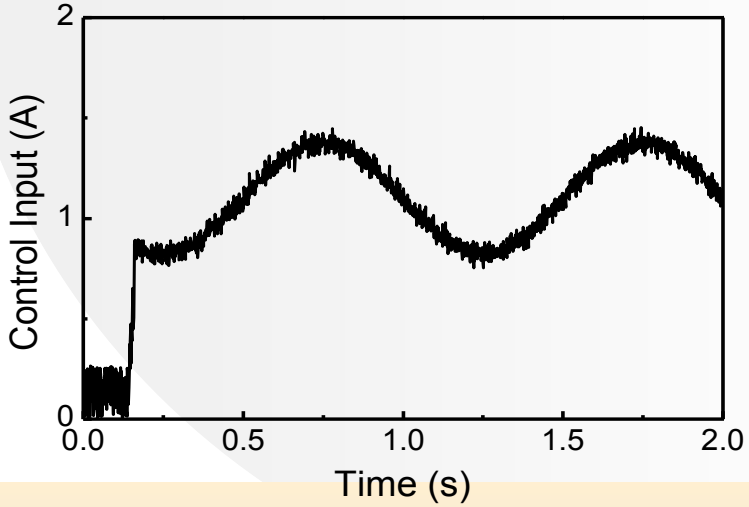


Experiment Setup for Speed Control Using MR Clutch

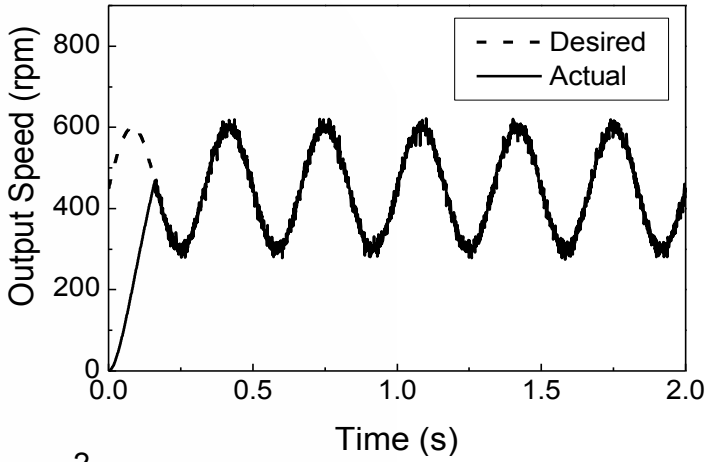
APPLICATION OF MR CLUTCH IN SPEED CONTROL

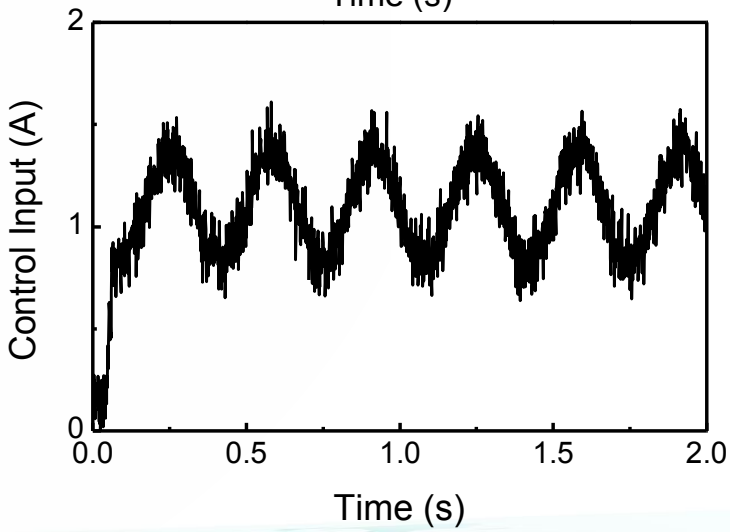
1 Hz sinusoidal output speed





3 Hz sinusoidal output speed





THANK YOU

A Wireless Air Pollution Monitoring System for Binh Duong Province

Principal Investigator:

TS. Võ Bích Hiển

Faculty of Engineering

VGU

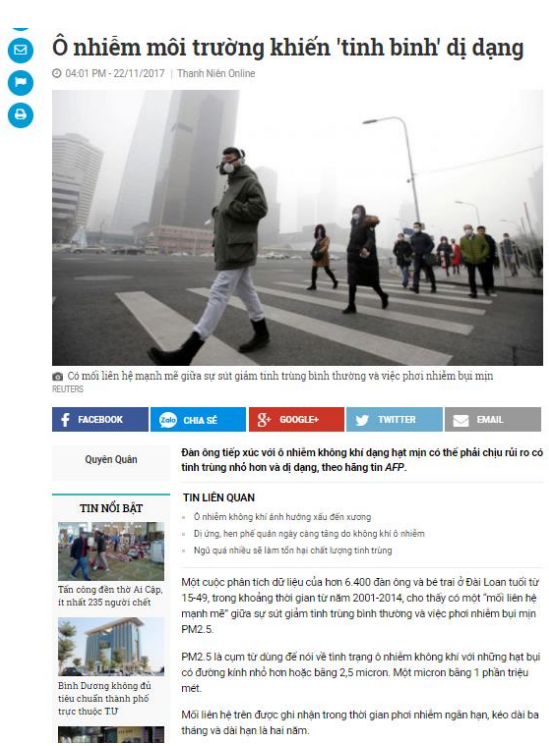
Members:

TS. Khiếu Hữu Lộc

ThS. Nguyễn Võ Thất Thuyết

ThS. Trần Quang Nhu

Ks. Nguyễn Đức Thịnh



Ô nhiễm môi trường khiến 'tinh binh' dị dạng

04:01 PM - 22/11/2017 | Thanh Niên Online

Có mối liên hệ mạnh mẽ giữa sự sút giảm tinh trùng bình thường và việc phơi nhiễm bụi mịn

REUTERS

FACEBOOK | CHIA SẺ | GOOGLE+ | TWITTER | EMAIL

Quyên Quân

Đàn ông tiếp xúc với ô nhiễm không khí dạng hạt mịn có thể phải chịu rủi ro có tinh trùng nhỏ hơn và dị dạng, theo hãng tin AFP.

TIN NỔI BẬT

Tấn công đền thờ Ai Cập, ít nhất 235 người chết

Bình Dương không đủ tiêu chuẩn thành phố trực thuộc TƯ

TIN LIÊN QUAN

- Ô nhiễm không khí ảnh hưởng xấu đến xương
- Dị ứng, hen phế quản ngày càng tăng do không khí ô nhiễm
- Ngủ quá nhiều sẽ làm tổn hại chất lượng tinh trùng

Một cuộc phân tích dữ liệu của hơn 6.400 đàn ông và bé trai ở Đài Loan tuổi từ 15-49, trong khoảng thời gian từ năm 2001-2014, cho thấy có một "mối liên hệ mạnh mẽ" giữa sự sút giảm tinh trùng bình thường và việc phơi nhiễm bụi mịn PM2.5.

PM2.5 là cụm từ dùng để nói về tình trạng ô nhiễm không khí với những hạt bụi có đường kính nhỏ hơn hoặc bằng 2,5 micron. Một micron bằng 1 phần triệu mét.

Mối liên hệ trên được ghi nhận trong thời gian phơi nhiễm ngắn hạn, kéo dài ba tháng và dài hạn là hai năm.

Tỉ lệ viêm đường hô hấp cao tại các thành phố lớn ở Việt Nam

TIN MỚI NHẤT

13/12/2016 19:07

Trong những năm gần đây, thể hiện qua tỉ lệ trẻ mắc bệnh viêm phổi tại Việt Nam cao nhất trong khu vực. Bệnh viêm phổi cùng một số bệnh khác về đường hô hấp đã lấy đi 4.000 sinh mạng mỗi năm.

Hãy đọc sách vì... sức khỏe!

Giáo dục dinh dưỡng và phát triển thể lực cho trẻ em

8 loại cây nên đặt trong phòng ngủ

Muốn ngừa ung thư hiệu quả thì ăn nhiều 6 loại thực phẩm này

12 điều tuyệt vời của dưa

Đây cũng là một trong những nguyên nhân hàng đầu dẫn đến tình trạng nghỉ ốm tại trường học và cơ quan trên cả nước.

Hiện nay, vấn đề khoảng cách chất lượng y tế giữa thành thị và nông thôn Việt Nam thường được đề cập rất nhiều, theo bác sĩ nhi khoa Trương Hoàng Quý - Phòng khám Family Medical Practice - cho biết có nhiều lý do để mọi người cân nhắc trở về vùng quê sinh sống thay vì tiếp tục ở thành thị.

ày 25 tháng 11 năm 2017

Tia Sáng

BỘ KHOA HỌC VÀ CÔNG NGHỆ

Tin tức | Diễn đàn | Quản lý khoa học | Khoa học công nghệ | Đổi mới sáng tạo | Giáo dục

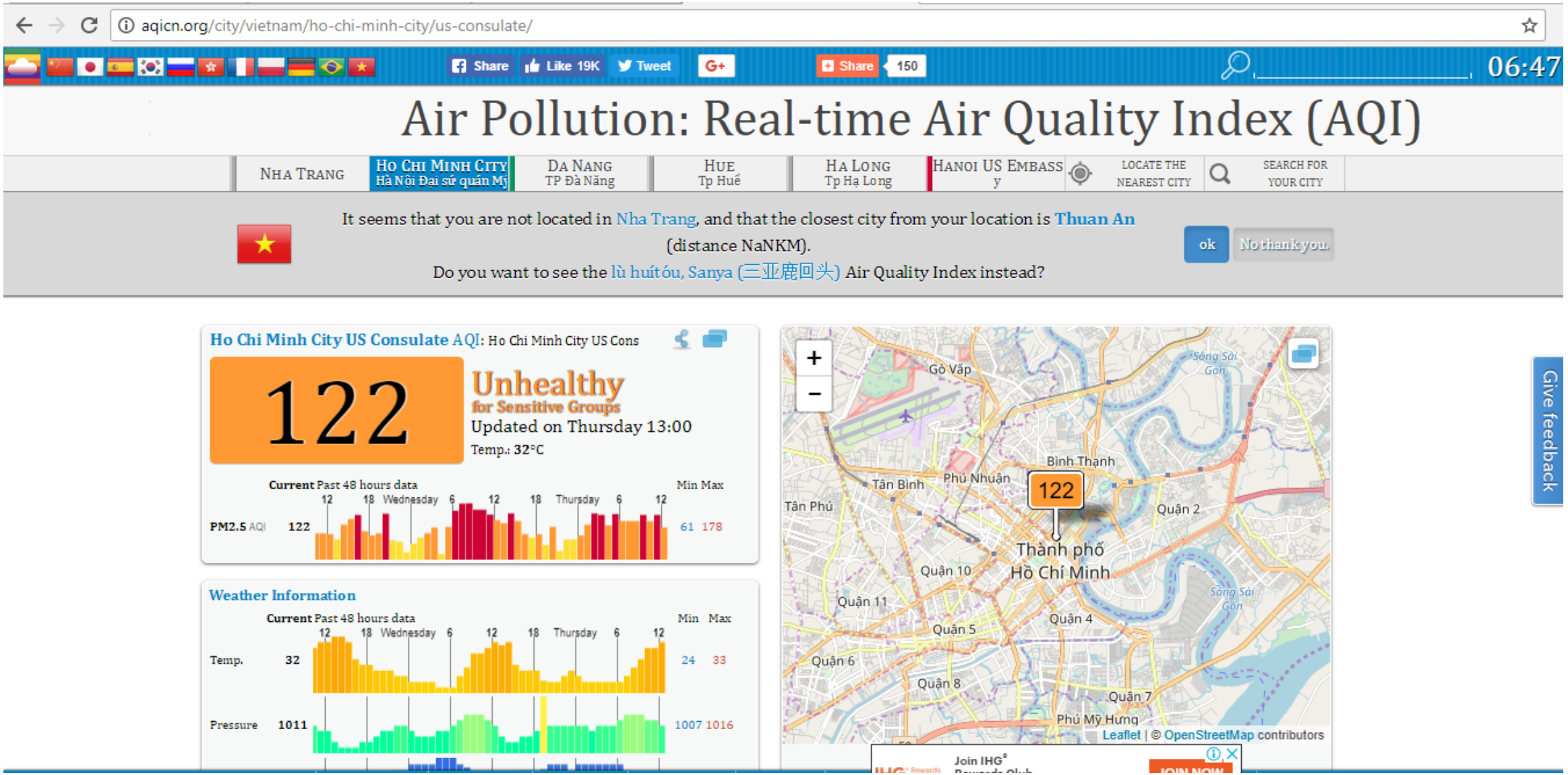
KHOA HỌC VÀ CÔNG NGHỆ

Ô nhiễm không khí làm tăng nguy cơ loãng xương

24/11/2017 08:00 -

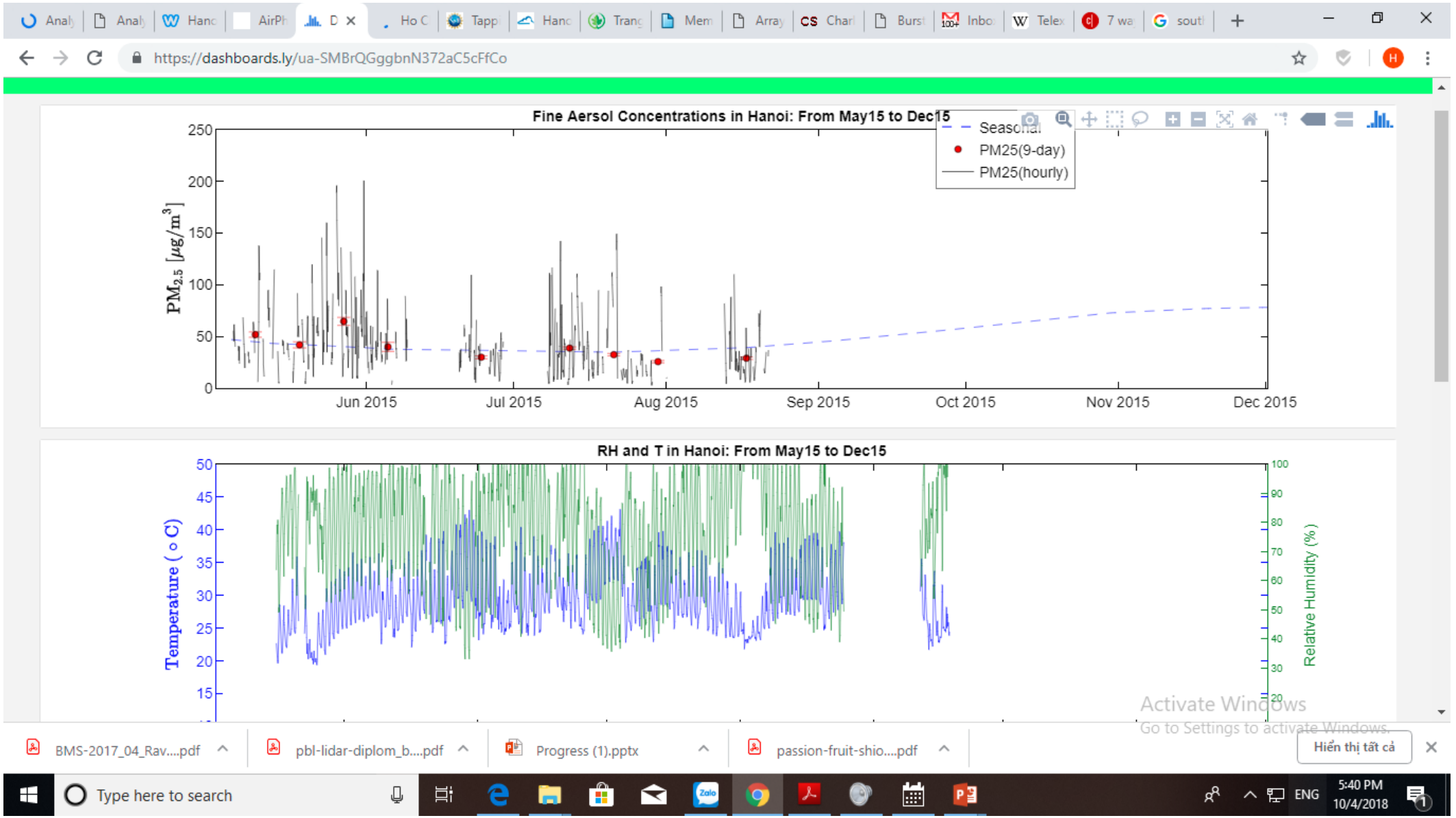
Các nhà khoa học tại Trường Y tế Cộng đồng Mailman thuộc Đại học Columbia, Mỹ, phát hiện việc tiếp xúc với không khí ô nhiễm làm tăng nguy cơ loãng xương và gãy xương. Kết quả nghiên cứu được đăng trên tạp chí The Lancet Planetary Health vào tháng 11/2017.

Current Situation



Only One Node in US Consulate in HCM City

It cannot create a city wide map of air pollution



SPARTAN node in Hanoi , a Canadian project

Không bảo mật | moitruongthudo.vn

CỔNG THÔNG TIN QUAN TRẮC MÔI TRƯỜNG
UBND THÀNH PHỐ HÀ NỘI

TRANG CHỦ | TIN TỨC | ĐĂNG NHẬP | ENGLISH

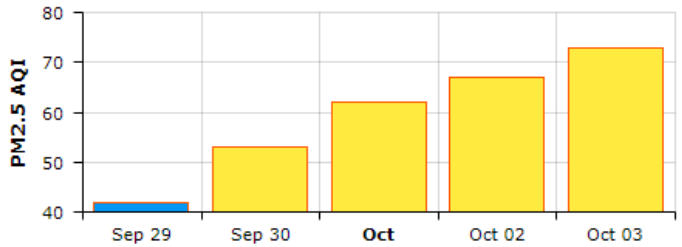
Chọn điểm đo

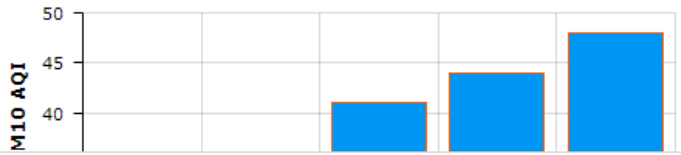
Chi cục bảo vệ môi trường

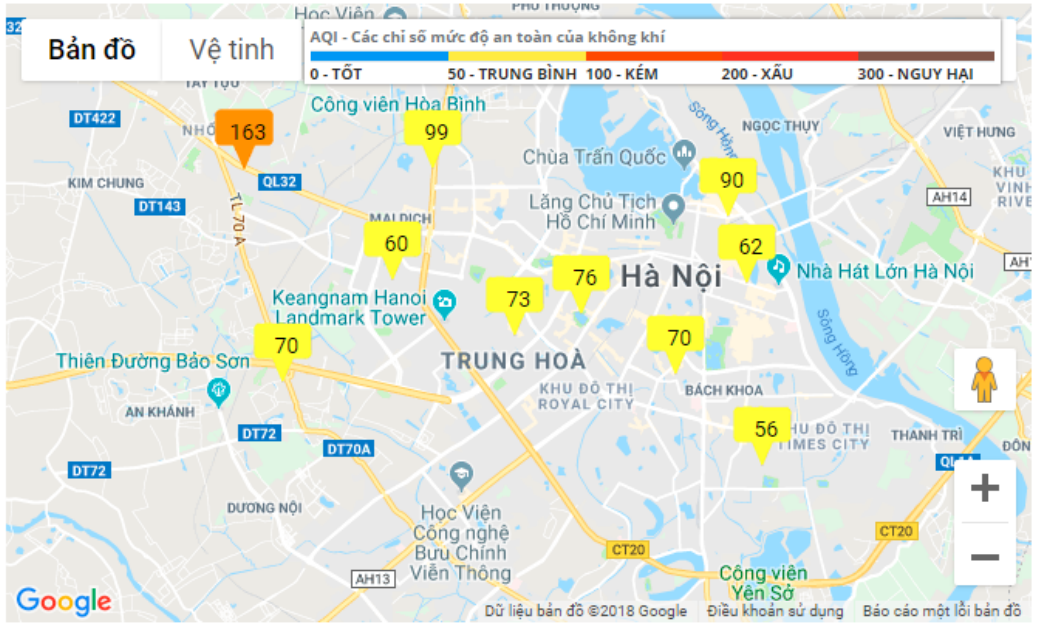
Số liệu ngày 03-10-2018

AQI 73 | **Nồng độ**

Chỉ số AQI chi tiết theo thành phần không khí







Bảng quy đổi giá trị AQI

Giá trị AQI	Đánh giá	Ảnh hưởng sức khỏe	Màu sắc

BMS-2017_04_Rav....pdf | pbl-lidar-diplom_b....pdf | Progress (1).pptx | passion-fruit-shio....pdf | Hiển thị tất cả

Type here to search

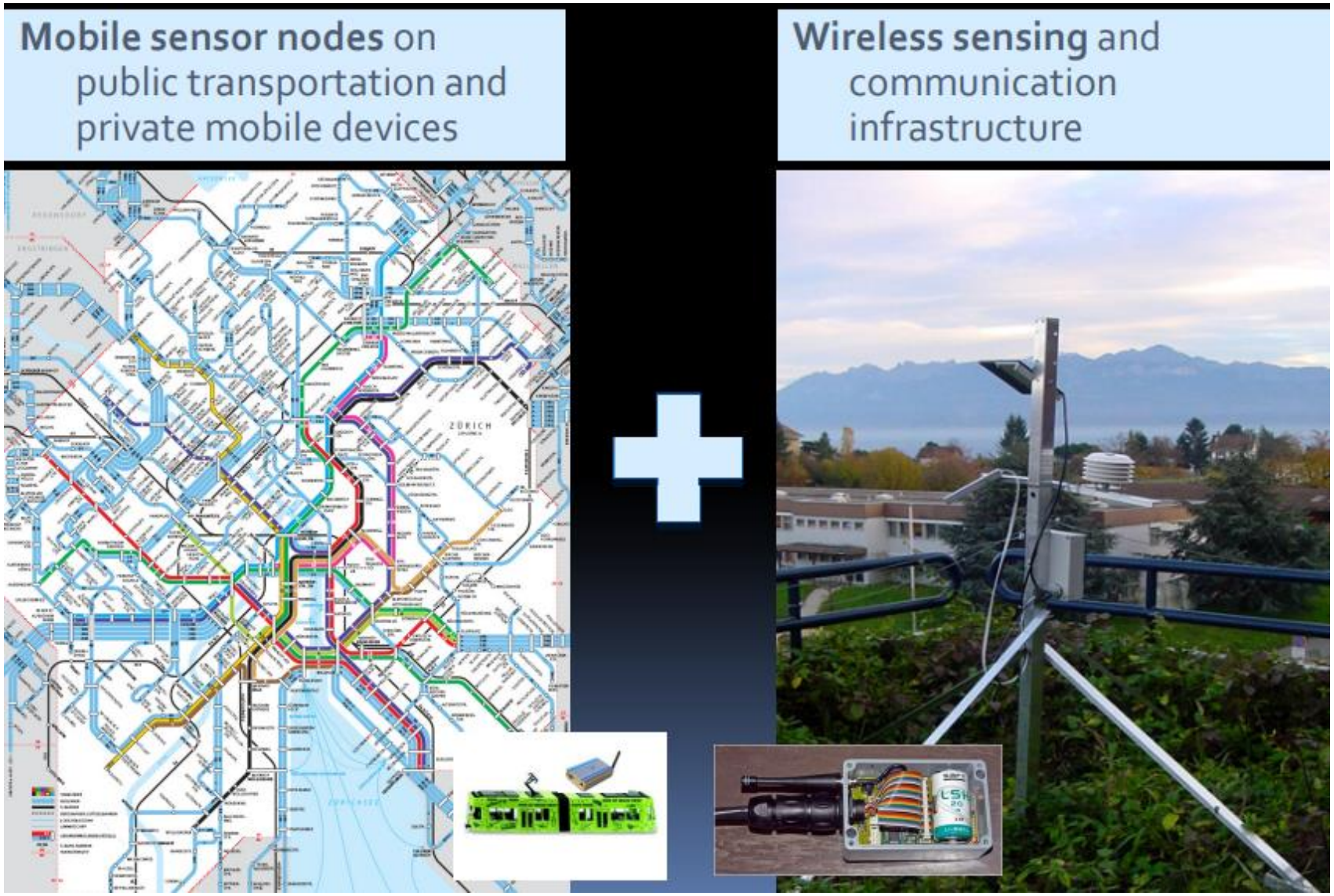
ENG 5:57 PM 10/4/2018

Low Cost Air Pollution Monitoring System

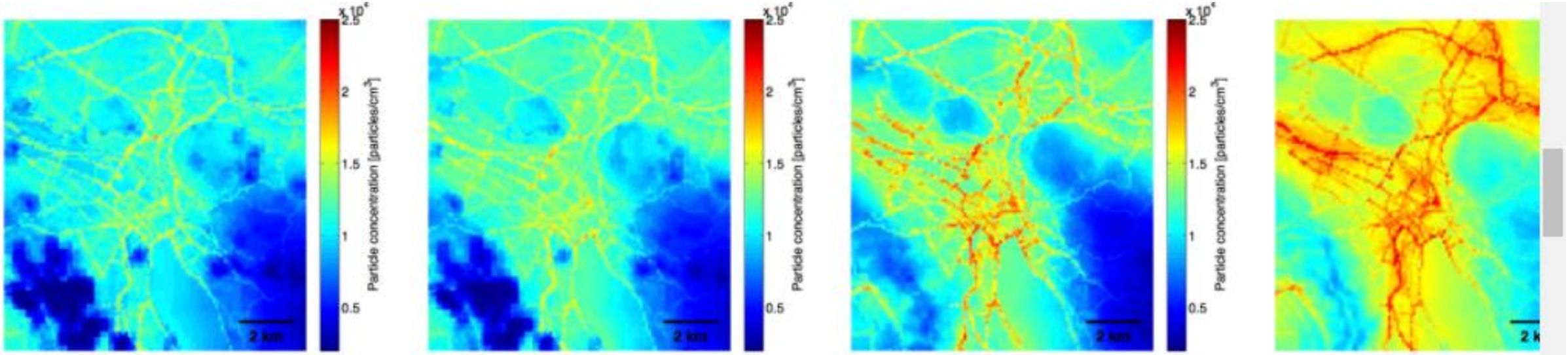
- OPENSENSE – A Swiss project in the city of Zurich
- Integrate Air Quality Measurement from Mobile and Crowd Sense Data

http://www.opensense.ethz.ch/trac/

Nodes from OPENSENSE



- Map of Air Pollution over 4 Seasons

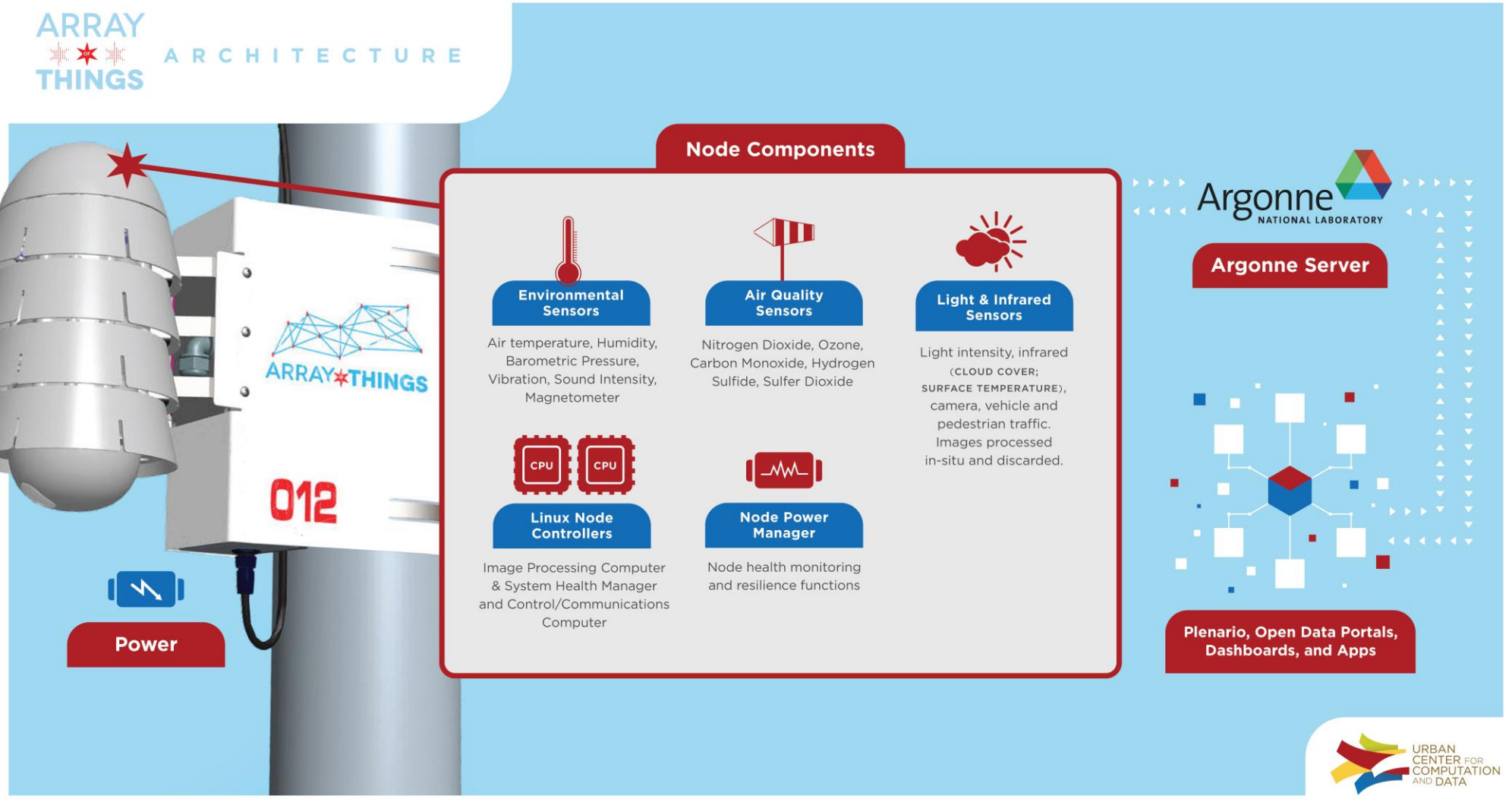


USA

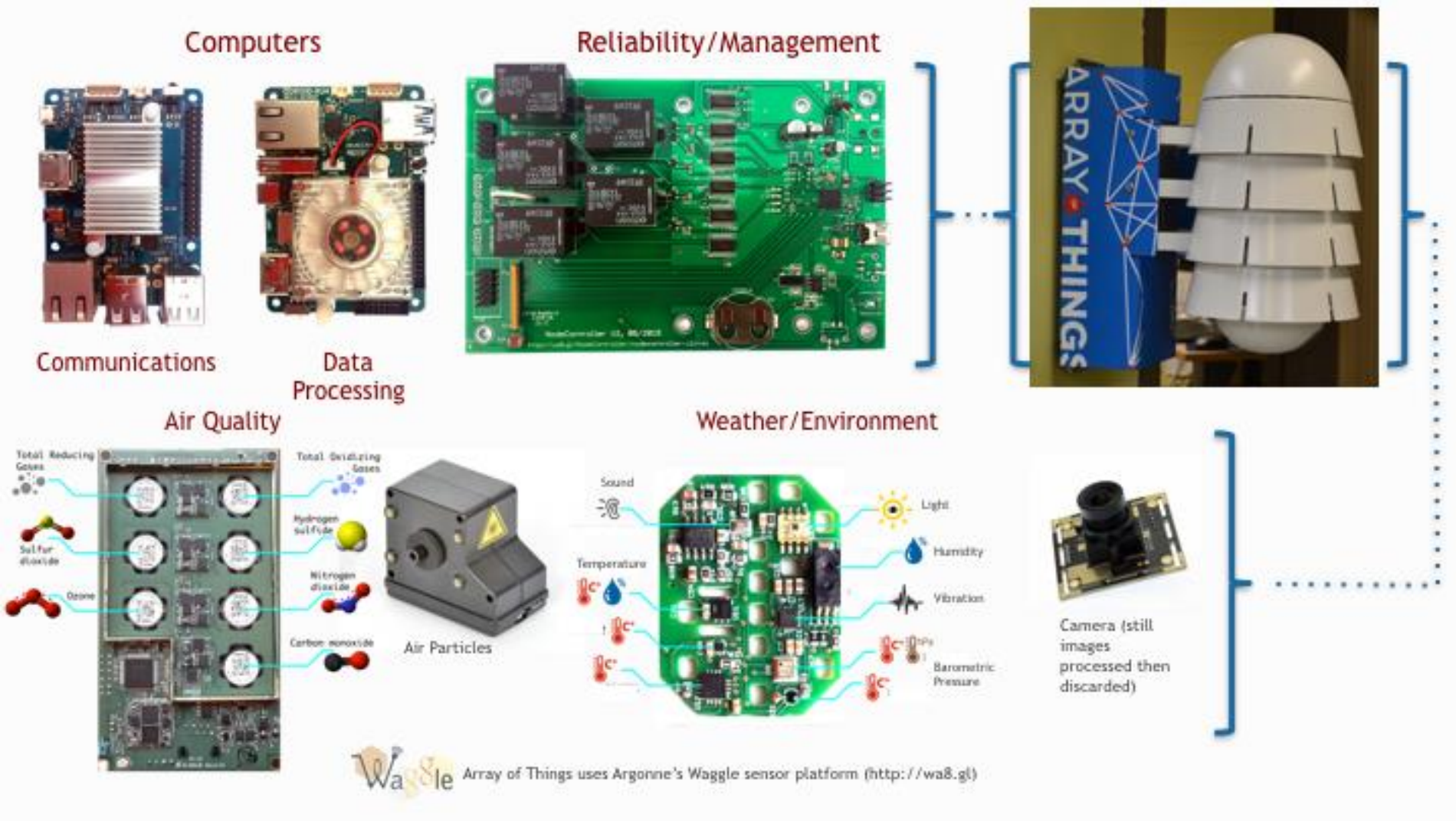
- Array of Things, University of Chicago and Argonne National Lab

- A Networked Urban Sensing Project (500 Nodes)
- Real Time Data on Climate, Traffic, Air Quality and Flooding.
- Smart 50 Award from Smart Cities Connect in 2018

Array of Things



One Node from the Array of Things

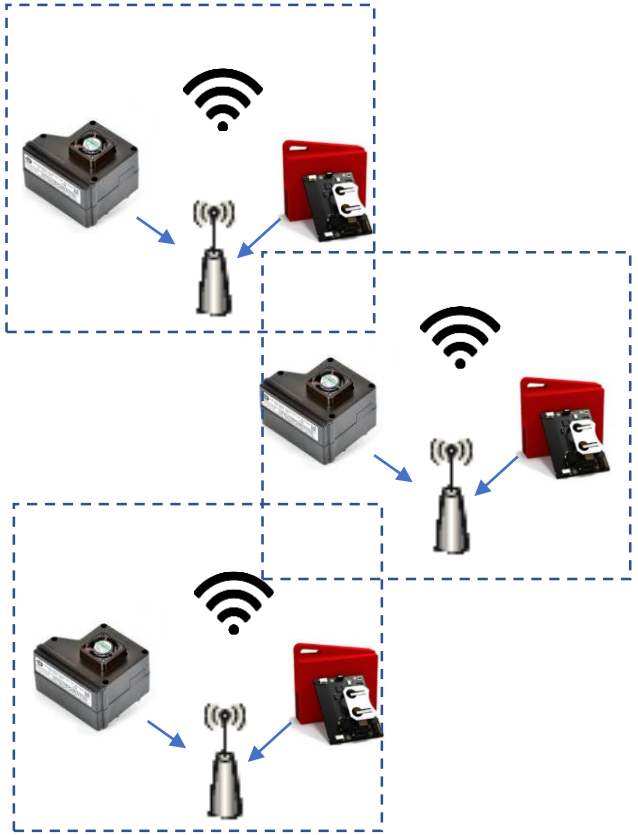


VGU Proposed Solution for Binh Duong

- ✓Low cost system and portable
- ✓Friendly interface for public users
- ✓Easy to install at different locations to form a wireless system to monitor the air pollution

System Design

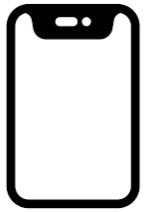
Cảnh báo ô nhiễm
qua E-mail, App…



Send data

Cloud

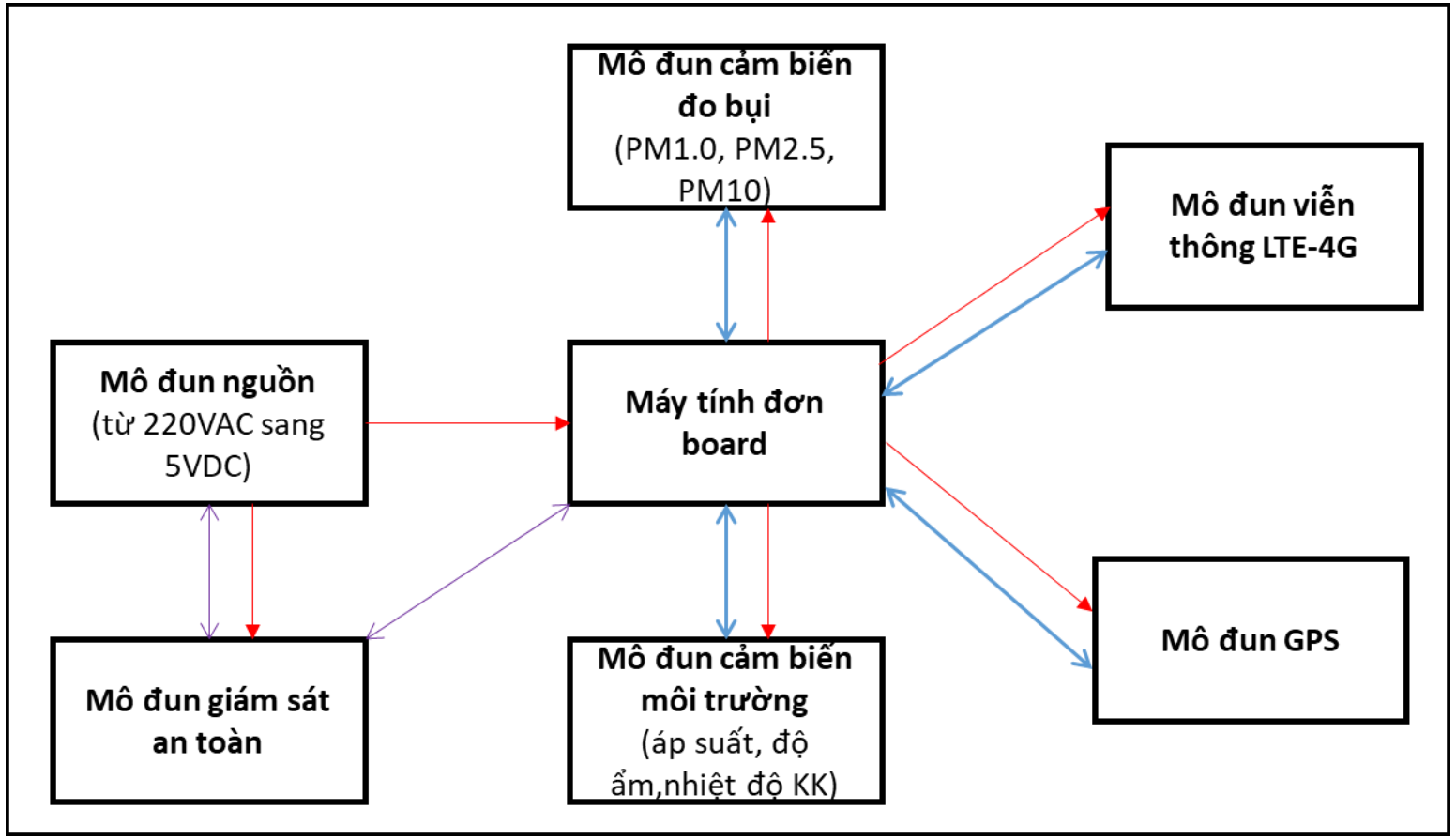
Display data
through a
smartphone App



Experts from
different fields

Wireless sensor node
Use the same Dust Sensor

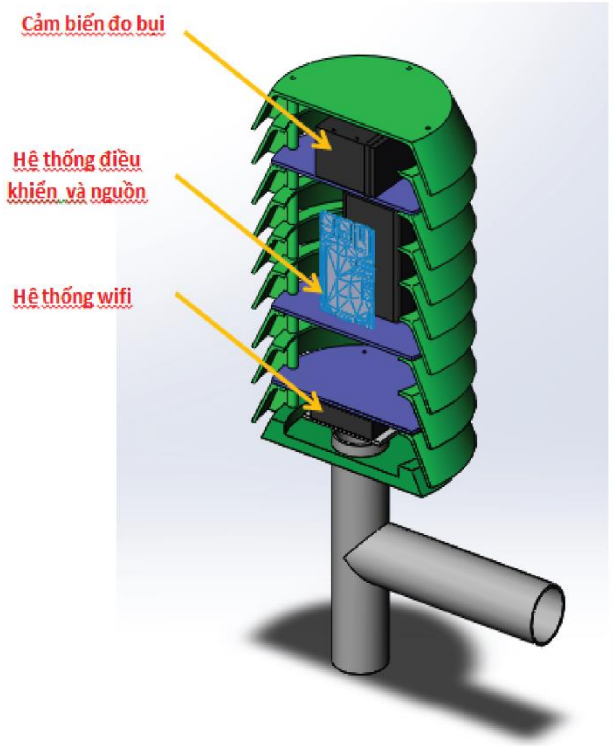
Hardware

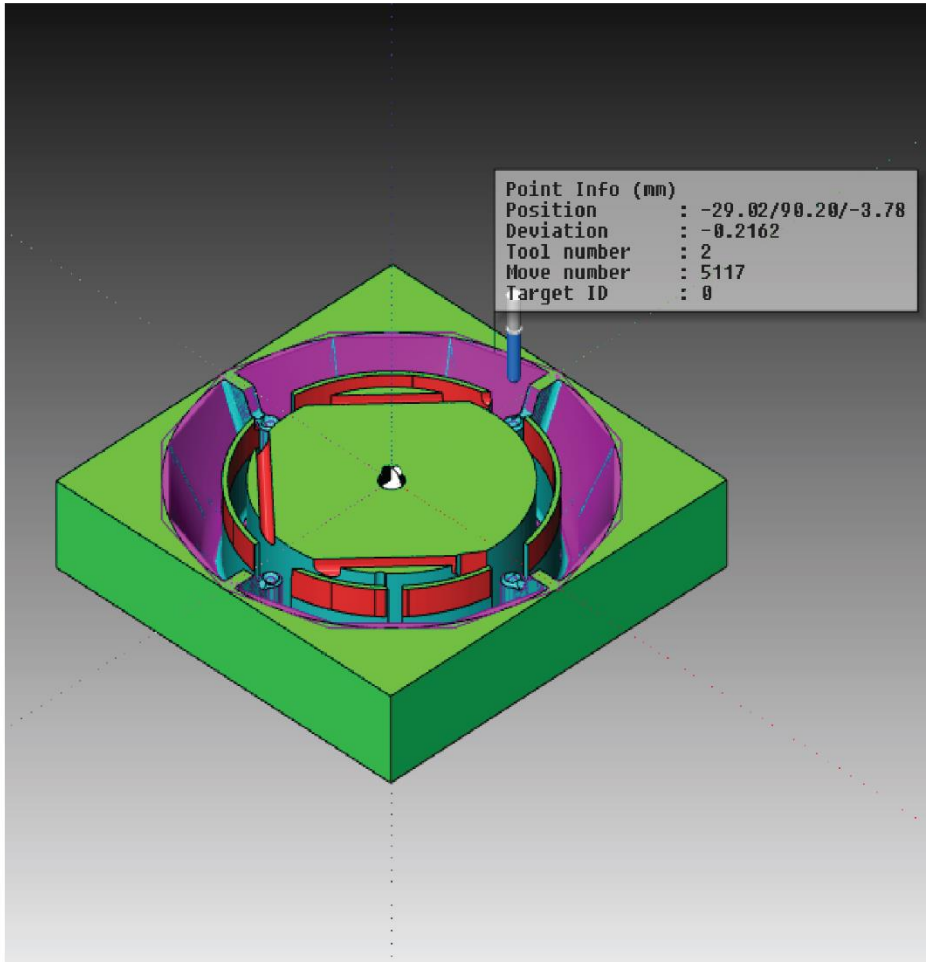

Mô đun cảm biến đo bụi (PM1.0, PM2.5, PM10)
Mô đun viễn thông LTE-4G
Mô đun nguồn (từ 220VAC sang 5VDC)
Máy tính đơn board
Mô đun GPS
Mô đun giám sát an toàn
Mô đun cảm biến môi trường (áp suất, độ ẩm,nhiệt độ KK)

Housing

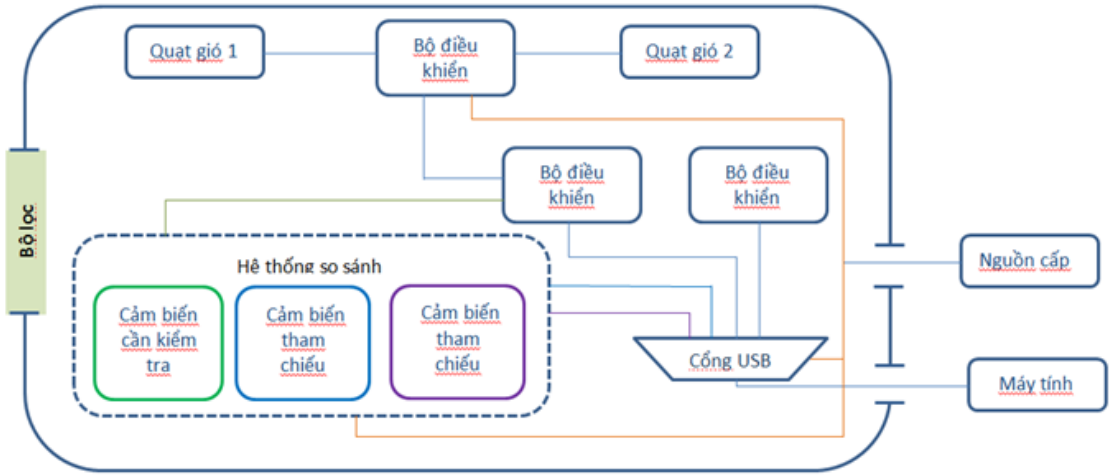
Measurement Parameters:

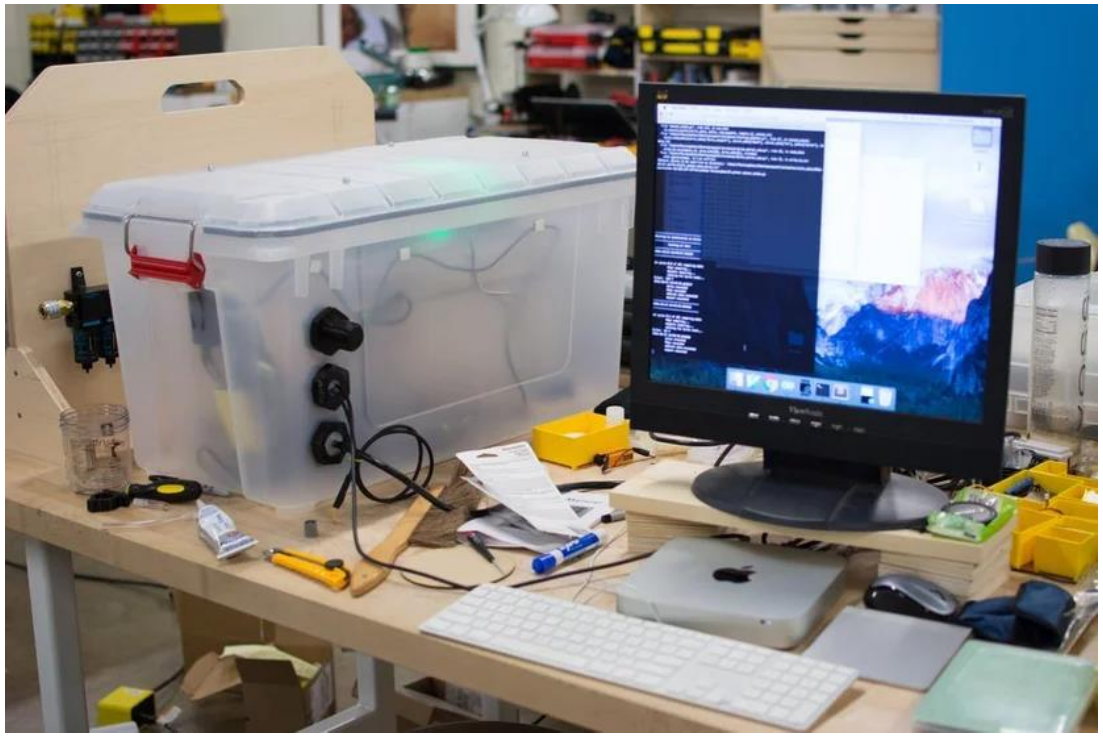
- PM 2.5 and 10.0 dust
- Temperature
- Humidity
- Pressure



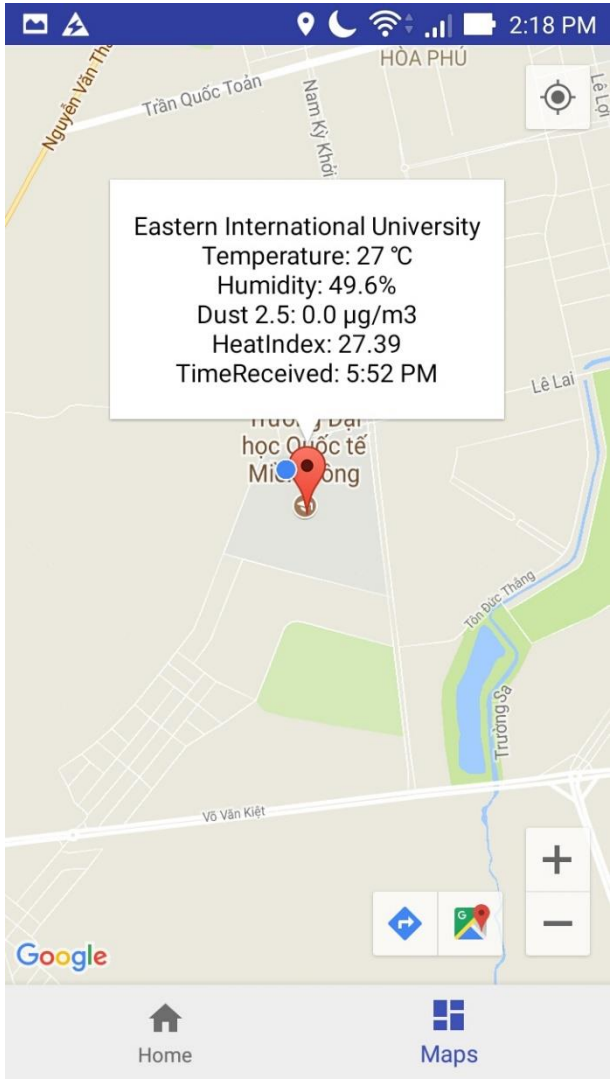


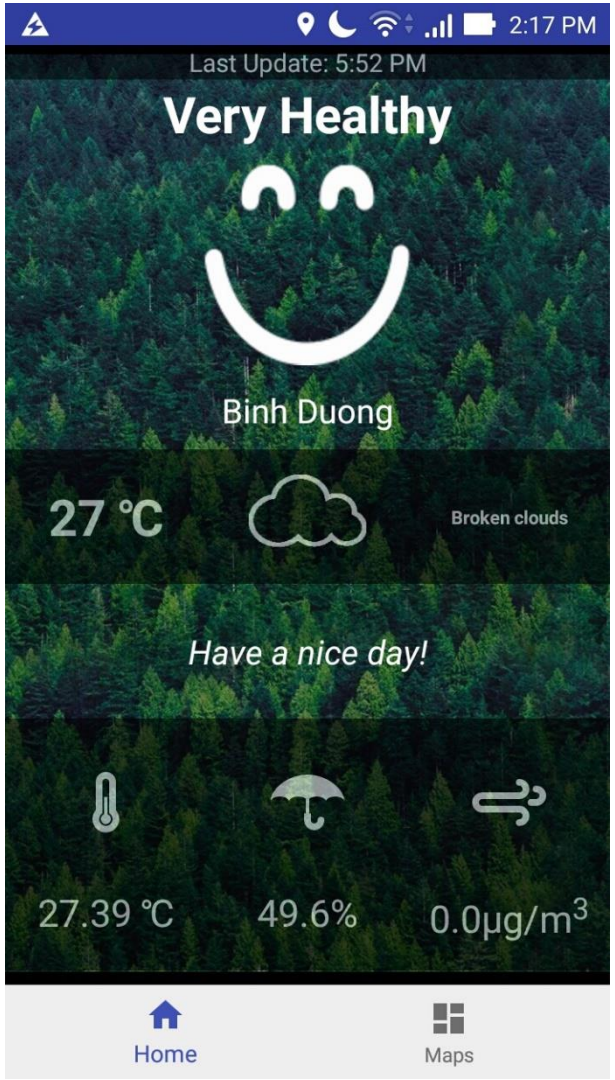
Calibration





Smart phone app



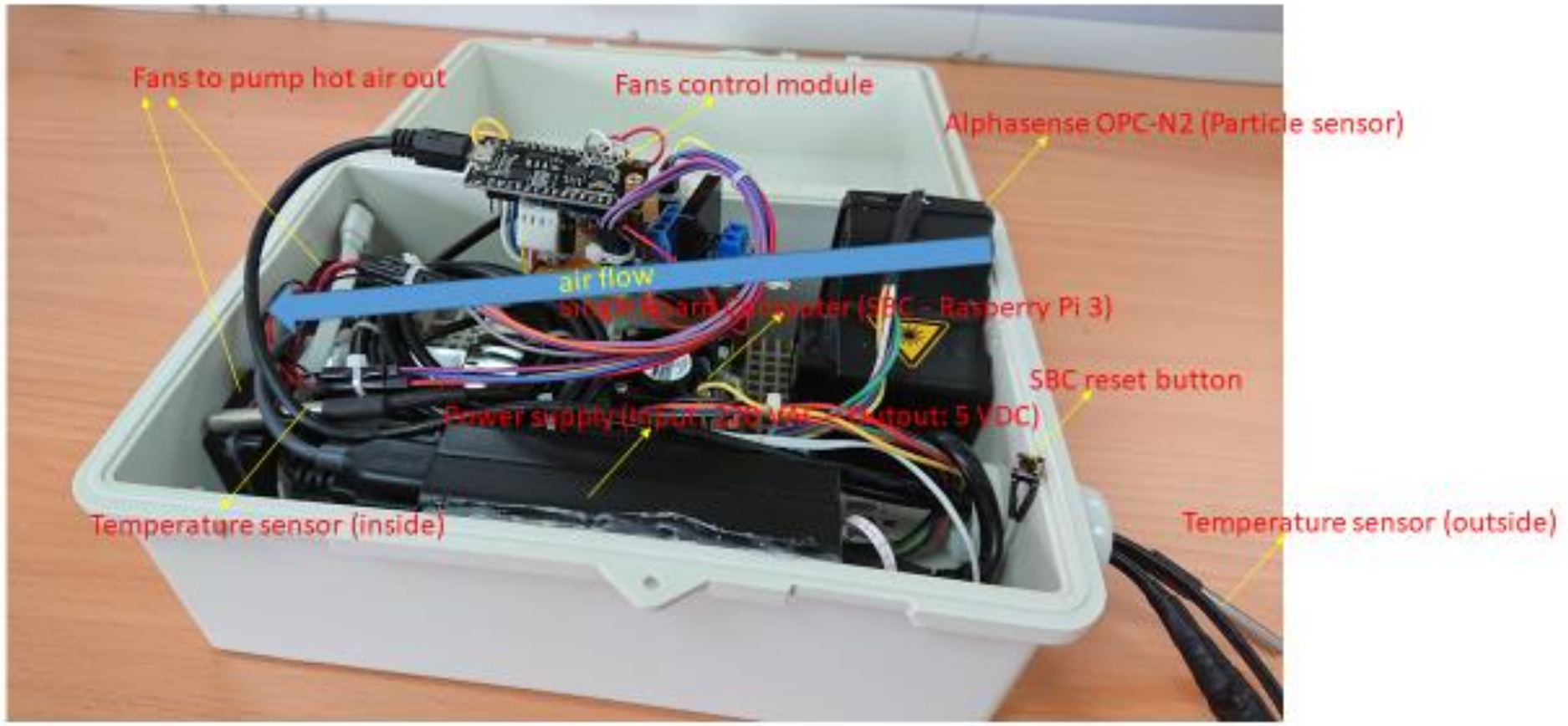


Smartphone App

In the near future (1 year) Binh Duong will have 10 such nodes

Contract with DOST Binh Duong

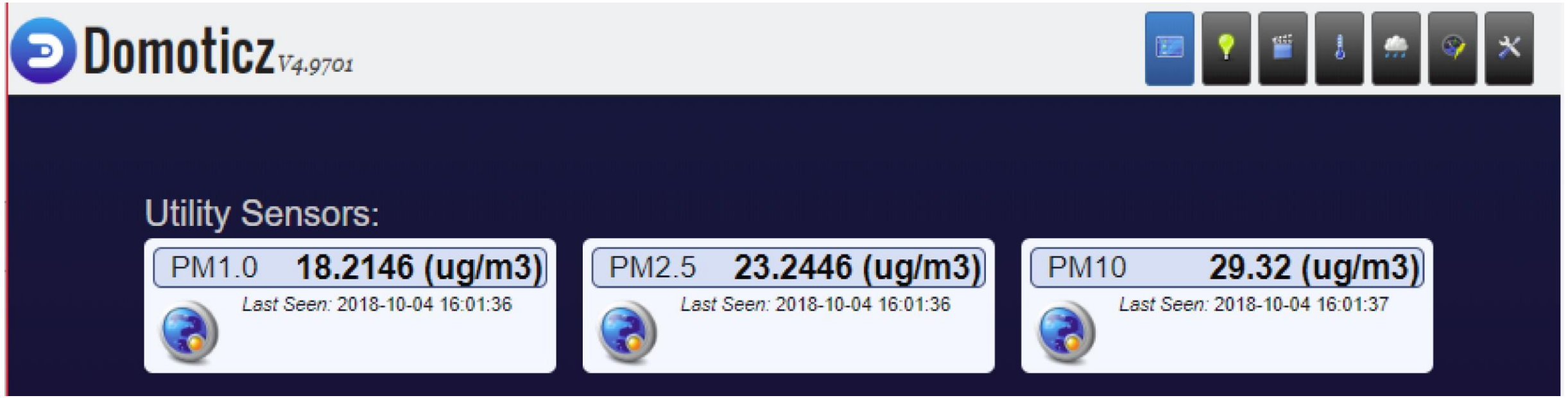
Prototype



OPC-N2 sensor box

Data on the web

http://171.244.37.192:8080/#/Dashboard



Collaboration with Southampton University, UK

University of Southampton team:

PI: Dr. Long Tran-Thanh (l.tran-thanh@soton.ac.uk)

Expertise at Southampton:

- World-leading research group in Artificial Intelligence & Machine Learning
- UK's top electronics and nanotechnologies labs/research group
- Top quality cleanroom to design electronics and sensor devices (one of the best in Europe)

Participation in the project:

- Lead the Machine Learning based data analysis and adjustment module to improve quality of sensory readings
- Can accommodate visitors to improve sensor design + hardware quality
- Will provide knowledge transfer to the Vietnamese partners at VGU

Collaboration with Southampton University

> Agents, Interaction and Complexity Research Group >

C-IoT Seminar on Crowdsourced Air Pollution Monitoring using Low Cost Mobile Sensors - Event

Date:
21st of November, 2018 @ 13:00 - 14:00

Venue:
New Mountbatten (53) - 4025

Event details

The Centre for Internet of Things and Pervasive Systems is organising a seminar on "Crowdsourced Air Pollution Monitoring in Ho Chi Minh City-Vietnam with Low Cost Mobile Sensors" from Dr Long Tran-Thanh. The event is open to anyone from across the University to attend.

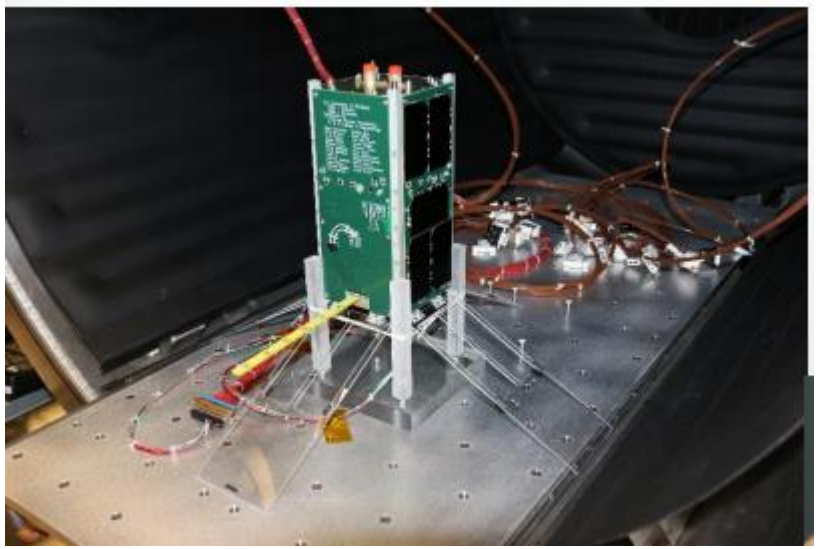
a need to implement a more cost efficient solution to the air pollution monitoring problem. In this project we propose a new approach which combines low cost sensor technology with crowdsourcing techniques to monitor the air pollution within HCMC. In particular, we aim to set up a proof of concept collaborative project between Southampton and the Vietnamese-German University (VGU), which aims to (i) build low cost sensors that are suitable for measuring a number

- Adopt the Fraunhofer FOKUS Smart City
- TRESCIMO – **T**estbeds for **Re**liable **S**mart **Ci**ty **M**achine to **M**achine C**o**mmunication – EU FP7 Program

Dr Hien Vo – Research Activities

Unmanned autonomous systems

- SPACE - Cubesat (small satellite)
- QB50 – an international constellation – 40 countries
- Co PI of QBUS NSF Project, IoT in Space

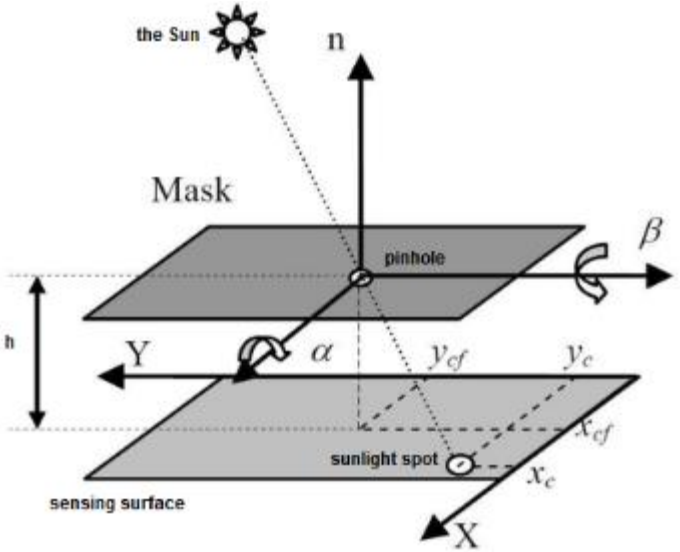


Launch from ISS on 2017

Dr Hien Vo – Cubesat and UAV

Unmanned autonomous systems

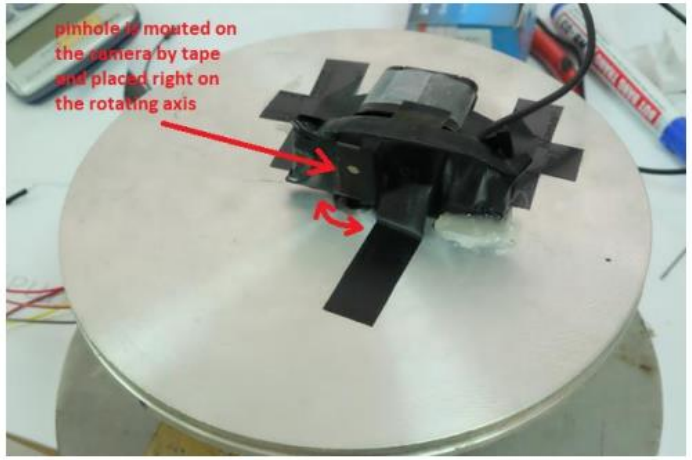
- SPACE - Cubesat (small satellite)
- a, sun sensor for the U of Paris Igosat (launch date 19)



Space Engineering

Unmanned autonomous systems

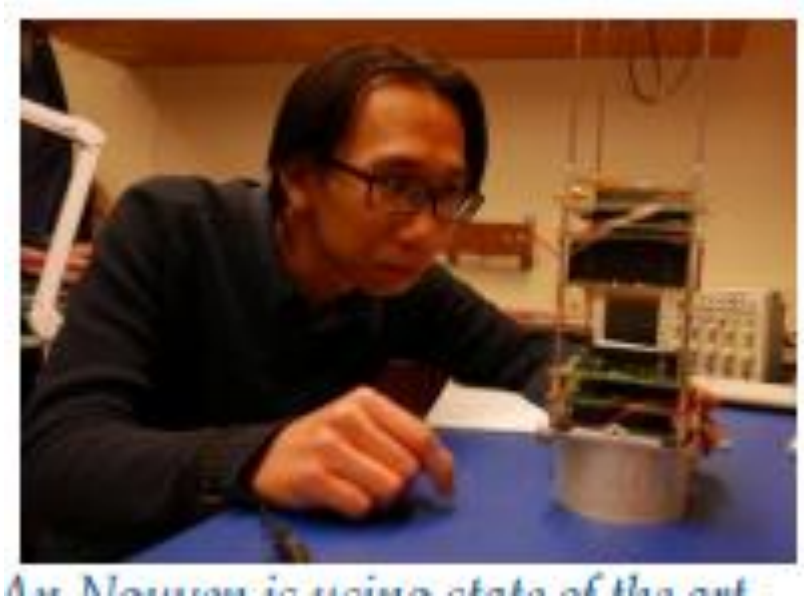
- Cubesat (small satellite)
- a, sun sensor for the U of Paris IGOSAT (launch date 2019)
- VGU student thesis work

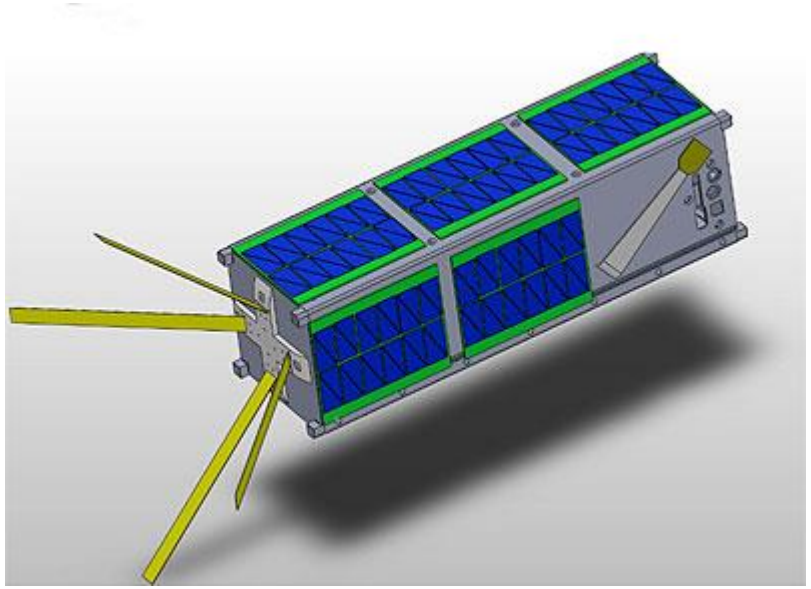


Dr Hien Vo – Research Activities

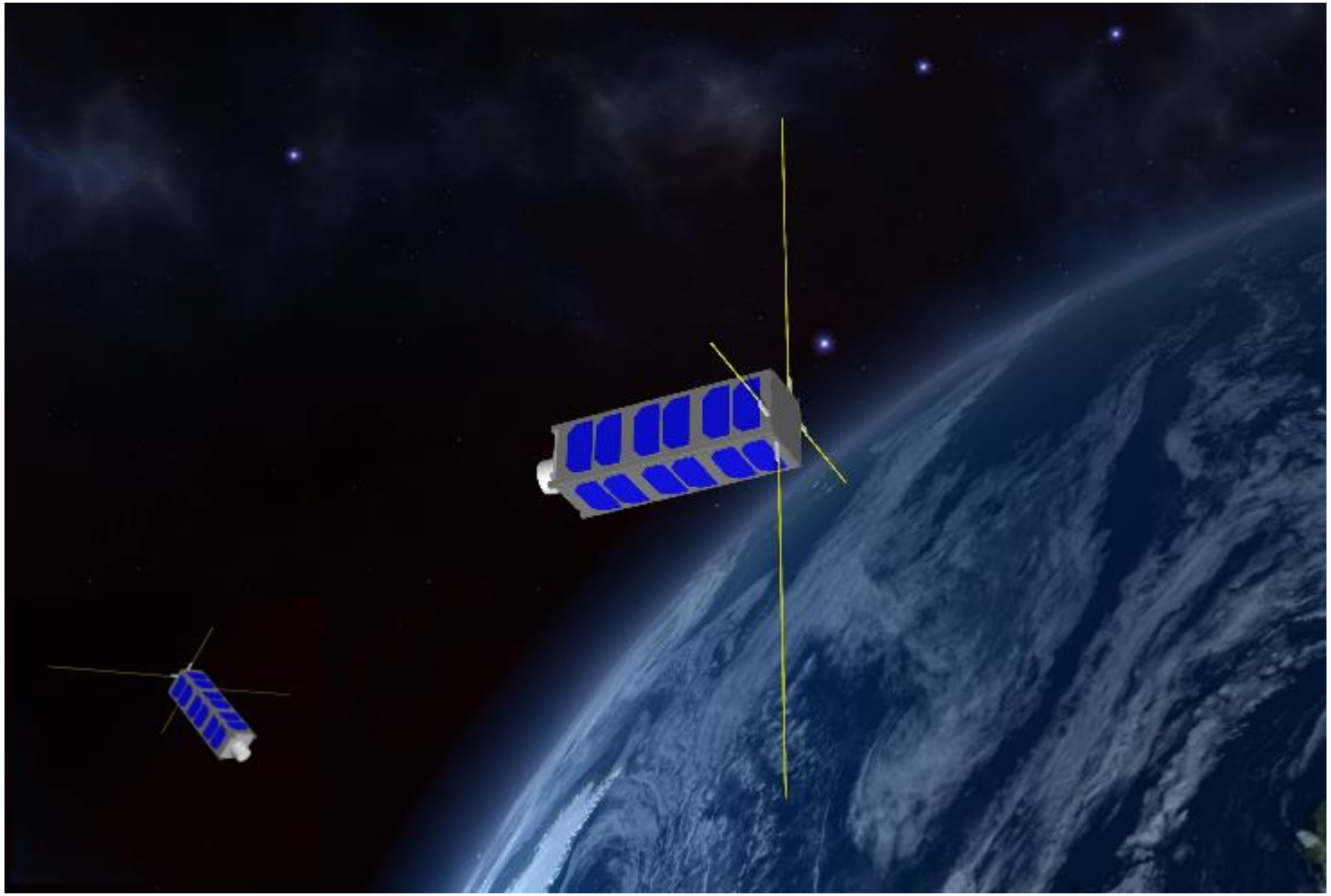
Unmanned autonomous systems

- Cubesat (small satellite)
- b, NMSat New Mexico Tech, launch date 2019





COMPOL Project



Dr Hien Vo – Space Engineering

The Consortium

The COMPOL project is leaded by APC Laboratory from the Paris Diderot University in France, with the help of CEA Saclay, within an international consortium made of:

- **University of Science and Technology of Hanoi** (Hanoi, Vietnam). USTH has a strong existing partnership with the Paris Diderot University, and would be interested in the Payload and the scientific data;
- **Vietnam German University** (Ho Chi Minh City, Vietnam). VGU is already working with Paris Diderot University and ODYSSEUS Space Inc. on another 3U CubeSat;
- **National Tsin Hua University** (Hsinchu, Taiwan). NTHU is already involved in the preliminary studies of COMPOL and is interested in the Payload and the scientific data;
- **Max Plank Institute** (Munich, Germany) is interested in participating in the nanosat development.
- **ODYSSEUS SPACE Inc.** (Tainan, Taiwan). ODYSSEUS is involved in the feasibility study of COMPOL and is already working with Paris Diderot University and VGU on another 3U CubeSat.

Dr Hien Vo – Research Activities

Unmanned autonomous systems

- AIR – unmanned aerial vehicle UAV
- Design, build and test vehicles
- New applications
- Control using a glove (TI second prize 17)

Dr Hien Vo – Research Activities

Unmanned autonomous systems

- AIR – unmanned aerial vehicle UAV
- Autonomous quadcopter for water sampling

Dr Hien Vo – Research Activities

Unmanned autonomous systems

- AIR – unmanned aerial vehicle UAV
- Sampling the Atmospheric Boundary Layer
- Input for better weather prediction
- Collaboration with VAST/IGP Hanoi

VIỆN NĂNG LƯỢNG NGUYÊN TỬ VIỆT NAM

VIETNAM ATOMIC ENERGY INSTITUTE

Unmanned autonomous systems

- AIR – Fixed wing UAV to Monitor Radiation from China Nuclear Reactor near China – VN Border
- Wind Dispersion of Radiation
- Only a few fixed stations
- Vice director Dr Nguyen Hao Quang
- Radiation Detector to be borrowed from IGOSAT project

-

Sustainable Urban Development

Vietnamese - German University

TOWARDS LIVABILITY: ASSESSMENT OF QUALITY OF LIFE IN URBAN AREAS OF BINH DUONG

Pham Thai Son son.pt@vgu.edu.vn

October 2018

Contents

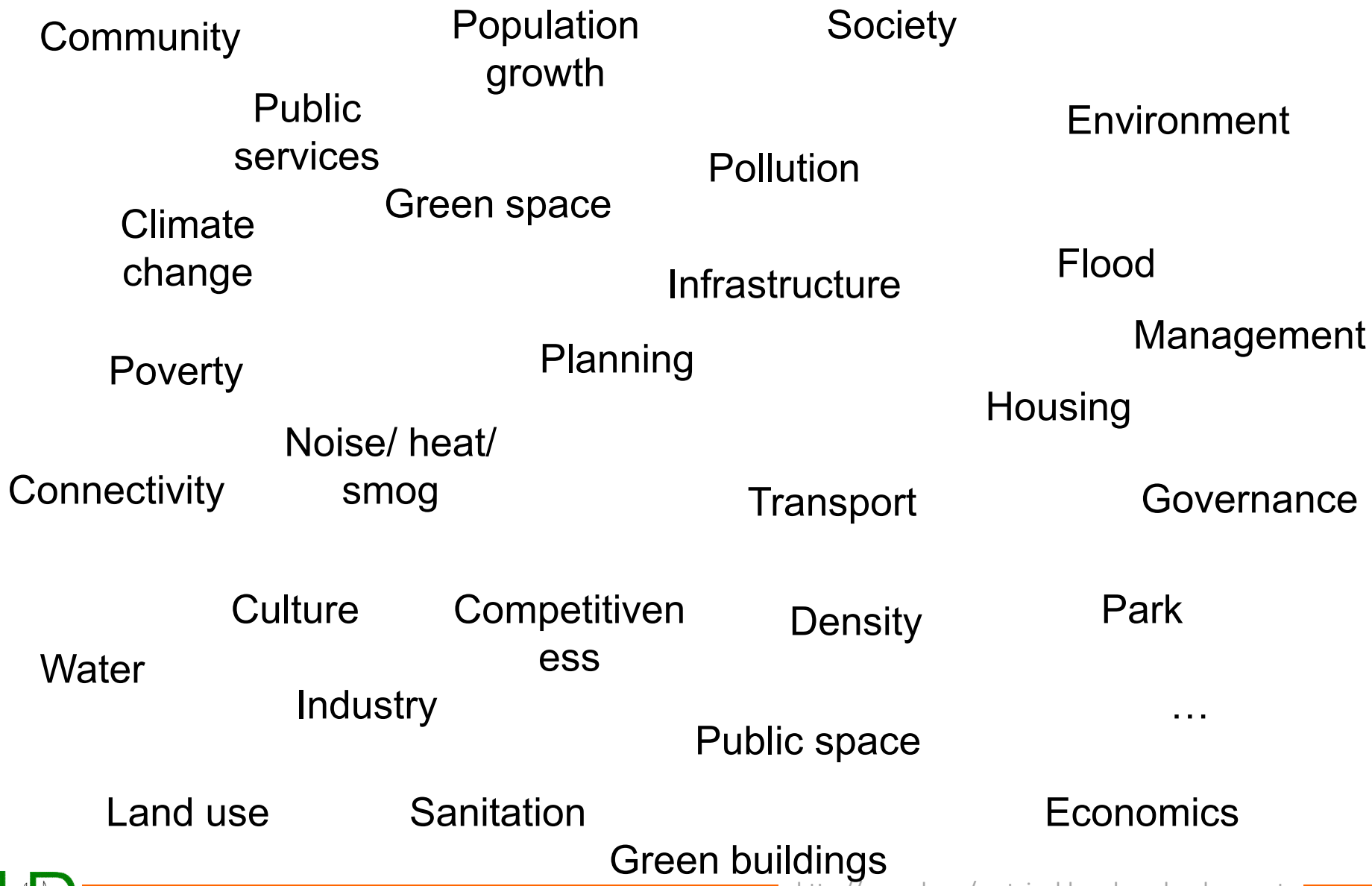
Vietnamese - German University

- Brief literature review
- Methodology
- Findings
- Conclusion and recommendations

BRIEF LITERATURE REVIEW

Urban challenges in Vietnam

Vietnamese - German University



Urban livability: city level

Vietnamese - German University

- **A livable city** is one that through ***good (urban) planning***, provides a *vibrant, attractive and secure environment* **for people to *live, work and play*** and encompasses *good governance*, a *competitive economy, high quality of living and environmental sustainability*

(Source: adopted from Centre for Livable Cities, Singapore)

Urban livability: neighborhood level

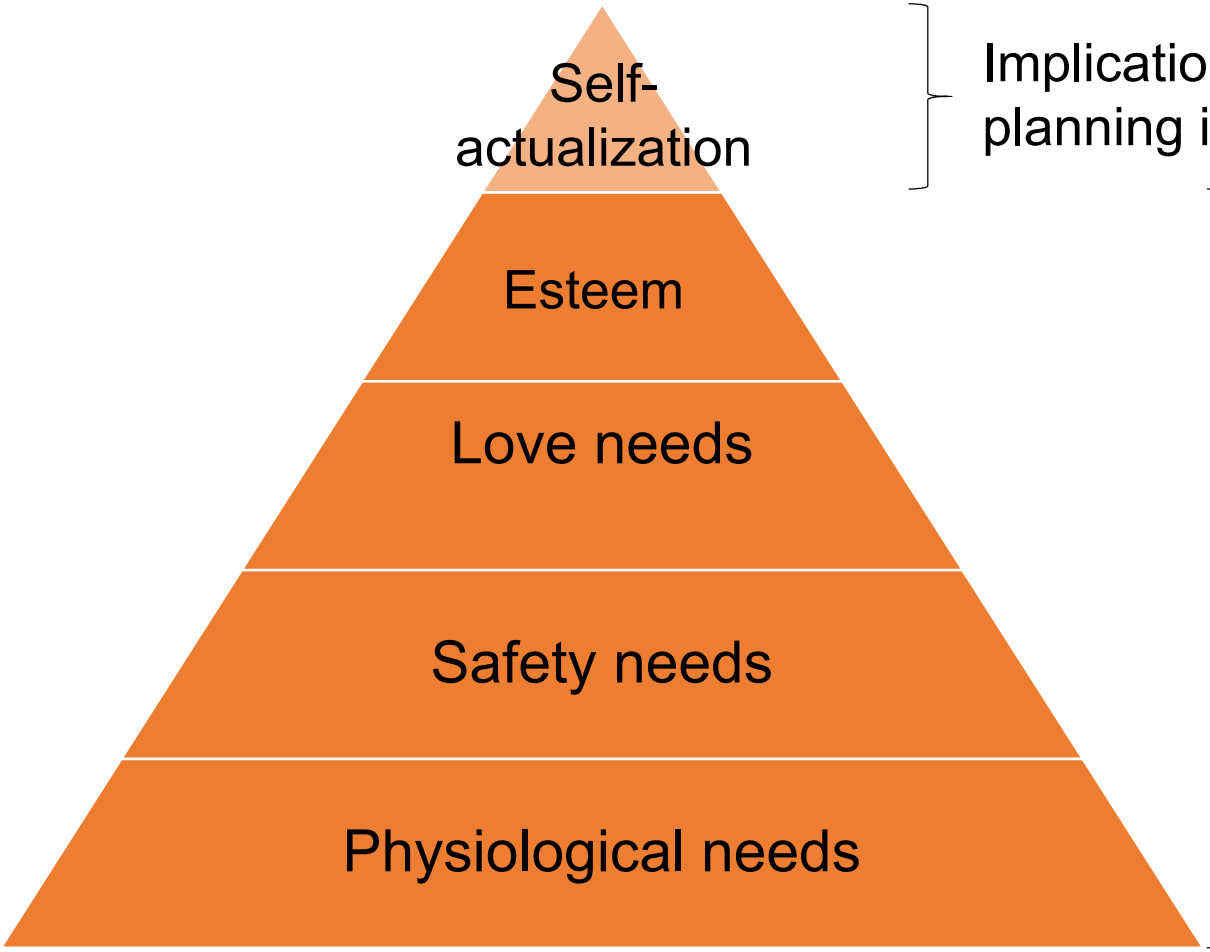
Vietnamese - German University

- Livability at neighborhood level is defined by :
  - ***Quality of space*** and built environment
  - ***Accessibility*** to places and services
  - Sense of ***safety and security***
  - Vibrant place with a ***sense of community/ place***

(Source: adopted from Centre for Livable Cities, Singapore)

Maslow hierarchy and urban planning

Vietnamese - German University



Implications to urban planning is unclear

Basic human needs that can be responded through urban planning and design

Source: Adopted from Maslow, 1943

METHODOLOGY

Research methods

Vietnamese - German University

Secondary data

Site survey: *over 30 field trips*

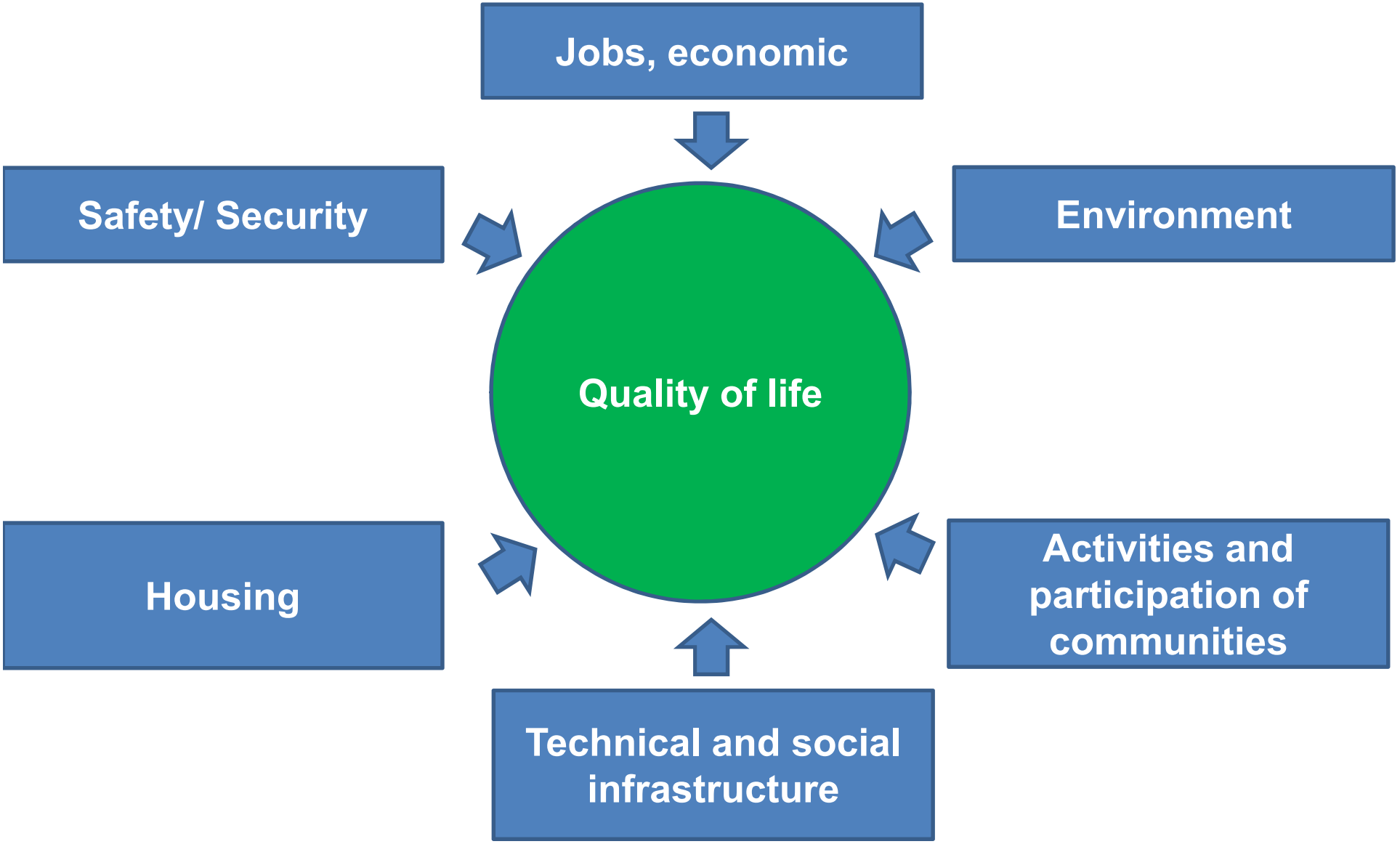
Qualitative survey: *in-depth interview, group discussion*

Experts method: *interview, workshop, conferences*

Quantitative survey: *800 households*

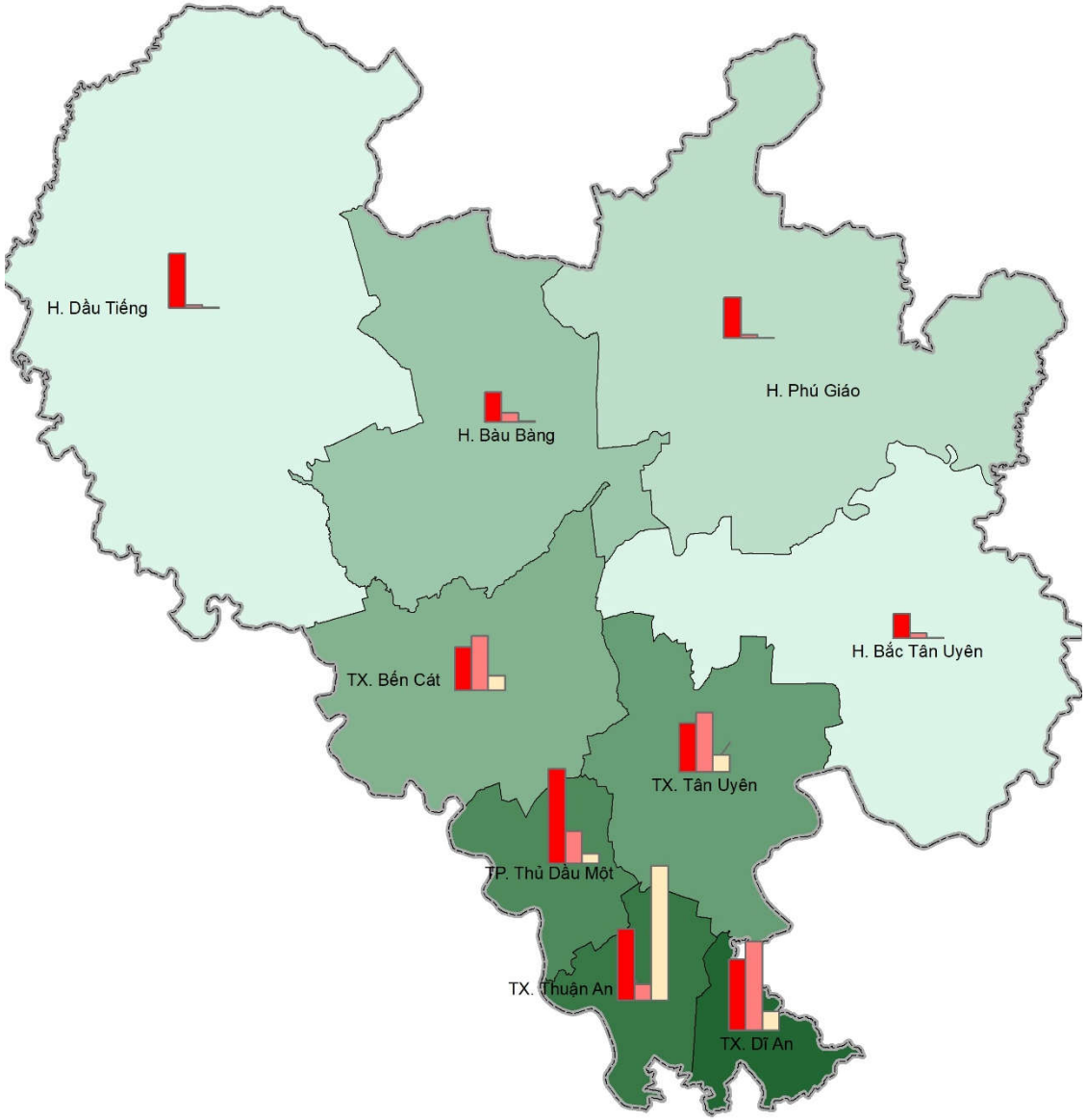
6 pillars for quality of life assessment

Vietnamese - German University



Study areas

Vietnamese - German University



- 5 provincial cities of Binh Duong

NOTE

150,000 người

Permanent settlement
Temporary settlement (> 6 months)
Temporary settlement (< 6 months)

Population density

1.626850 - 1.688013
1.688014 - 1.770507
1.770508 - 2.560168
2.560169 - 10.024112
10.024113 - 12.769776
12.769777 - 33.480701
33.480702 - 57.107267
57.107268 - 65.052672

Case studies for in-depth survey

Vietnamese - German University

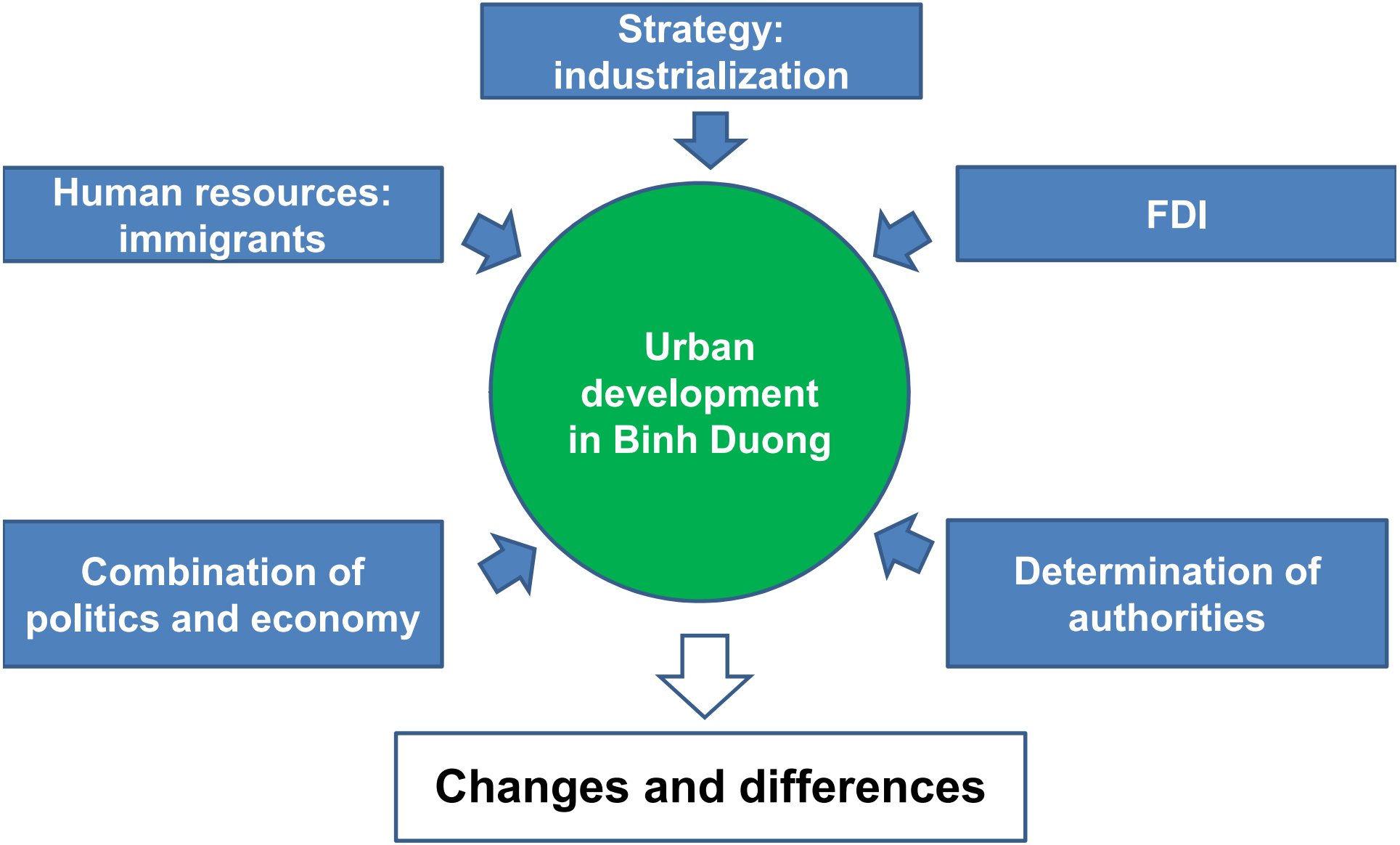
Ward/ Neighborhood	Area (ha)/ *Selected criteria*	Population 2013 (people)	Population 2016 (people)	Permanent residents 2016 (people)	Temporary residents 2016 (people)	Popolation Density (people/ha)
Phu Cuong	***2,450***	***24,856***	***25,551***	***21,901***	***3,650***	***1,043***
KP8	*Centre*	*1,104*	*1,088*	*1,001*	*87*	*N/A*
KP11	*Sub-ward*	*1,910*	*1,997*	*1,824*	*158*	*N/A*
Di An	***1,044***	***90,908***	***93,268***	***41,782***	***51,486***	***8,934***
Binh Minh 2	*Centre*	*4,110*	*4,450*	*3,695*	*755*	*N/A*
Thong Nhat 2	*Sub-urban, near industrial area*	*12,548*	*11,604*	*3,174*	*8,430*	*N/A*
Lai Thieu	***790***	***56,448***	***56,933***	***33,617***	***23,316***	***7,207***
Binh Hoa	*Sub-urban*	*16,617*	*15,474*	*3,531*	*11,943*	N/A
Binh Duc 1	*Near centre, Stability*	*4,471*	*4,862*	*4,270*	*592*	N/A
My Phuoc	***2,150***	***51,612***	***57,587***	***19,807***	***37,780***	***2,678***
KP3		*15,980*	*18,648*	*4653*	*13,995*	*N/A*
Uyen Hung	***3,334***	***21,298***	***30,403***	***12,092***	***18,311***	***912***
KP8	*Sub-urban*	*4,997*	*6,762*	*2,088*	*4,674*	*N/A*
KP1	*Centre*	*1,182*	*1,323*	*1,271*	*52*	*N/A*

Source: Statistical data of Binh Duong

RESULTS

Motivations for development

Vietnamese - German University



Changes

Vietnamese - German University

Economy growth and structure

Population growth and structure

Living standards of households

Urban special transformation and land use change

Safety

Despite of many challenges, Binh Duong has been becoming a *«more livable locality »*

Differences

Vietnamese - German University

By location

By groups of communities, settlement status

Group: community / local management / provincial management

By incomes

By ages

By ages

- *Note: Site survey and questionnaire with 800 people*

Differences between areas

Vietnamese - German University

Old urban center (Thu Dau Mot): stable for long time

≠

First industrial development zones (Di An, Thuan An): to be stable

≠

≠

Recently industrial development zones (Ben Cat, Tan Uyen, New City): in process of rapid transition

Differences between locations in the same area

Vietnamese - German University

Centre

- Stability and transformation
- Jobs
- Residential groups/ components

Sub-area

- Number of immigrants, complexity of area
- Security issues
- Environmental conditions

Far from industrial zones ≠ **Near industrial zones**

Differences between groups of resident

Vietnamese - German University

Local residents ≠ **Long-term immigrants**

Long-term immigrants ≠ **Recent immigrants**

- Occupations/ Jobs and incomes
- Stability
- Accessibility to basic services
- Integration with community

Development perspectives and vision

Vietnamese - German University

Residents/ community

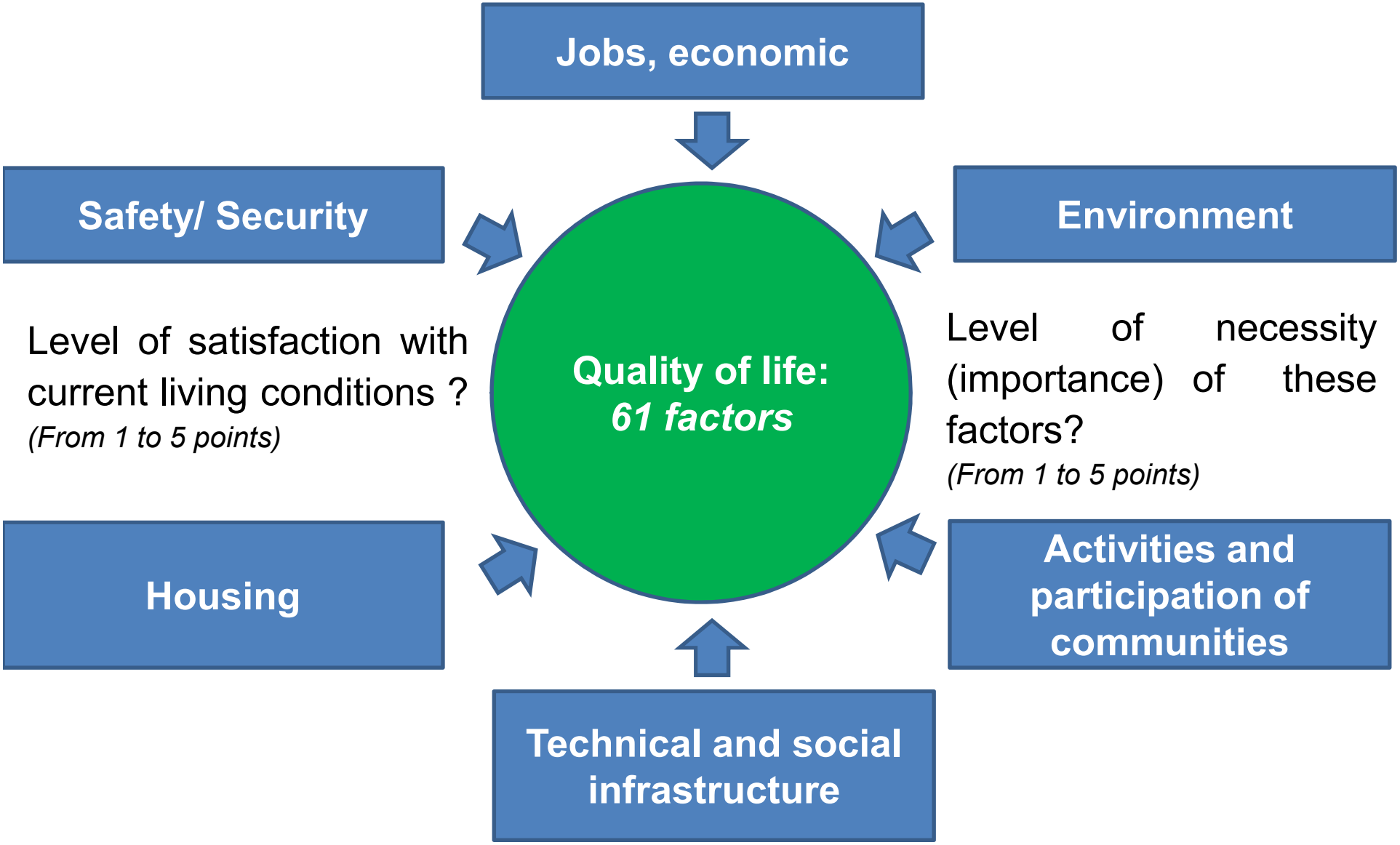
Local authorities (wards, communes)

- Perspective on quality of life improvement
- Perspectives and visions about development

Upper level management authorities

61 factors to assess quality of life

Vietnamese - German University



What are people satisfied with?

Vietnamese - German University

Most satisfied:

- Housing condition
- Improvement of social infrastructure
- Improvement of technical infrastructure

Most unsatisfied:

- Safety/ Security
- Administrative management and urban planning
- Participation

Note: Results from assessment on 61 factors from 800 respondents

Which factors are important?

Vietnamese - German University

Most important:

- Safety/ Security
- Careers and incomes of family members
- Housing (location and legal documents)

Less important:

- Community activities and relationships
- (not so basic) Public (neighborhood) facilities
- Administrative management and urban planning

Note: Results from assessment on 61 factors from 800 respondents

CONCLUSION AND RECOMMENDATIONS

Livability in the context of Binh Duong

Vietnamese - German University

Short-term

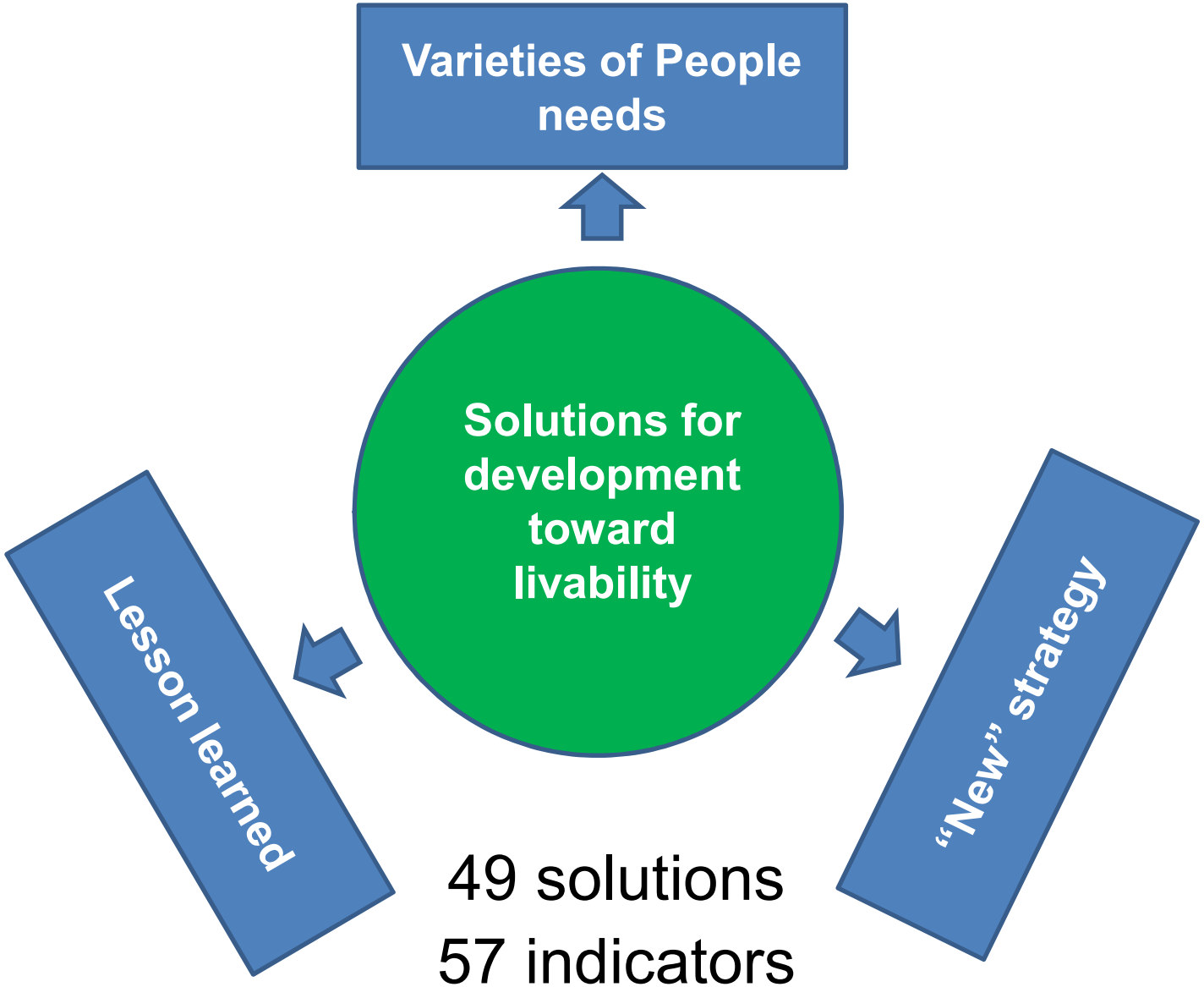
- Safety/ Security
- Jobs
- Good accessibility to basic services

Mid-to-long term

- Neighborhood and community buildings; Creation of sense of place
- Urban management

Định hướng giải pháp

Vietnamese - German University



Livability in the context of Binh Duong

Vietnamese - German University

H1: Strategy and action plan towards livability

H2: Implementation of livability indicators

A3: Urban redevelopment

G10: Land use efficiency and new urban area development

G7: Comprehensive information system

F3: Public space

G4: Transit-Oriented Ddevelopment strategy

Q&A

Vietnamese - German University

THANK YOU FOR YOUR ATTENTION

Sustainable Urban Development

Model-Driven Security & Privacy

Assoc. Prof. Dr. Manuel Clavel

Software Engineering and Programming Languages
Computer Science
Vietnamese-German University

manuel.clavel@vgu.edu.vn

9 October 2018, Binh Duong New City, VGU Campus

Security & Privacy

- The current implementation of **Industry 4.0** faces many challenges, including [From *BIBB : Industrie 4.0 und die Folgen für Arbeitsmarkt und Wirtschaft*]:
  - IT security issues, which are greatly aggravated by the inherent need to open up those previously closed production shops.
  - Unclear legal issues and data security.
- There is an increasing concern of both users and regulators about security & privacy breaches. E.g., **EU General Data Protection Regulation** (GDPR).
  - The GDPR is designed to allow individuals to more effectively control their personal data.
  - Also, to improve public trust and harmonise data protection standards across Europe for business operating in digital markets.
  - The regulation came into force on May 2018.

Security & Privacy

[From GDPR Alliance: *The General Data Protection Regulation (GDRP) In A Nutshell*]

- Requires that consent is given or there is a good reason to process or store personal information.
- Gives a person a right to know what information is held about them.
- Allows a person to request information about them is erased and that they are 'forgotten' unless there is a reason not to do thise.g. a loan account.
- If data is lost, stolen or is accessed without authority, the authorities must be notified and possibly the people whose data has been accessed may need to be notified also.
- Data cannot be used for anything other than the reason given at the time of collection.
- Data is securely deleted after it is no longer needed.
- Allows national authorities to impose fines on companies breaching the regulation. These fines can be up to 20 million EURO or 4% of the businesses global turnoverwhichever is higher.

Security & Privacy

[From ENISA: *Privacy and Data Protection By Design. From Policy to Engineering: Key Findings (December 2014)*]

- Privacy and data protection features are, on the whole, ignored by traditional engineering approaches when implementing the desired functionality.
- This ignorance is caused and supported by limitations of awareness and understanding of developers and data controllers as well as lacking tools to realise **privacy by design**.

Model-Driven Engineering (MDE)

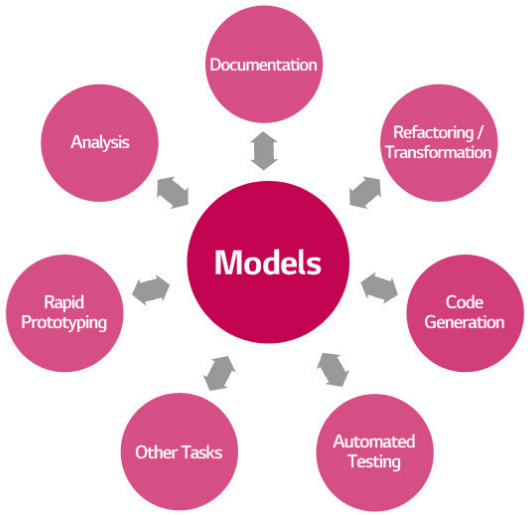
MDE core idea

- Different views of a system are specified using **models**.
- System implementations are **automatically generated** from models.

Model-Driven Engineering (MDE)

MDE benefits

- Reduce software **development time**.
- Reduce software **cost**.
- Improve software **quality**.



Model-Driven Engineering (MDE)

MDE in practice

- Modelling can not completely replace programming.
- But for specific domains MDE delivers what promises.

Model-Driven Security (MDS)

- MDS is a specialization of MDE.
  - David A. Basin, Manuel Clavel, Marina Egea: *A decade of model-driven security*. SACMAT 2011: 1-10.
- Systems are modelled together with their security requirements.
  - **Fine-grained access control policies**: they declare who can access which information and under which circumstances.

    [Facebook Help Center (2018)]
    A tag is a special kind of link. When you tag someone, they'll be notified. Also, if you or a friend tags someone in your post, the post could be visible to the audience you selected plus friends of the tagged person.
    Tags in photos and posts from people you aren't friends with may appear in timeline review where you can decide if you want to allow them on your timeline. You can also choose to review tags by anyone, including your friends.

- Security infrastructures are directly generated from the models.

Model-Driven Security (MDS)

Secure data-management applications

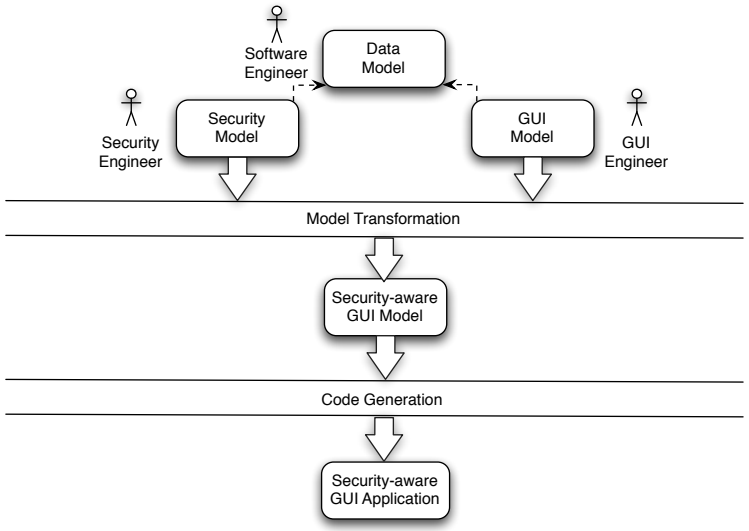
- Applications that create, delete, read, and update information stored in a database.
- Enforcing (fine-grained) access control policies is a nontrivial task:
  - Currently, authorization checks are manually encoded and spread throughout the code.
  - This is cumbersome, error prone, and scales poorly.
  - This is also difficult to audit and maintain.

ActionGUI

- ActionGUI is a novel, rigorous, tool-supported model-driven methodology for developing secure data-management applications.
  - David A. Basin, Manuel Clavel, Marina Egea, Miguel Angel García de Dios, Carolina Dania: *A Model-Driven Methodology for Developing Secure Data-Management Applications*. IEEE Trans. Software Eng. 40(4): 324-337 (2014).

ActionGUI

- Using ActionGUI, secure data-management application are modeled using three interrelated models: the *data*, *security*, and a *GUI models*.
- From the models, ActionGUI automatically generates complete, deployable web applications, along with all support for fine-grained access control.



- Case studies have been carried out that provide evidence of ActionGUI's potential for developing real-world applications.
  - Miguel Angel Garcia, Carolina Dania, Manuel Clavel, David Basin. *Model-driven development of a secure eHealth application*, Engineering Secure Future Internet Services and Systems 2014: 97-118.

Model-based Quality Assurance

- In MDE, the quality of the generated software depends on the quality of the source models.
  - *If the models do not properly specify the system's intended behavior, neither will do the generated system.*
- Security models are formal objects and one can reason about their properties.
  - Can someone with role r have access to data x?
  - Is there any scenario in which someone of type X may be granted access to data of type Y?

Model-based Quality Assurance

ActionGUI

- In ActionGUI, security models and security properties are mapped, respectively, to first-order theories and first-order formulas, and theorem-proving tools are used to reason about their properties.
- A security property holds in every scenario allowed by a security model, if the negation of the formula corresponding to the security property is unsatisfiable in the theory corresponding to the security model.
- We use Satisfiability Modulo Theory (SMT) solvers to automatically check properties of security models.
  - Carolina Dania, Manuel Clavel: *OCL2MSFOL: a mapping to many-sorted first-order logic for efficiently checking the satisfiability of OCL constraints*. MODELS 2016: 65-75.
  - Miguel Angel García, Carolina Dania, Manuel Clavel: *Formal reasoning about fine-grained access control policies*. APCCM 2015: 91-100

Model-Driven Privacy

Scientific & technical challenges

- Although related to security modeling, privacy modeling needs to cope with new concerns:
  - Data should be accessible only upon the user's explicit **consent** and only for specific **purposes**.
  - Users should be **notified** about whom, when, and for which purpose their data is accessed.

Model-Driven Privacy

Research project

- Extend ActionGUI to include **privacy models** as primary artifacts in the development of data-management applications.
  - Define a new **modeling language** for specifying privacy policies.
  - Implement a new **code-generator** to automatically enforce privacy policies in data-management applications.
  - Design and perform a **case study** to validate the new ActionGUI.

Model-Driven Privacy

Case study

- A social network to exchange medical-related information among healthcare professionals, patients, and caregivers.
- Collaboration with legal experts as well as experts in human social behavior will be sought.

Questions?

Protection of Aggregated Energy Storage Systems (AESS) in AC and DC Microgrids

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Vietnamese-German University

Vietnamese-German University

Content

- Introduction on AC and DC microgrids (MGs)
- An aggregated energy storage system (AESS) in microgrids
- Protection Algorithm of AESS in AC microgrids
- Protection Algorithm of AESS in DC microgrids
- Results
- Further Research Activities

1. Introduction on AC and DC MG (1)

- Why microgrid technology is a *HOT* topic?
- What is definition of microgrid?
- What are main characteristics of AC (alternative current) and DC (direct current) microgrids

1. Introduction on AC and DC MG (2)

- While traditional energy sources such as oil, coals are being exhausted recently, renewable energy sources have been developed strongly as an alternative method (e.g., wind and solar energy, biomass…).
- Alternative power plants using renewable energy do not have the ability to generate the large amount of electric power to the grid.
- A micro-grid is an effective solution being developed to transmit power from the new alternative power units to some certain areas (islands, smart homes, industrial parks, deserts…) or to integrate to the grid like an aggregator.

1. Introduction on AC and DC MG (3)

- A microgrid (MG) mainly consists of *renewable energy sources* (wind turbine, photovoltaic generation system…), *back-up generators* (gas-microturbine, diesel generators…), *loads* (linear and non-linear loads), *energy storage devices* (batteries, supercapacitors, flywheels) and *protective devices*.
- Distributed generators (DGs) are classified into two main types, namely, rotating-based (or synchronous-based) DGs (RBDGs), and inverter-based DGs (IBDGs).
- A microgrid also operates at low-voltage level (380V). The power output is mostly less than 5MW (referred to IEEE standard).
- A microgrid can work at two different modes including: *grid-connected* and *islanded operation modes* to supply the reliable and environment friendly power for customers.

1. Introduction on AC and DC MG (4)

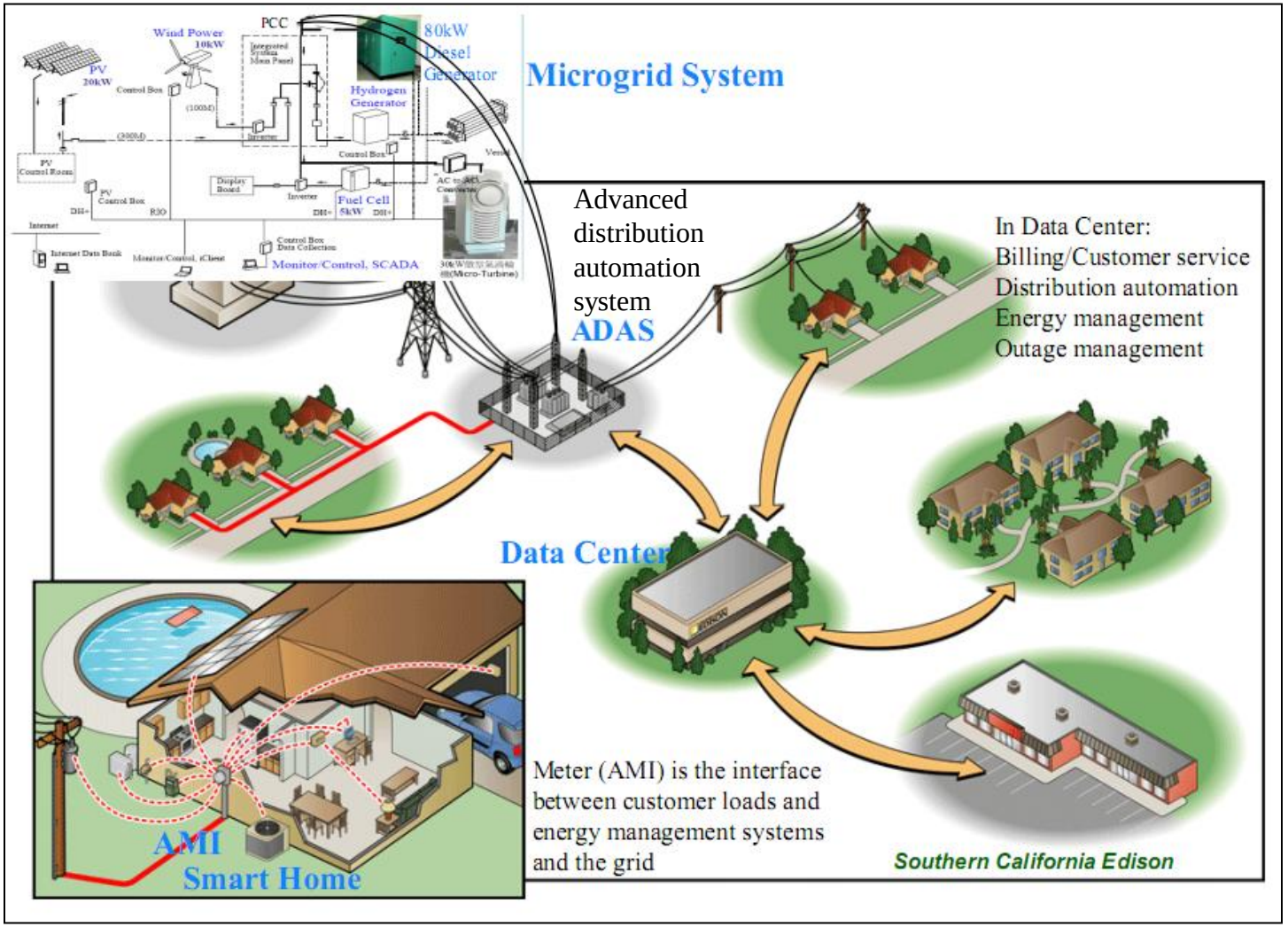


Fig 1. Microgrid system and a smart-grid structure

1. Introduction on AC and DC MG (5)

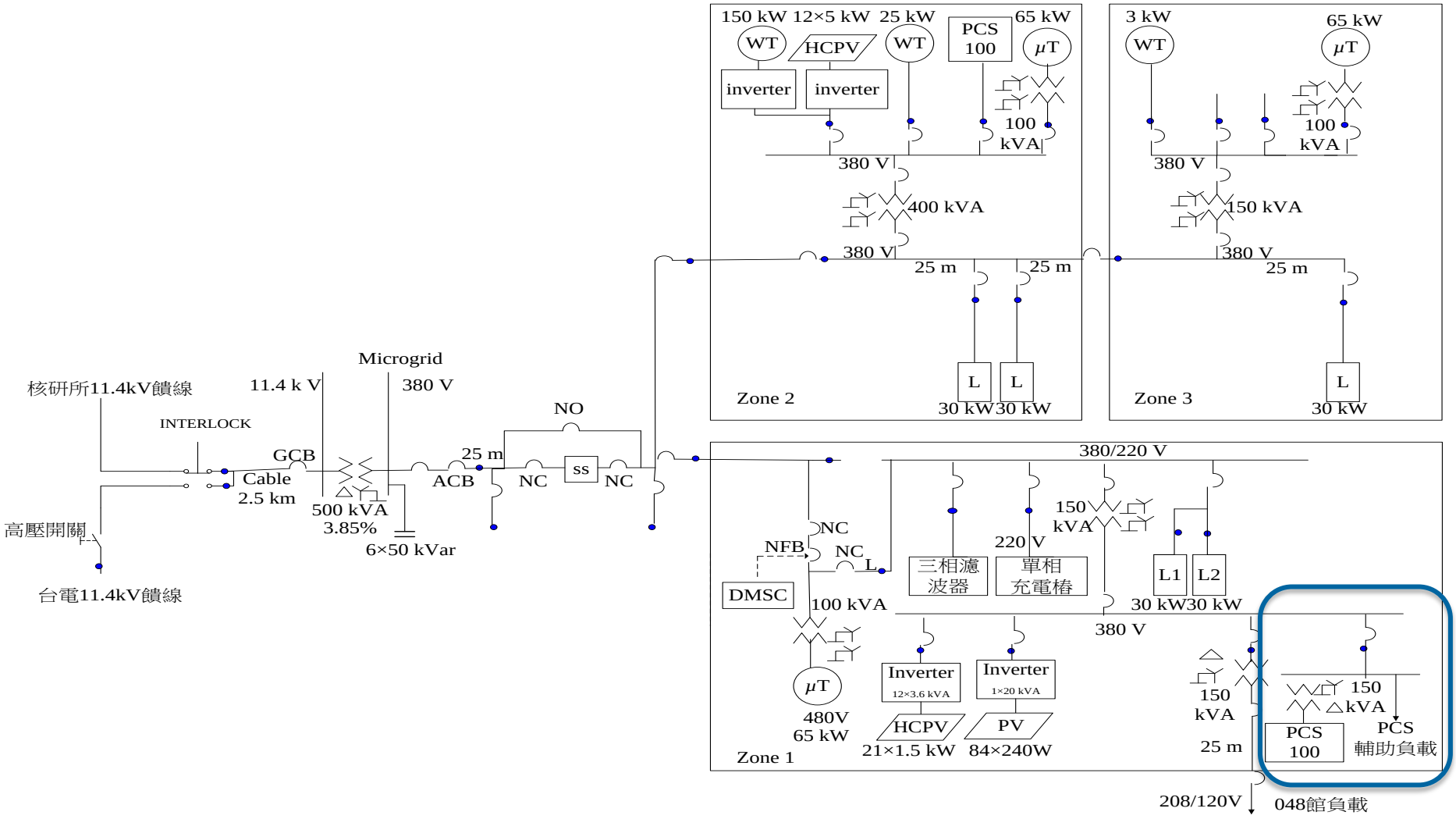


 Fig 2. System configuration of a real-time AC microgrid in Taiwan

1. Introduction on AC and DC MG (6)

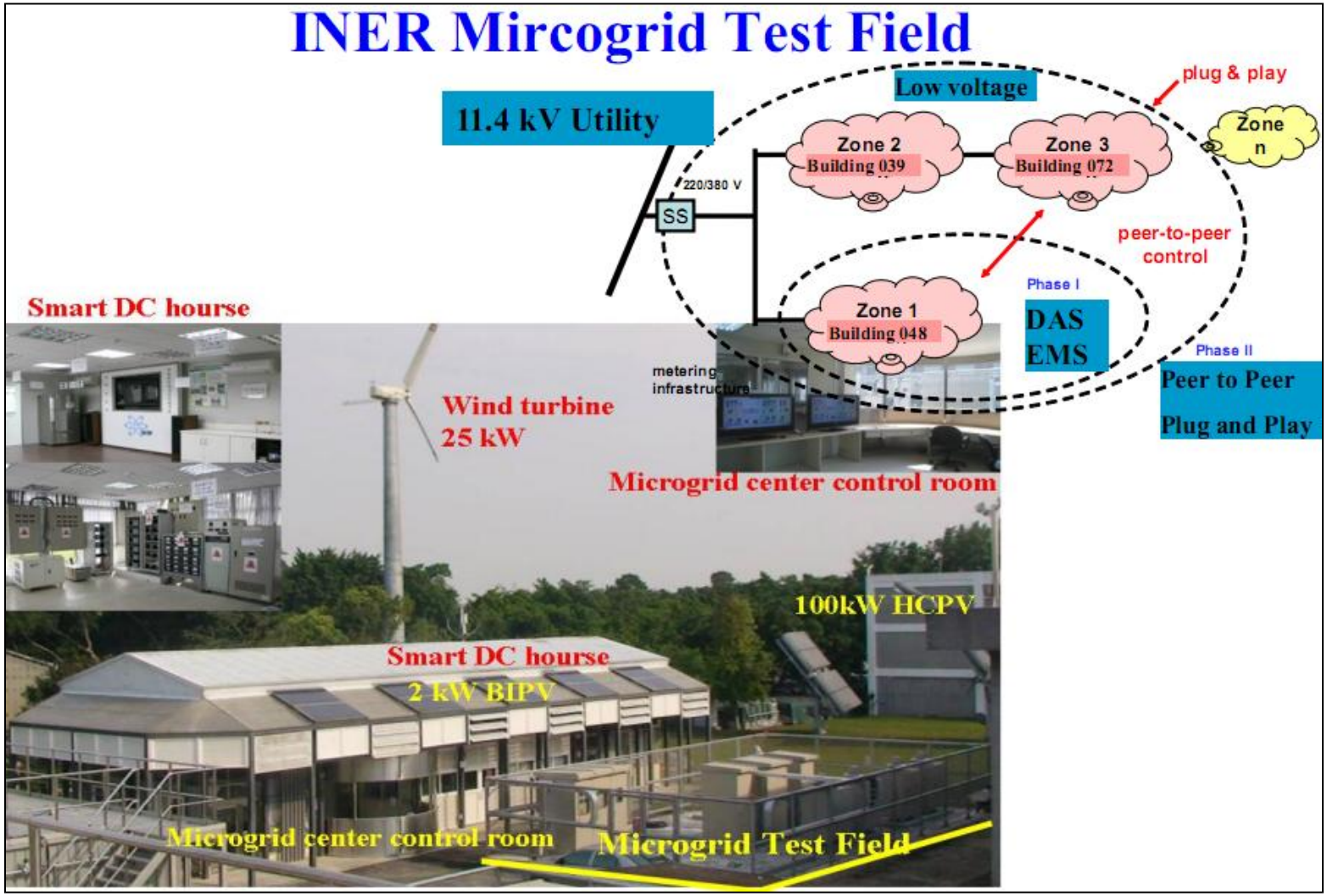


Fig 3. A real-time 380V AC microgrid in Taiwan

1. Introduction on AC and DC MG (7)

Charger	太陽能充電器	MornIng Star	TS-mppt-60 150Vdc(max) 60Adc	7
Xan11~15、Xan#1	變流充電器	Schneider	XW6048 48Vdc 6000Wdc	6
TR11~15	6KVA 隔離變壓器	鈺峰	1□3ω120/240V---->1□3ω110/220V	5
DC meter 1-1~1-2	直流多功能電表	Aigo	MP-84DH(單向省電型)	2
DC meter 1-3	直流多功能電表	Aigo	MP-84DH(R)(雙向省電型)	1
Shunt1	分流器	Aigo	50mV / 500A	1
Shunt2~3	分流器	Aigo	50mV / 1000A	2
CB1~7	直流無熔絲開關	Schneider	C60N · 2P125Vdc · 50Adc	7
CB8~14	直流無熔絲開關	Schneider	C60N · 2P125Vdc · 63Adc	7
CB15~20、CB22	直流無熔絲開關	士林	NF250-CN 2P250Vdc 125A	7
CB21	直流無熔絲開關	士林	NF1000-HS 3P250Vdc 1000A	1
NFB1~11	無熔絲開關	Schneider	C60N · 3P415Vac · 63A	11
MNFB11~15	無熔絲開關	Schneider	C60N · 3P415Vac · 63A	5
SW11~15	切換開關	西北	KD-3P75A · 3P250Vac · 75A	5

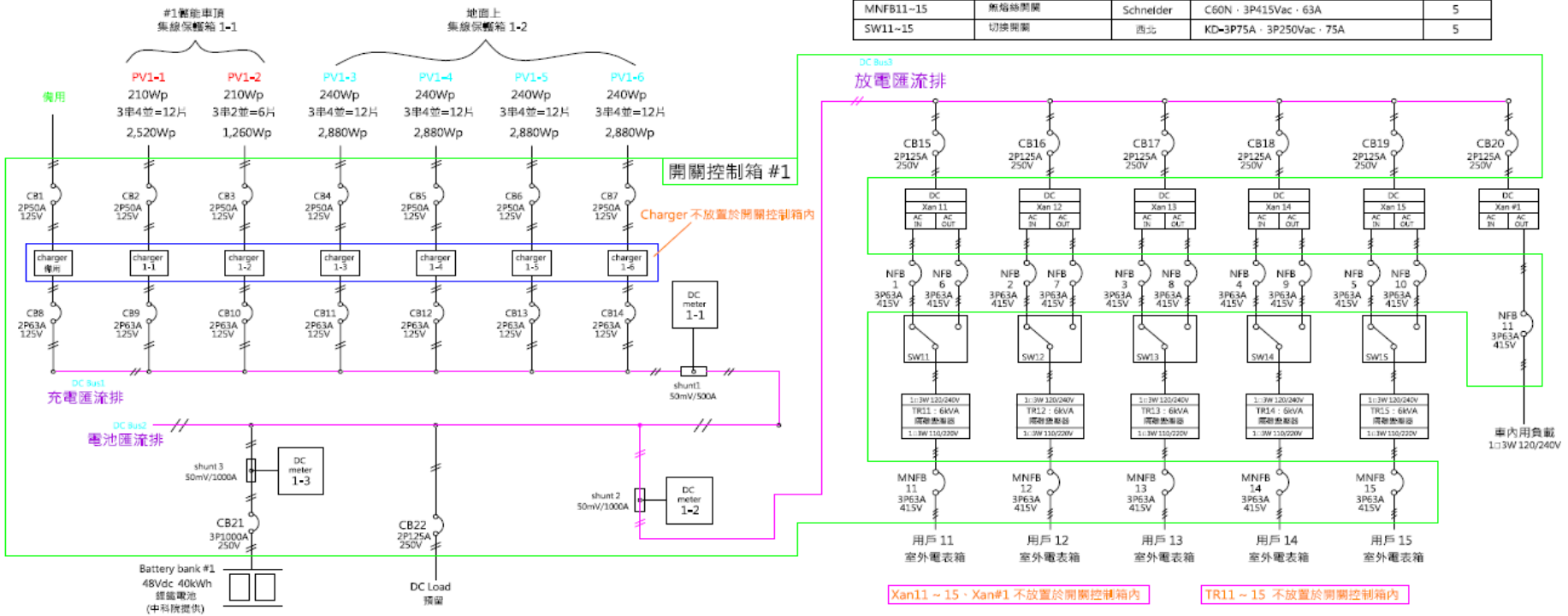


Fig 4. System configuration of a real-time DC microgrid in Taiwan

1. Introduction on AC and DC MG (8)

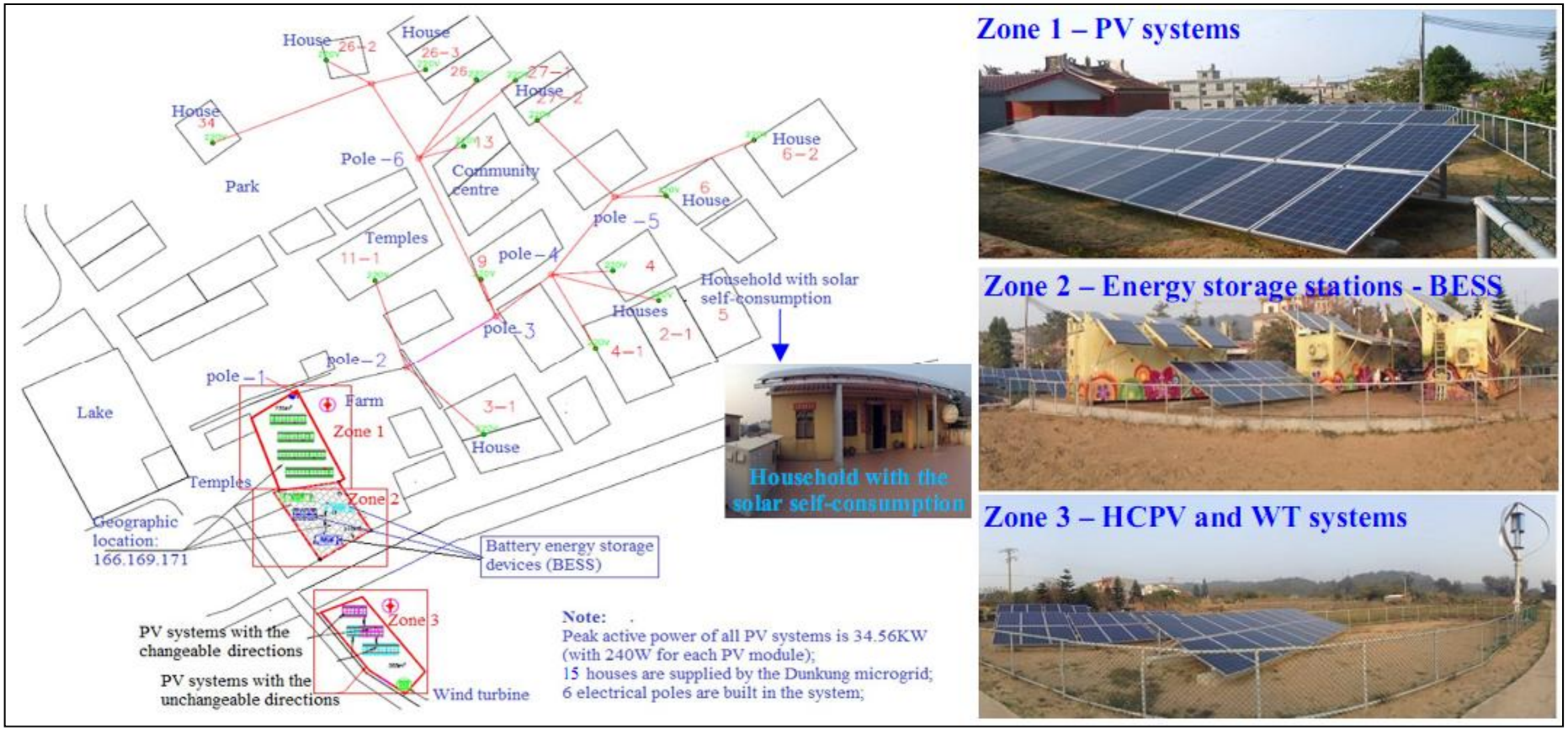


Fig 5. Geographic location and some real pictures of the Dongkeng DC MG

1. Introduction on AC and DC MG (9)

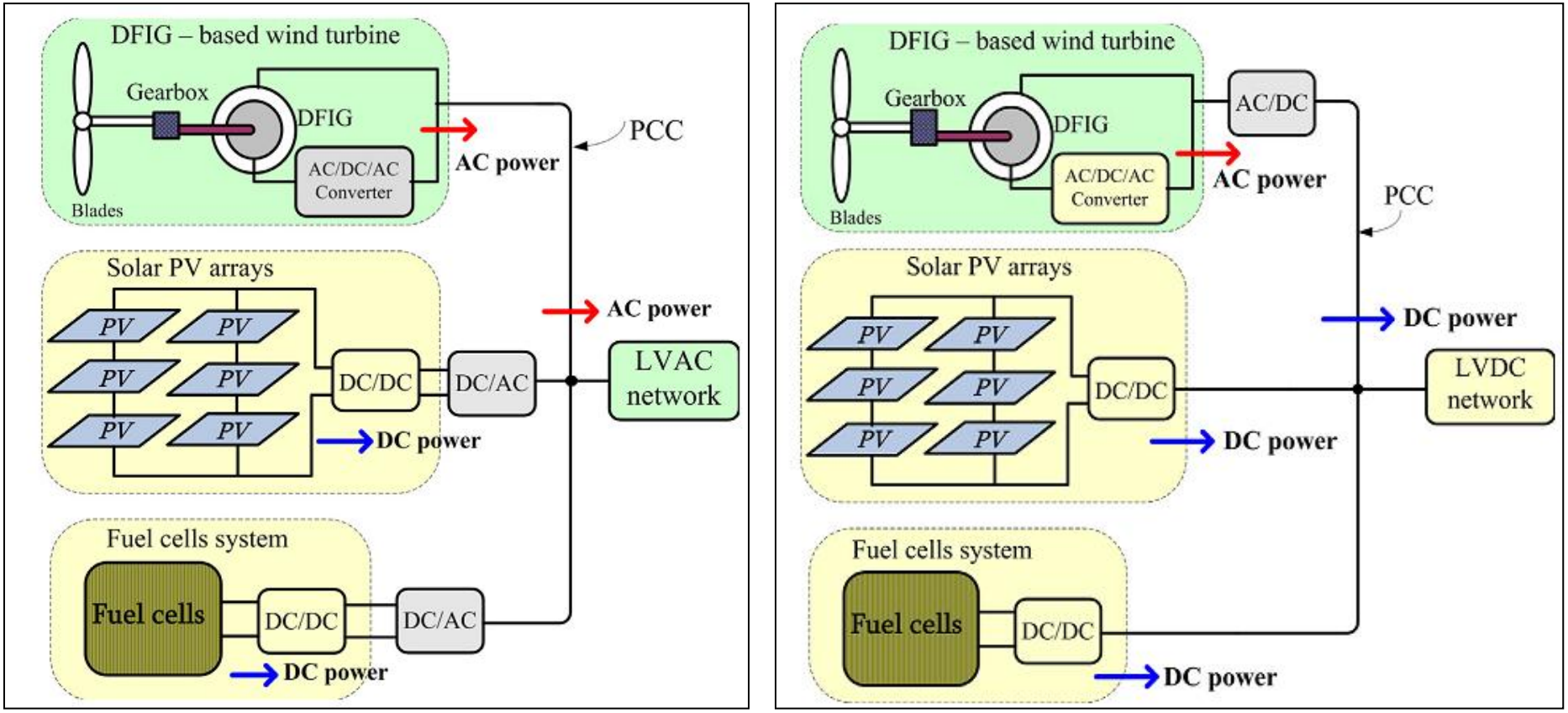


Fig 6. AC microgrid versus DC microgrid

1. Introduction on AC and DC MG (10)

- **Special research fields of microgrid technology:**

(1) Integration of distributed energy resources (DERs) to MGs

(2) Power conversion system with reactive power control for renewable energy

(3) Grid-connected operation of MGs

(4) Islanded operation of MGs

(5) Seamless transitions between grid-connection and stand-alone operation modes of the MG

(6) Energy management system in microgrids (demand response and optimal power flow analysis)

(7) Microgrid protection

2. An aggregated energy storage system in microgrids (1)

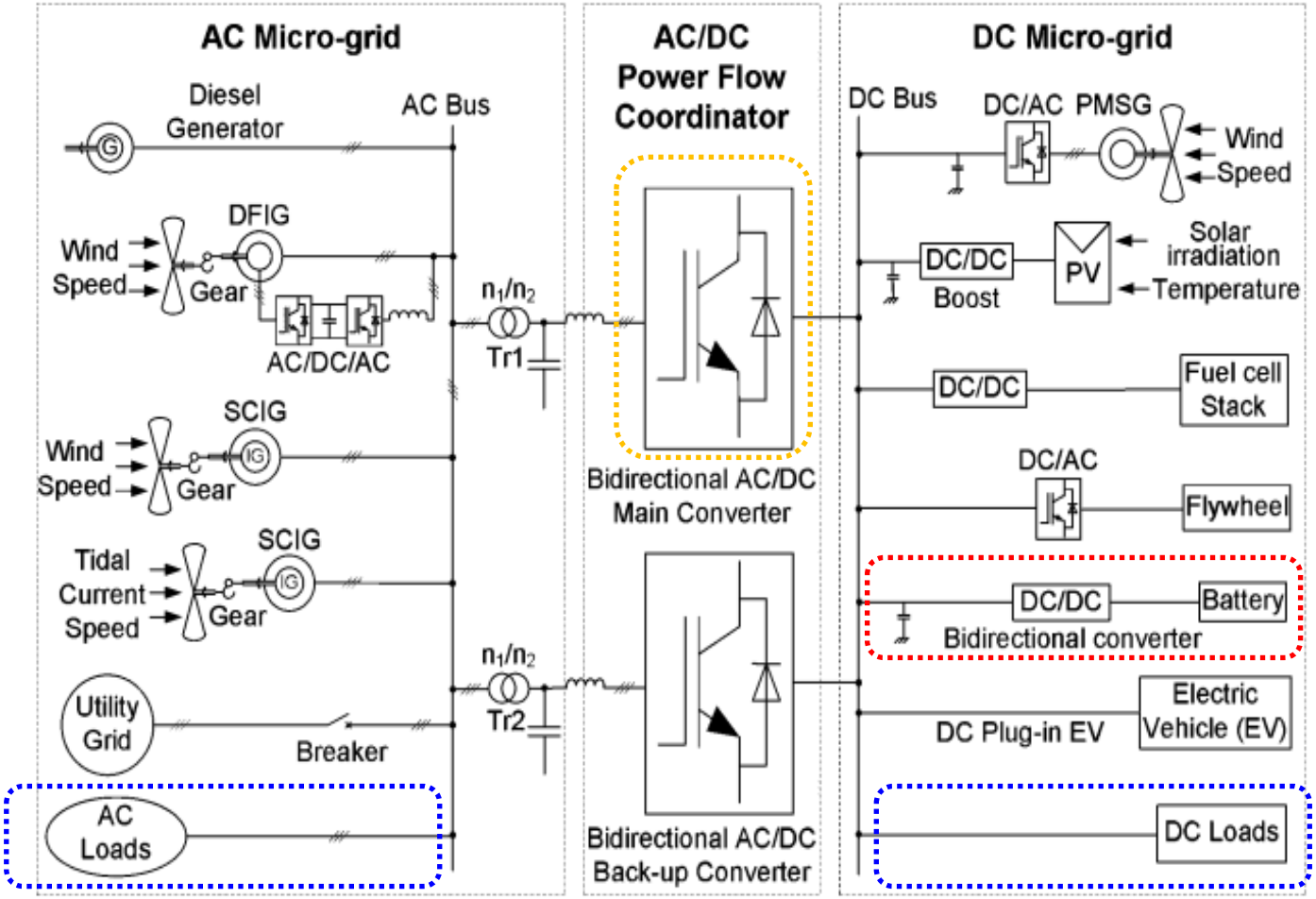
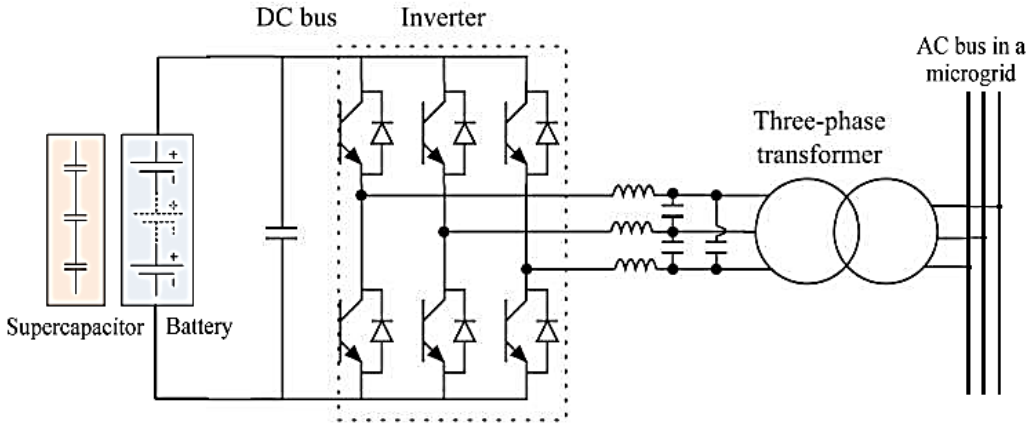
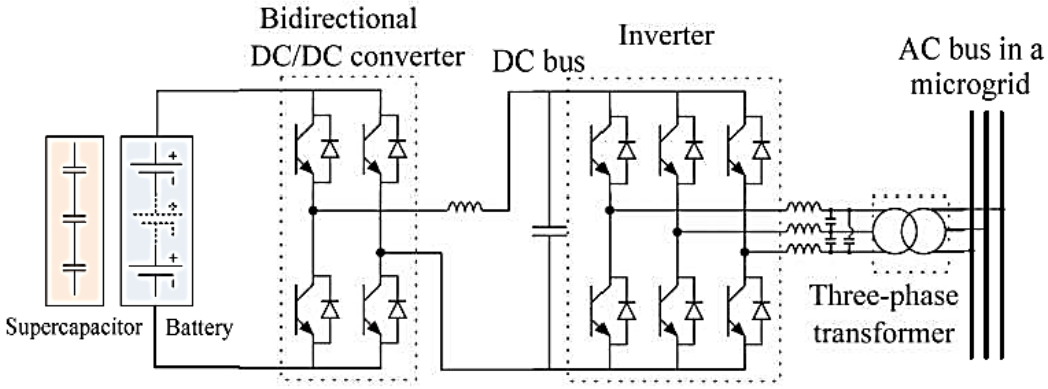


Fig 7. A hybrid AC/DC microgrid system

2. An aggregated energy storage system in microgrids (2)



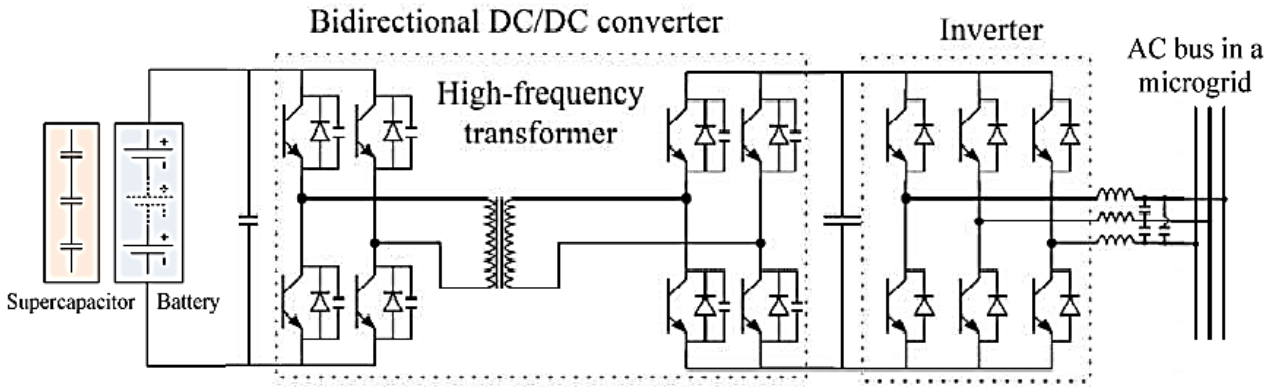
a) The super-capacitor/battery system is directly connected to a DC/AC inverter and a transformer



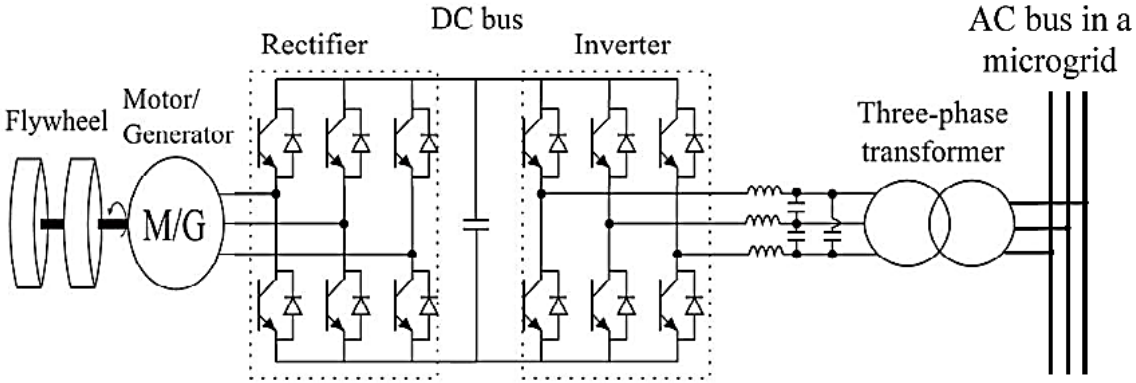
b) The super-capacitor/battery system is connected to a bidirectional DC/DC converter, a DC/AC power inverter and a three-phase transformer

Fig 8. Connection diagrams of three typical energy storage devices in an AC MG

2. An aggregated energy storage system in microgrids (3)



c) The super-capacitor/battery system is connected to a bidirectional DC/DC converter with a high-frequency transformer

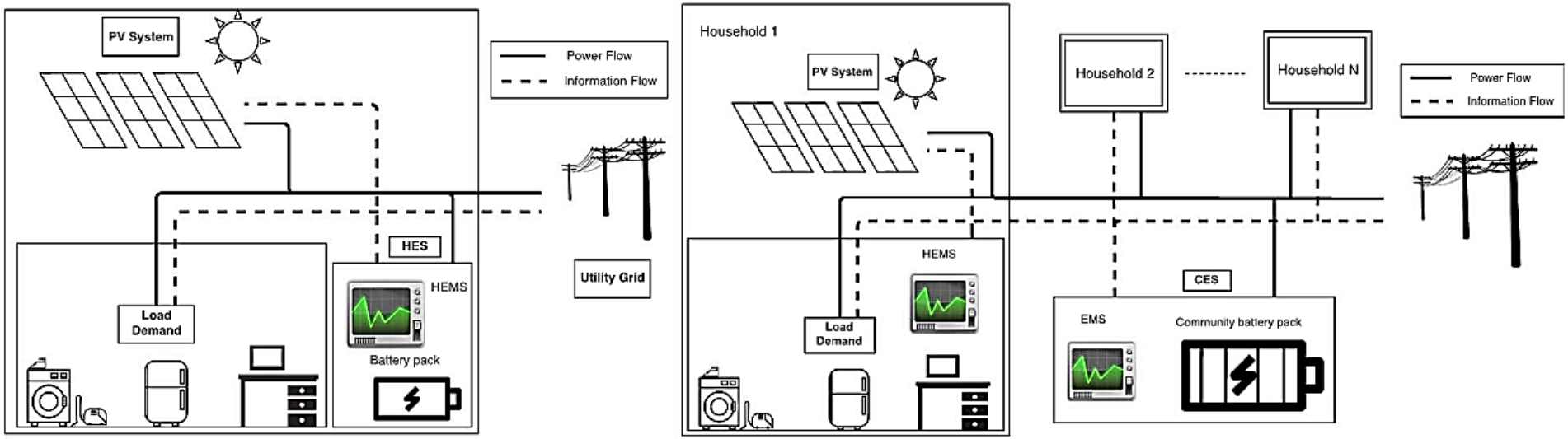


d) A flywheel energy storage system is connected to the AC microgrid through power converters and the transformer

Fig 8. Connection diagrams of three typical energy storage devices in an AC MG (cont.)

2. An aggregated energy storage system in microgrids (4)

- Energy storage systems: Household energy storage (HES) and aggregated energy storage (AES)



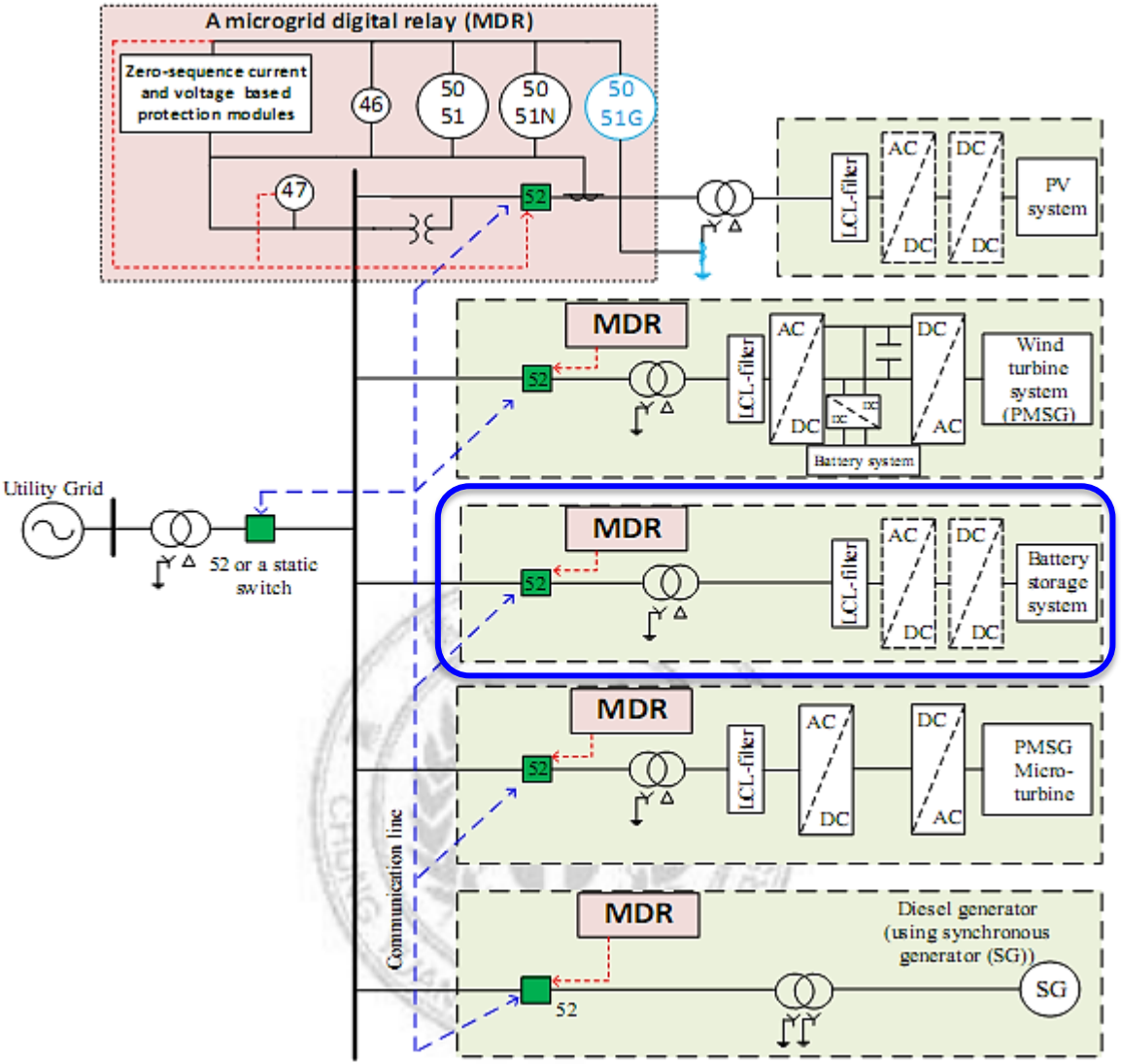
(a) Scenario I: HES system

(b) Scenario II: AES system

2. An aggregated energy storage system in microgrids (5)

- Although the power total of microgrid is quite small at few kilowatts, the **investment cost** of the energy storage system is a possible downside for the HES system ➔ No incentive for deployment of the HES system for the households.
- On the other hand, the AES system is a promising selection for demand-side management (DSM) and distributed energy resources (DER) side management at the community size ➔ Surplus energy from all customers having microgrids can be stored in an aggregated energy storage system to perform multiple applications for both the customers (households, industrial or commercial customers) and the utility grid.

3. Protection Algorithm of AESS in AC microgrids

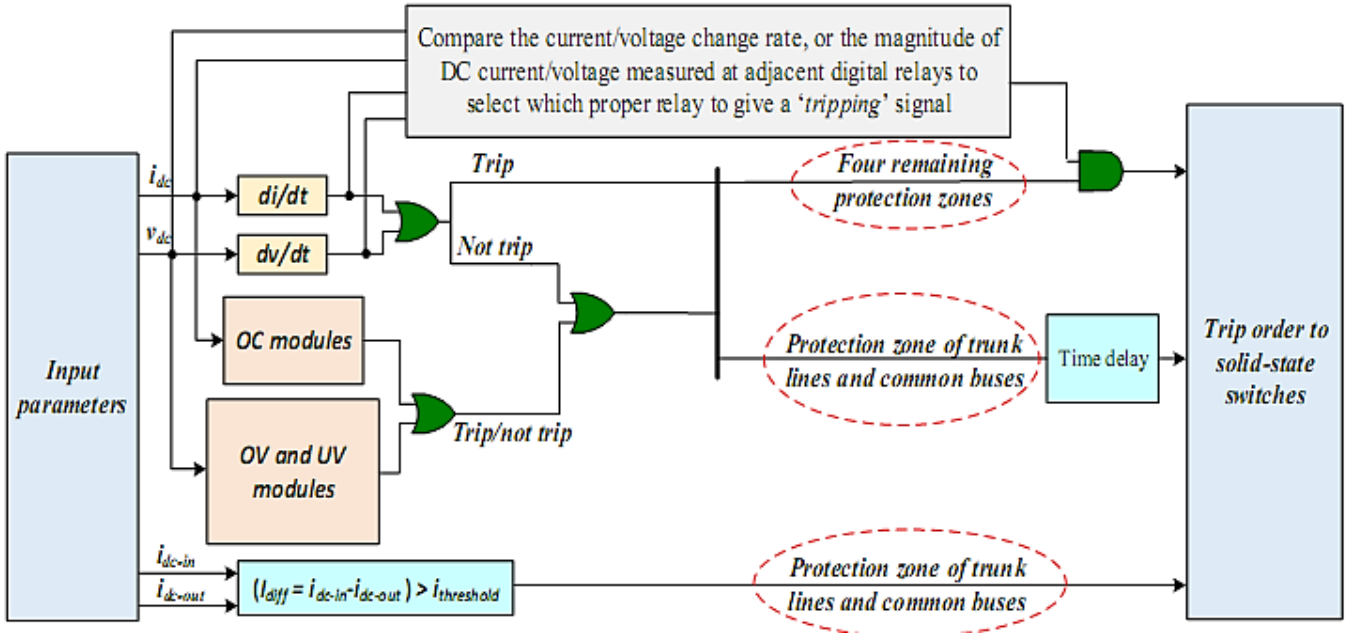


4. Protection Algorithm of AESS in DC microgrids

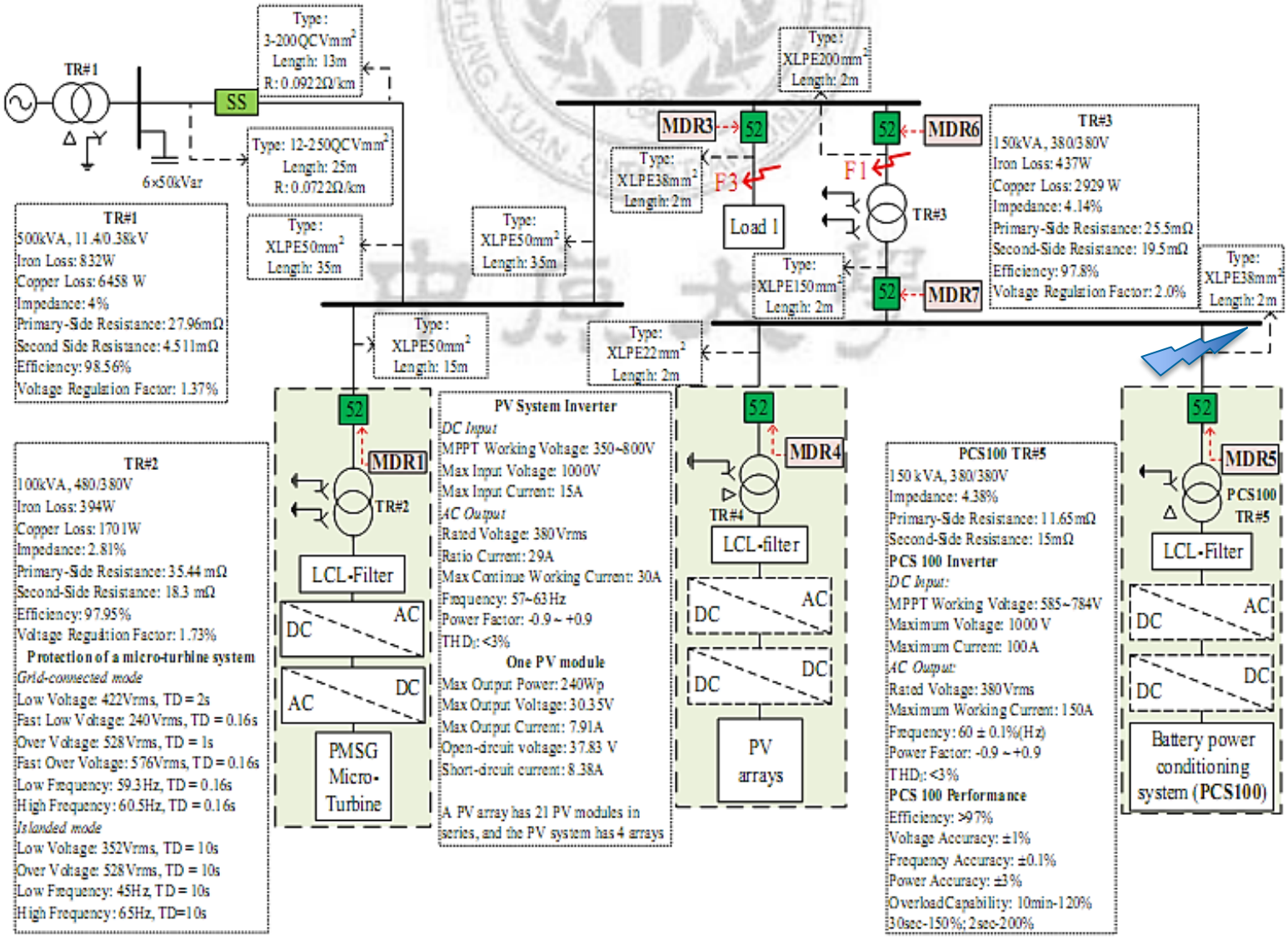
Protection of DG-source/energy-storage branches

- *di/dt* and *dv/dt* protection modules;

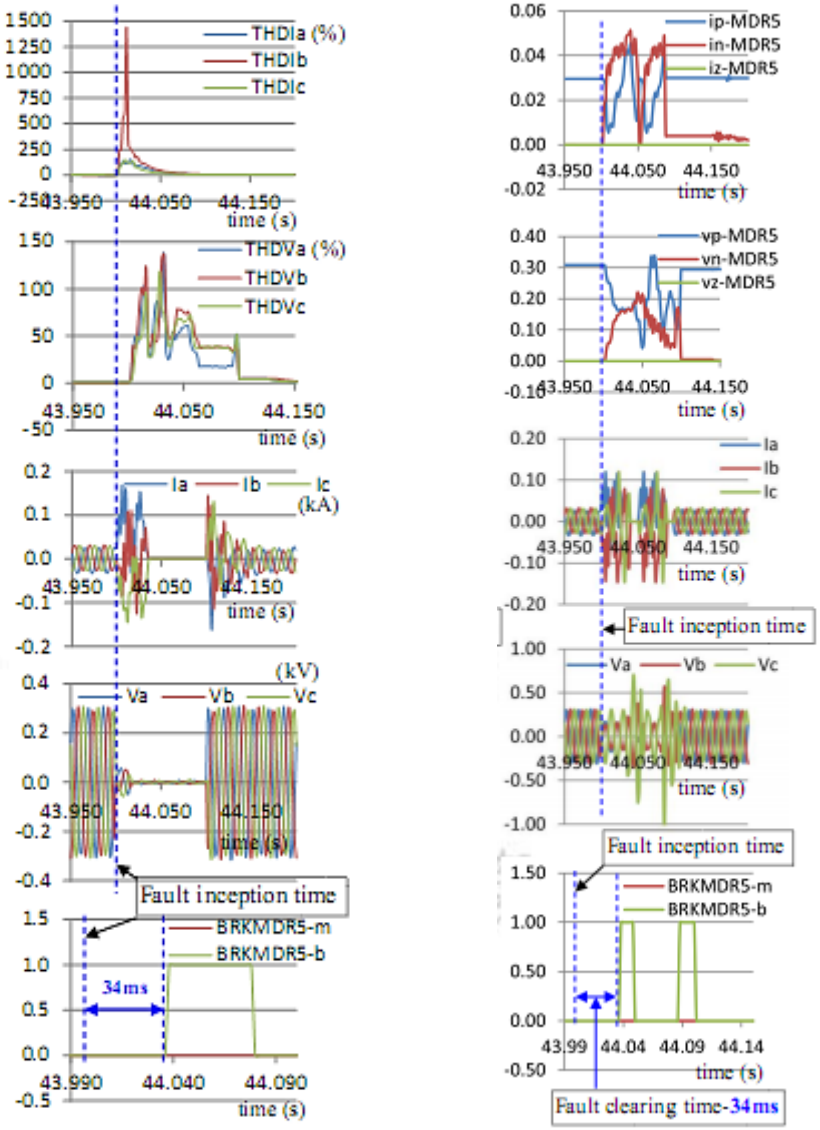
- overcurrent protection module;
- under-voltage protection module;
- over-voltage protection module;



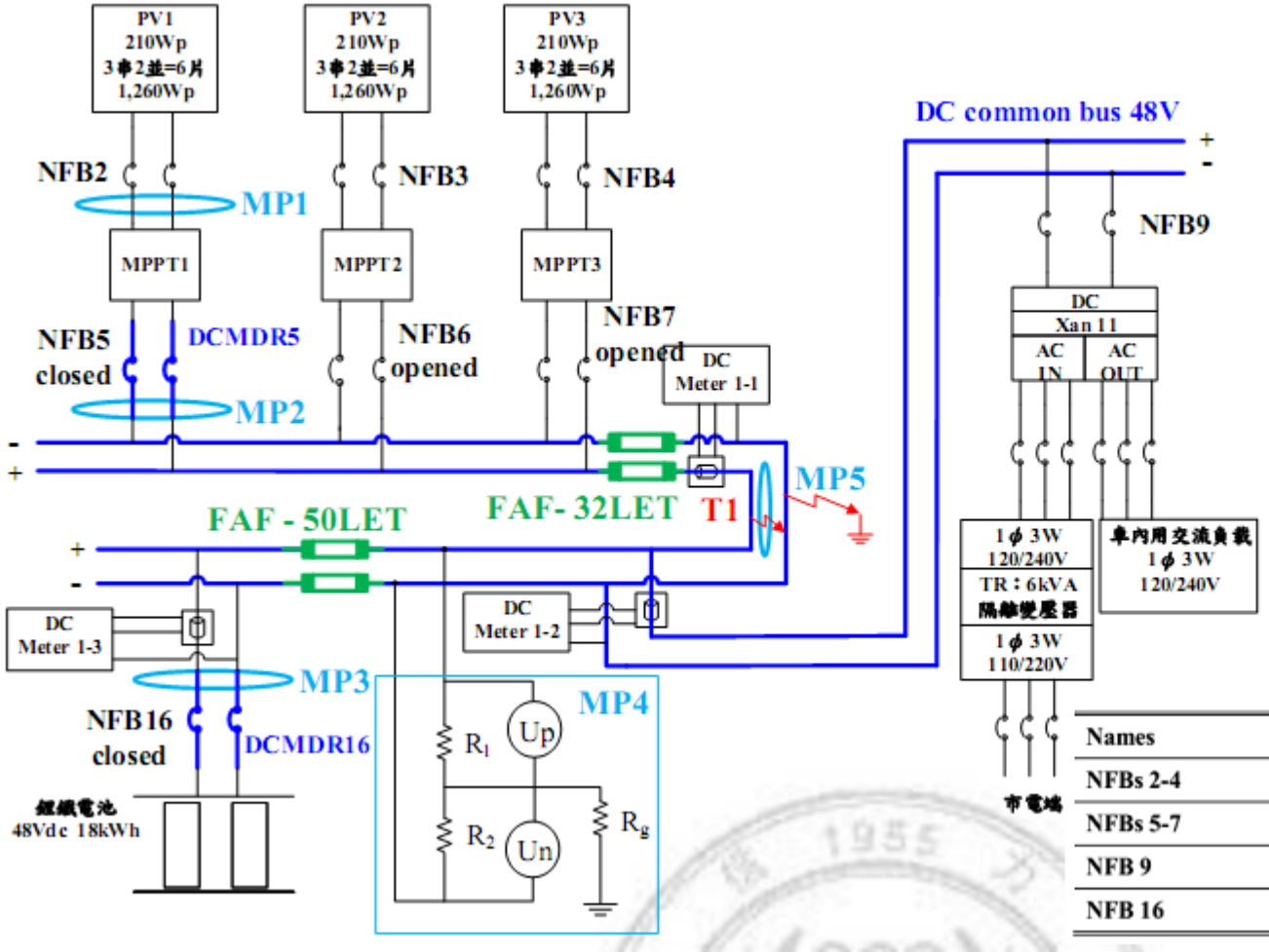
5. Results (1)


TR#1
SS
6×50kVar
Type: 3-200QCVmm²
Length: 13m
R: 0.0922Ω/km
Type: 12-250QCVmm²
Length: 25m
R: 0.0722Ω/km
Type: XLPE50mm²
Length: 35m
Type: XLPE50mm²
Length: 35m
Type: XLPE50mm²
Length: 15m
Type: XLPE200mm²
Length: 2m
MDR3
MDR6
MDR7
MDR1
MDR4
MDR5
52
Type: XLPE38mm²
Length: 2m
F3
F1
Load 1
TR#3
Type: XLPE150mm²
Length: 2m
Type: XLPE22mm²
Length: 2m
Type: XLPE38mm²
Length: 2m
TR#1
500kVA, 11.4/0.38kV
Iron Loss: 832W
Copper Loss: 6458 W
Impedance: 4%
Primary-Side Resistance: 27.96mΩ
Second Side Resistance: 4.511mΩ
Efficiency: 98.56%
Voltage Regulation Factor: 1.37%
TR#3
150kVA, 380/380V
Iron Loss: 437W
Copper Loss: 2929 W
Impedance: 4.14%
Primary-Side Resistance: 25.5mΩ
Second-Side Resistance: 19.5mΩ
Efficiency: 97.8%
Voltage Regulation Factor: 2.0%
TR#2
100kVA, 480/380V
Iron Loss: 394W
Copper Loss: 1701W
Impedance: 2.81%
Primary-Side Resistance: 35.44 mΩ
Second-Side Resistance: 18.3 mΩ
Efficiency: 97.95%
Voltage Regulation Factor: 1.73%
Protection of a micro-turbine system
Grid-connected mode
Low Voltage: 422Vrms, TD = 2s
Fast Low Voltage: 240Vrms, TD = 0.16s
Over Voltage: 528Vrms, TD = 1s
Fast Over Voltage: 576Vrms, TD = 0.16s
Low Frequency: 59.3Hz, TD = 0.16s
High Frequency: 60.5Hz, TD = 0.16s
Islanded mode
Low Voltage: 352Vrms, TD = 10s
Over Voltage: 528Vrms, TD = 10s
Low Frequency: 45Hz, TD = 10s
High Frequency: 65Hz, TD=10s
TR#2
LCL-Filter
AC
DC
DC
AC
PMSG Micro-Turbine
PV System Inverter
DC Input
MPPT Working Voltage: 350~800V
Max Input Voltage: 1000V
Max Input Current: 15A
AC Output
Rated Voltage: 380Vrms
Ratio Current: 29A
Max Continue Working Current: 30A
Frequency: 57~63Hz
Power Factor: -0.9 ~ +0.9
THDi: <3%
One PV module
Max Output Power: 240Wp
Max Output Voltage: 30.35V
Max Output Current: 7.91A
Open-circuit voltage: 37.83 V
Short-circuit current: 8.38A
A PV array has 21 PV modules in series, and the PV system has 4 arrays
TR#4
LCL-filter
DC
AC
DC
DC
PV arrays
PCS100 TR#5
150 kVA, 380/380V
Impedance: 4.38%
Primary-Side Resistance: 11.65mΩ
Second-Side Resistance: 15mΩ
PCS 100 Inverter
DC Input:
MPPT Working Voltage: 585~784V
Maximum Voltage: 1000 V
Maximum Current: 100A
AC Output:
Rated Voltage: 380Vrms
Maximum Working Current: 150A
Frequency: 60 ± 0.1%(Hz)
Power Factor: -0.9 ~ +0.9
THDi: <3%
PCS 100 Performance
Efficiency: >97%
Voltage Accuracy: ±1%
Frequency Accuracy: ±0.1%
Power Accuracy: ±3%
OverloadCapability: 10min-120%
30sec-150%; 2sec-200%
PCS100 TR#5
LCL-Filter
AC
DC
DC
DC
Battery power conditioning system (PCS100)

5. Results (2)

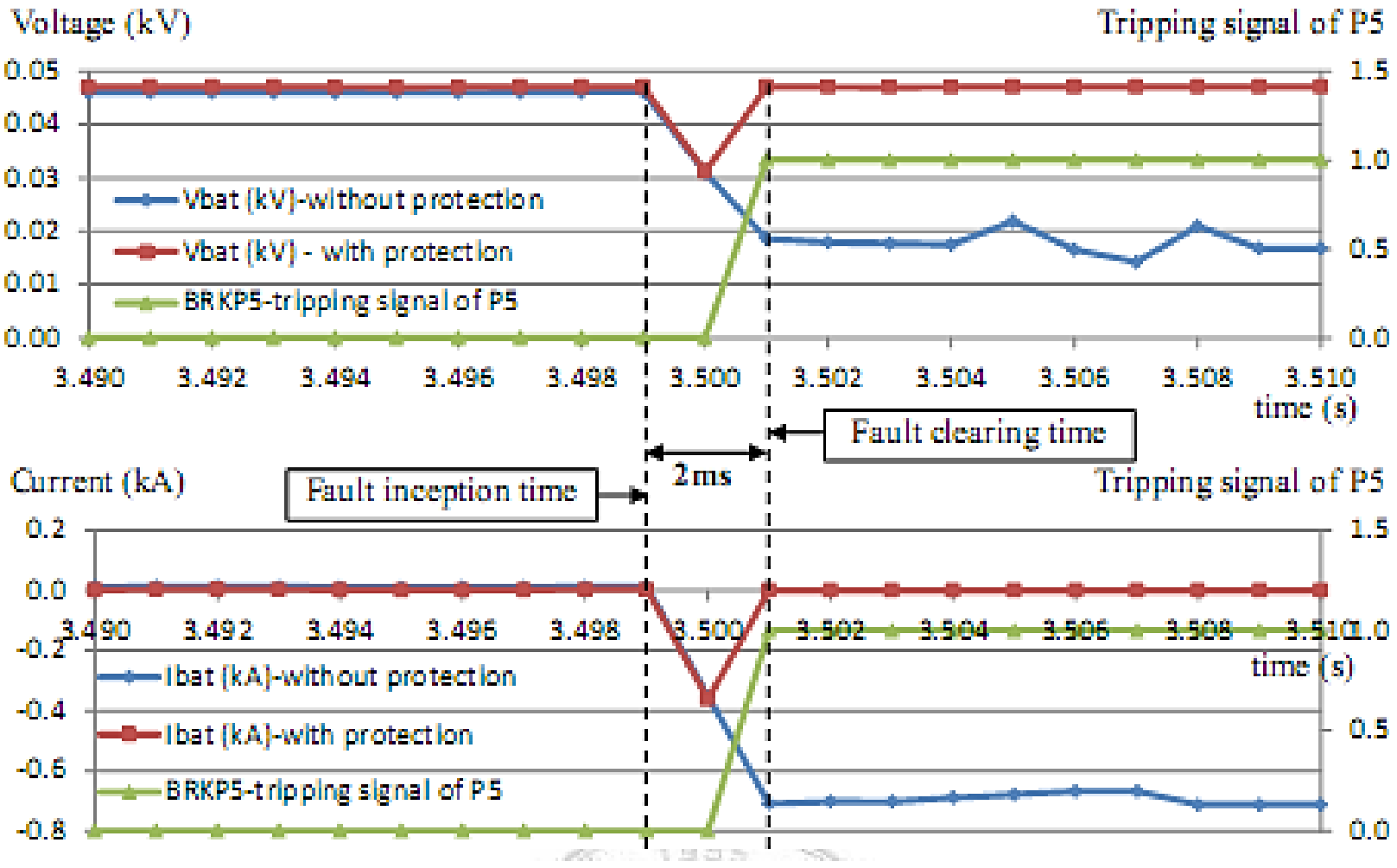

THDIa (%)
THDIb
THDIc
time (s)
THDVa (%)
THDVb
THDVc
time (s)
Ia
Ib
Ic
(kA)
time (s)
(kV)
Va
Vb
Vc
time (s)
Fault inception time
BRKMDR5-m
BRKMDR5-b
34ms
time (s)
ip-MDR5
in-MDR5
iz-MDR5
time (s)
vp-MDR5
vn-MDR5
vz-MDR5
time (s)
Ia
Ib
Ic
time (s)
Fault inception time
Va
Vb
Vc
time (s)
Fault inception time
BRKMDR5-m
BRKMDR5-b
time (s)
Fault clearing time-34ms

5. Results (3)



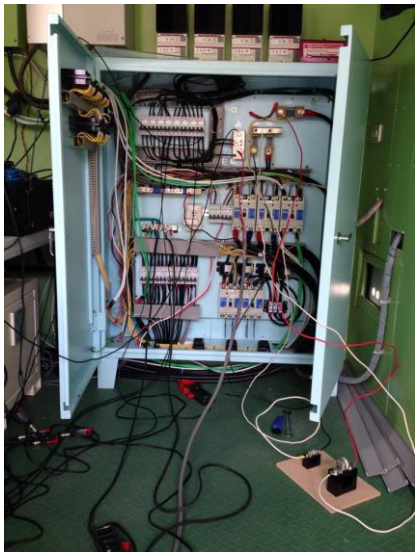
Names	Descriptions
NFBs 2-4	C60N, 2P50A, 150V_{dc}
NFBs 5-7	C60N, 2P63A, 150V_{dc}
NFB 9	NFB250CN, 2P125A, 250V_{dc}
NFB 16	NFB350CN, 2P350A, 250V_{dc}

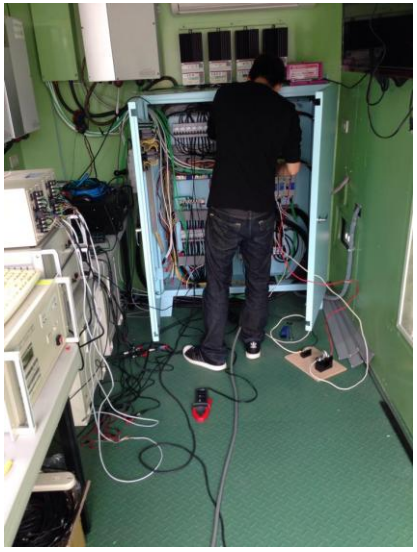
5. Results (4)


Voltage (kV)
Tripping signal of P5
0.05
0.04
0.03
0.02
0.01
0.00
1.5
1.0
0.5
0.0
Vbat (kV)-without protection
Vbat (kV) - with protection
BRKP5-tripping signal of P5
3.490
3.492
3.494
3.496
3.498
3.500
3.502
3.504
3.506
3.508
3.510
time (s)
Fault clearing time
2ms
Fault inception time
Current (kA)
Tripping signal of P5
0.2
0.0
-0.2
-0.4
-0.6
-0.8
1.5
1.0
0.5
0.0
Ibat (kA)-without protection
Ibat (kA)-with protection
BRKP5-tripping signal of P5
time (s)

REAL PICTURES OF EXPERIMENTS



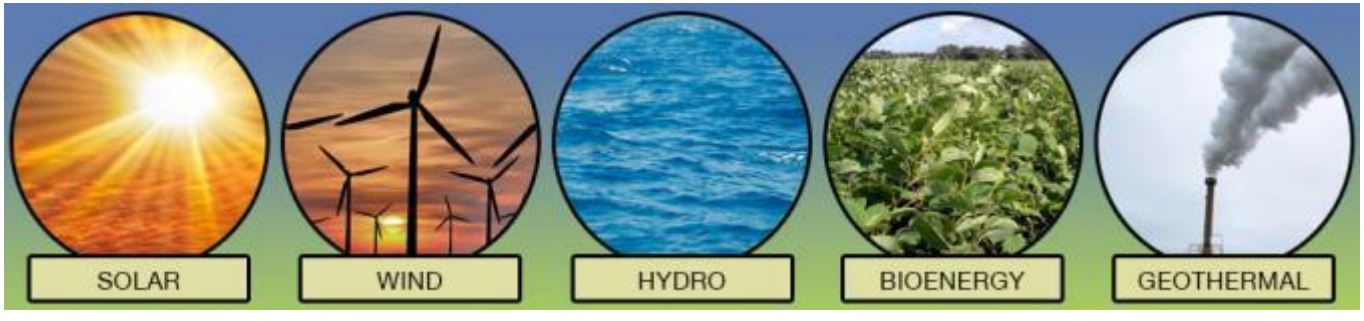





6. Further Research Activities (1)

AC and DC Microgrids (Renewable Energy Systems):

- **Energy management system (EMS) in the grid-connected and islanded operation modes of Microgrids**
- Optimal power flow analysis in Microgrids
- Fault analysis of AC and DC Microgrids
- **Microgrids protection and control**
- **Reliability assessment of components in Microgrids such as: Energy Storage Systems, PV, WT, ...**



6. Further Research Activities (2)

Smart distribution grids:

- Smart-grids using open ADR (Automated Demand Response)
- Smart distribution systems using smart meters - AMI (Advanced Metering Infrastructure), and AMR (Automatic meter reading)
- Applying Internet of Thing (IoT) for energy management system of smart-grids, the operation of renewable energy systems integrated to the grid
- Protection of distribution networks with integration of renewable energy systems

6. Research Projects for VGU students

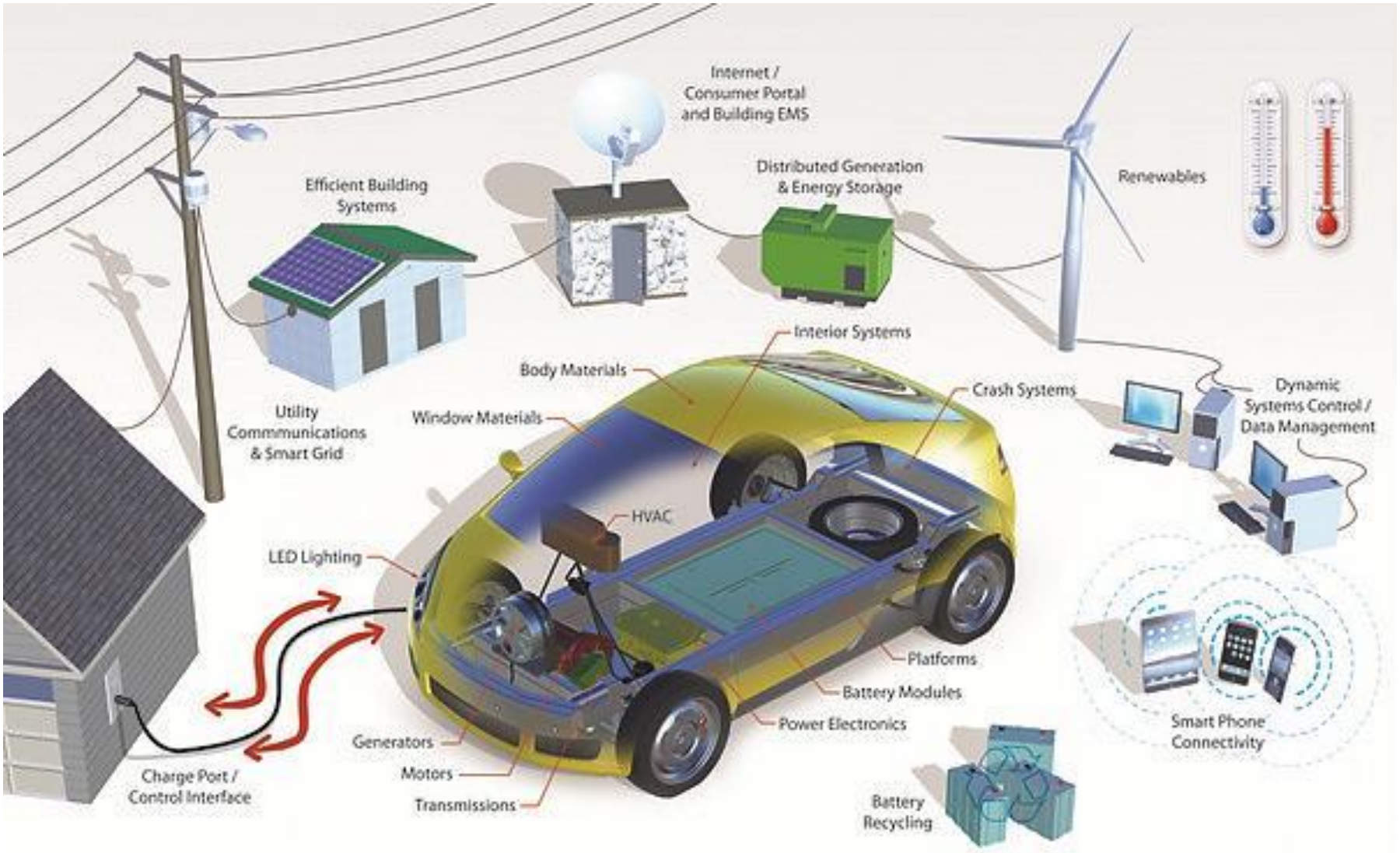
ONGOING:

1. Study on an Off-grid PV Generation System with an Energy Information Communication Framework (3/2018 – 11/2018)

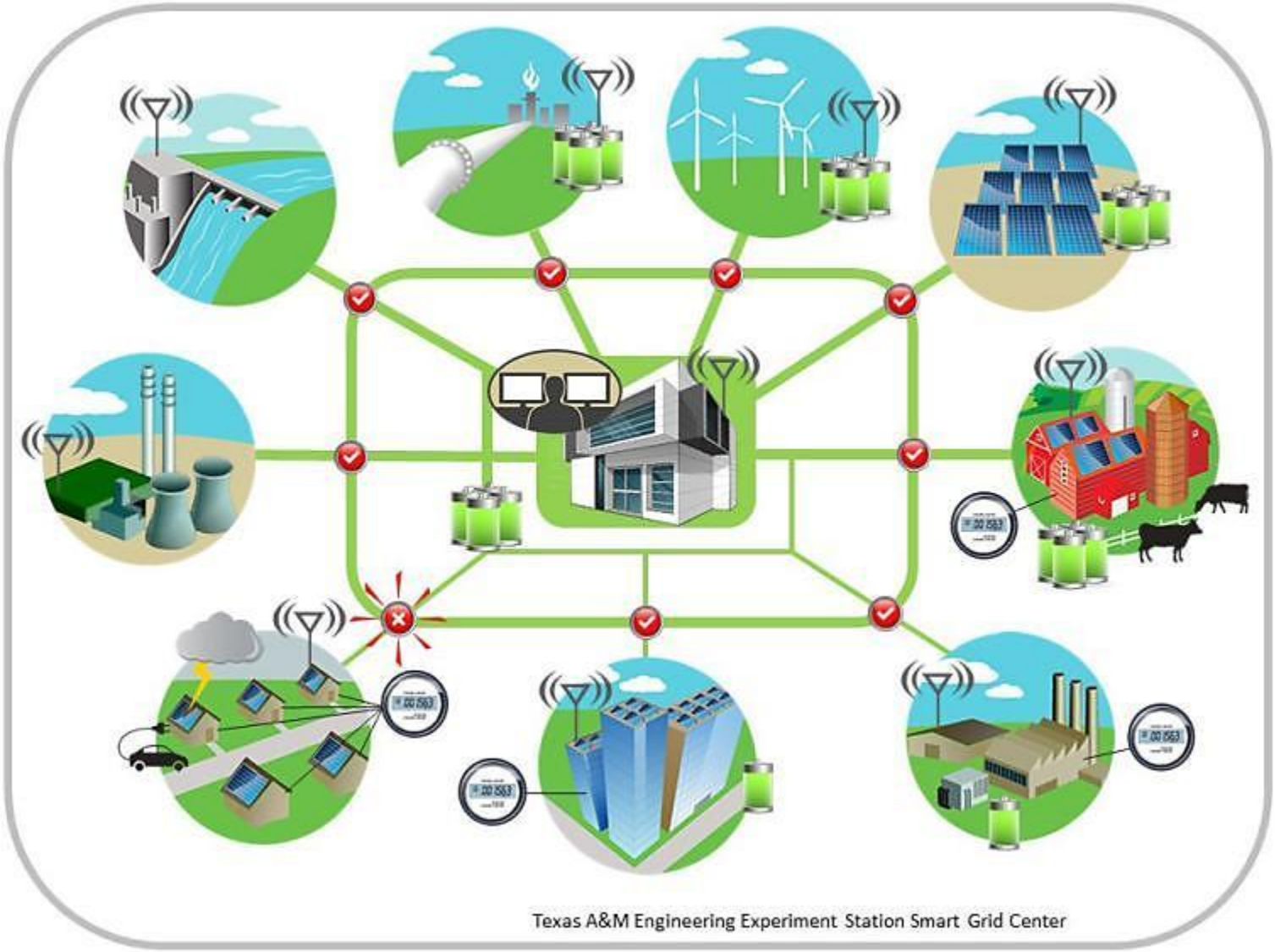
FUTURE:

1. Design of Vertical Axis Wind Turbines (VAWT)
2. Design of Smart Meter for a PV Generation System
3. Modeling and Simulation on PV Generation System, Wind Turbine Generation System and Energy Storage System in Microgrids
4. Design of Digital Relays for Protection of AC and DC Microgrids

Smart Grids

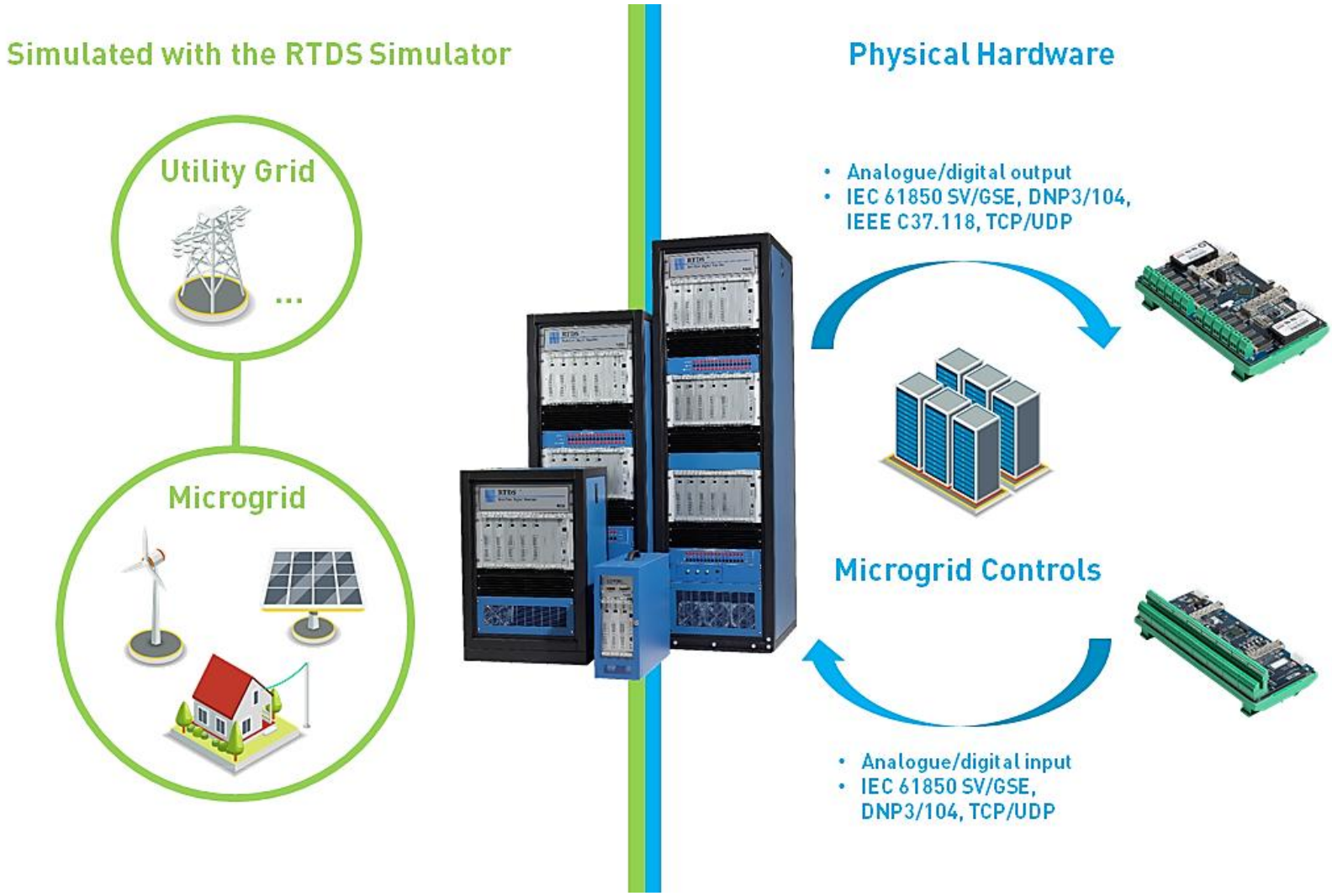

Internet / Consumer Portal and Building EMS
Efficient Building Systems
Distributed Generation & Energy Storage
Renewables
Interior Systems
Body Materials
Crash Systems
Dynamic Systems Control / Data Management
Utility Communications & Smart Grid
Window Materials
HVAC
LED Lighting
Platforms
Battery Modules
Power Electronics
Generators
Motors
Transmissions
Charge Port / Control Interface
Smart Phone Connectivity
Battery Recycling

Energy Management System



Protective relays

Real Time Digital Simulator (RTDS)



Real Time Digital Simulator (RTDS)

THANK YOU FOR YOUR LISTENING

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Vietnamese-German University

Vietnamese German University

Research conference

9.10.2018

Examining the service efficiency of Vietnamese banking system

Dr. Le Minh Hanh – Faculty of Economics and Management

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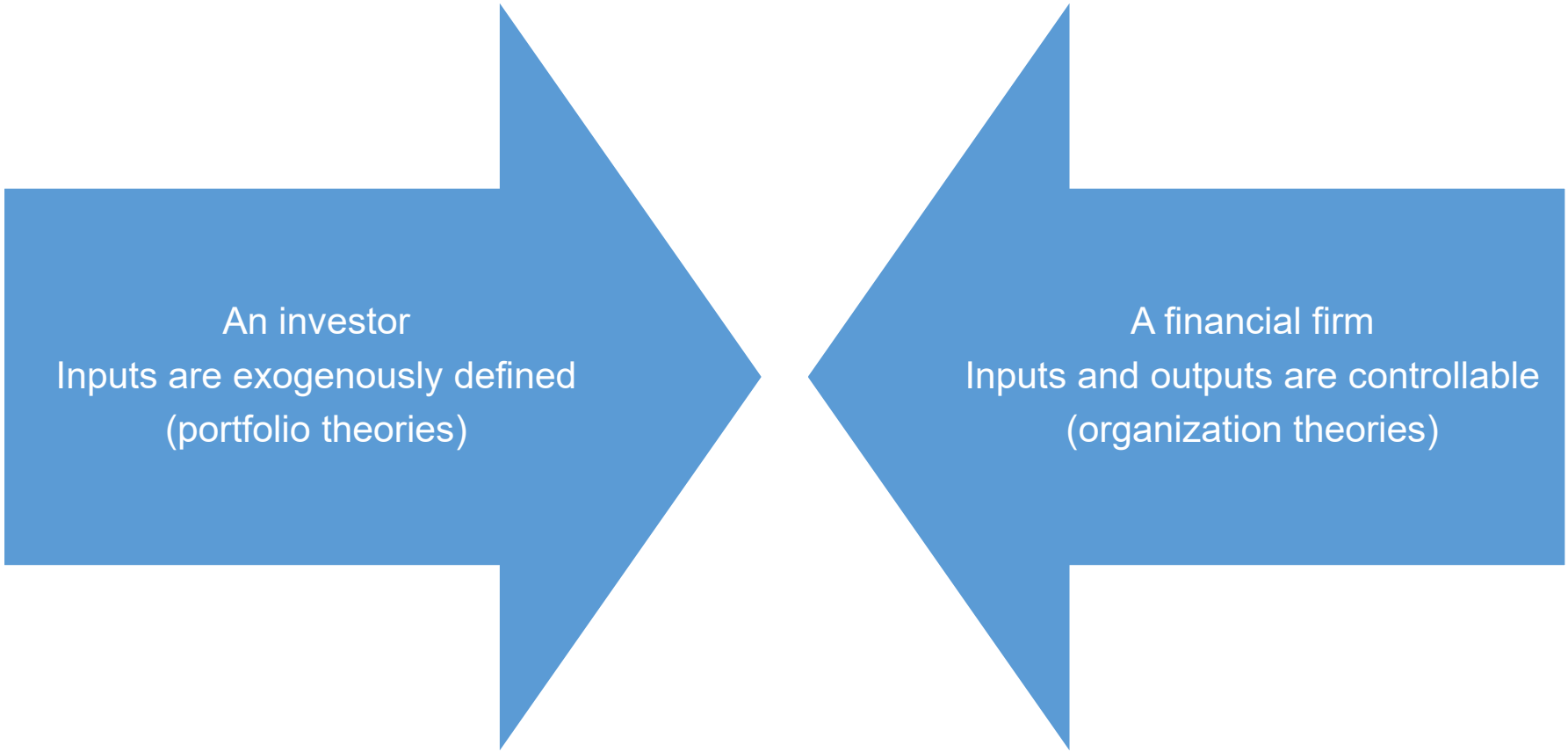
Outline

- **Background analysis**
- **Data Envelopment Analysis model**
- **Findings**

What is a bank?



Sealey and Lindley (1977)

Bank behavior models and bank efficiency analysis

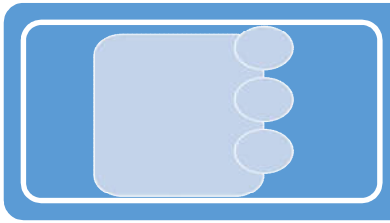
Focus: Bank as a financial firm
Primary goal: Maximizing shareholder values in the long term

↓

Secondary goals			
Intermediation approach	**Production approach**	**User cost approach**	**Value added approach**
Maximize the profit in intermediating funds	Minimize the operating costs of the operating process	Minimize the user costs in producing financial services	Maximize the value added of banking activities to obtain competitive viability

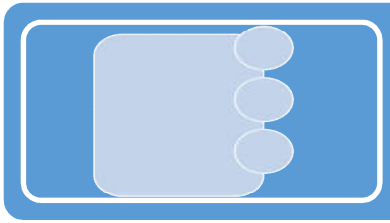
Ahn and Le (2014)

Bank as a service producer



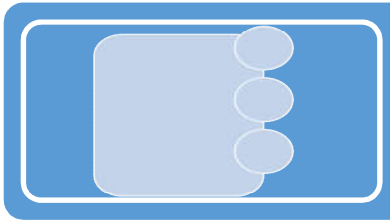
Focus

- Technical aspect
- Service producing process



Inputs - Outputs

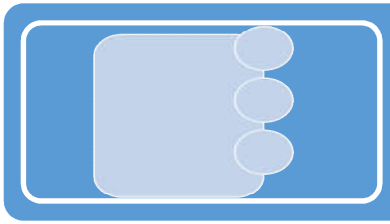
- Inputs: Resources (physical resources)
- Outputs: Banking services



Strengths:

Justify the significance of deposit services

Address the importance of operational resources



Weaknesses

- Requiring data with limited assess

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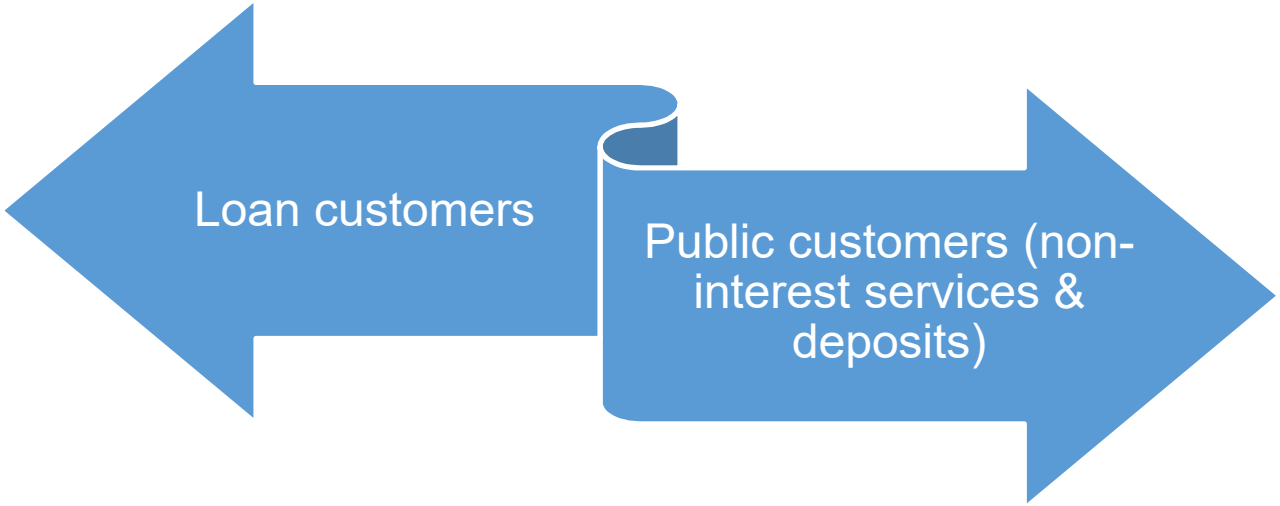
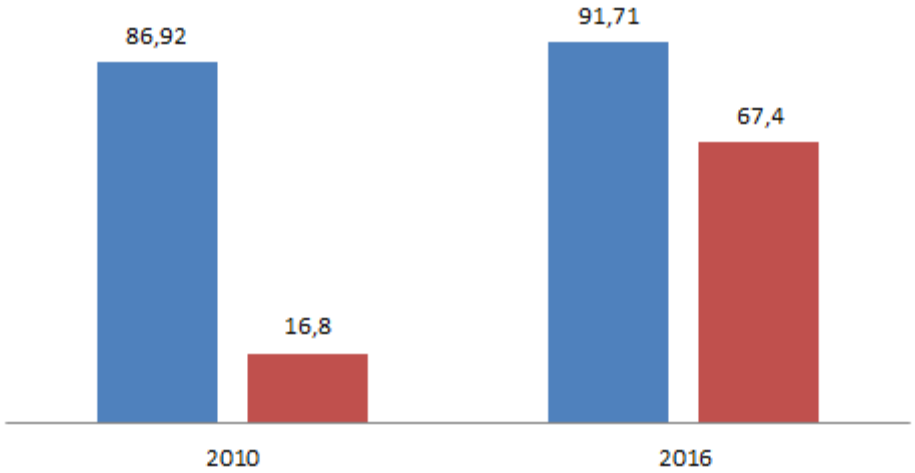
Bank customers



- ✓ Purchasing and using behaviors
- ✓ Knowledge about services
- ✓ Responses to changes in bank and market changes

Banking system in Vietnam

- A surge in banking industry shown in the past 10 years
- However with considerable fluctuations: M&A, Restructure, Non-performing loans...
- Who are customers?



Source: State Bank of Vietnam

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Question

How efficient do banks serve public customers and loan customers?

DEA's approach to measure efficiency

- Data Envelopment Analysis (DEA) applies the **frontier approach** → DEA provides efficiency measure of a decision making unit (DMU), not based on specific indicators, but in a dynamic relation with others in the same peer group. Efficiency score of a DMU is not defined by an absolute standard, but it is defined in relative to others in the reference group
  - **Efficient frontier** contains the best-practiced observations which could produce more output or consume least input such that no other banks in the peer group could outperform.
  - Other observations shall be considered as inefficient ones. Deviation from the efficient frontier refers to **inefficiency**.
- DEA is **deterministic** → it assumes the measurement error free and does not separate random noise and inefficiency term, but simply assumes that the residual represents the inefficiency term → this approach could overestimate the inefficiencies
- DEA is **non-parametric** → production frontier is generated from the actual data of all the banks under consideration, NOT from specific functional forms.

Specification of DEA model

- **DMU(s):** Decision making unit(s)
- **Input(s):** taken from the production process *or from decision process*
- **Output(s):** taken from the production process *or from decision process*
- ***Weights:*** DEA model employs the variable weight method. There is no priori assumption on weights of production factors. In fact, weights are assigned so that every DMU is viewed in the best possible light.
- **Returns to scale:** Constant returns to scale or variable returns to scale
- **Orientation:** Input orientation or output orientation

Outcome of DEA measurement method

- **Efficient frontier** is the envelopment surface consisting of all the best practice units
- **Efficiency score** for each DMU reflecting distance to the frontier, lying within the interval of [0,1]. Efficiency score is equal to unity for efficient DMUs, and less than unity for inefficient DMUs.
- **Efficient reference set**, or peer group containing a small subset of efficient units "closest" to the unit under evaluation, for each inefficient DMU;
- **Efficient target** for each inefficient DMU (projections onto the frontier).

CCR model (I)

Fractional program (FP_0)

$$\max \sum_{r=1}^{s} u_r y_{ro} / \sum_{i=1}^{m} v_i x_{io}$$

$$s.t. \quad \sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0; \forall j$$

$$u_r; v_i \ge \varepsilon \text{ for all r; i}$$

The ratio scale is being maximized with the constraints that…

…the ratio scale lies within the [0,1] being bounded as an efficiency measure

… the **optimal weights** are obtained, i.e. each DMU is presented in best possible light, in the sense of maximizing the ratio scales. There is no priori assumption on weights of inputs and outputs.

Linear program - multiplier form (LP_0)

$$\max \sum_{r=1}^{s} \mu_r y_{ro}$$

$$s.t. \quad \sum_{i=1}^{m} v_i x_{io} = 1$$

$$\sum_{r=1}^{s} \mu_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0, \forall j$$

$$\mu_r; v_i \ge \varepsilon \text{ for all r; i}$$

(FP_0) is equivalent to (LP_0), under the nonzero assumption of v and X>0

CCR- Dual problem - Envelopment form

$$\min \theta_o - \varepsilon\left(\sum_{r=1}^{s} s_r^+ + \sum_{i=1}^{m} s_i^-\right)$$

$$s.t. \sum_{j=1}^{n} \lambda_j x_{ij} + s_i^- = \theta_o x_{io}; i = 1;...m \qquad (DLP_0)$$

$$\sum_{j=1}^{n} \lambda_j y_{ij} + s_r^+ = y_{ro}; r = 1;...s$$

$$\lambda_j; s_i^-; s_r^+ \geq 0; \forall i; j; r$$

- Production possibility set: $P = \left\{(X;Y) \middle| X \geq \sum_{j=1}^{n} \lambda_j X_j; Y \leq \sum_{j=1}^{n} \lambda_j Y_j; \lambda_j \geq 0\right\}$
- The first constraint: $\theta_o \boldsymbol{x_{io}}$ lies within the production possibility set
- The second constraint: $\boldsymbol{y_{ro}}$ lies within the production possibility set
- Minimize θ_0 → minimize $\theta_0 \boldsymbol{x_{io}}$ → to find out the possibility for DMU_0 to reduce the input while still maintain in the production possibility set. θ belongs to [0, 1]. If there is no possibility to minimize $\boldsymbol{x_{io}}$; i.e. $\theta_0 = 1$, then DMU_o is efficient
- In order to confirm that DMU is fully efficient under Pareto concept, slacks should be taken into account.

BCC model

- The CCR model with the constant returns to scale assumption is only appropriate when all DMUs are operating at an optimal scale
- Banker, Charnes and Cooper (1984) proposed the DEA model for variable returns to scale by adding the convexity constraint: N1' $\boldsymbol{\lambda} = 1$

$$\min \theta_o - \varepsilon\left(\sum_{r=1}^{s} s_r^+ + \sum_{i=1}^{m} s_i^-\right)$$

$$s.t. \sum_{j=1}^{n} \lambda_j x_{ij} + s_i^- = \theta_o x_{io}; i = 1;...m$$

$$\sum_{j=1}^{n} \lambda_j y_{ij} + s_r^+ = y_{ro}; r = 1;...s$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j; s_i^-; s_r^+ \geq 0; \forall i; j; r$$

This approach forms a convex hull which envelopes the data points more tightly than the CRS conical hull → Efficiency scores obtained under BCC model are higher than or equal to those obtained under CRR model.

Data and Model

DMUs	Inputs	Outputs
Domestic commercial banks From 2012 to 2017	• Interest expenses • Non-interest expenses • Operating expenses • Total fixed assets	(A) • Non-interest revenue • Total customer deposits (B) • Interest revenue • Total customer loans

Model for efficiency estimation:
Output-oriented BBC model

Findings

- Top performers in serving public customers are: CTG; BID; HDB; MBB; OCB; PGB; SGB; TPB; VCB
- Top performers in serving loan customers are: CTG; BID; HDB; MBB; OCB; PGB; TCB; TPB; VCB
- In the most recent years (in 2015, 2016 and 2017), the banking system experience higher efficiency in public customer market than in loan customer market
- Regarding scale efficiency, banks are operating with higher scale efficiency in the loan customer market.

Thank you very much for your attention!

Research in Computational Fluid Dynamics: Some applications

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Scientific Workshop and exhibition at VGU
Binh Duong, 9th October, 2018

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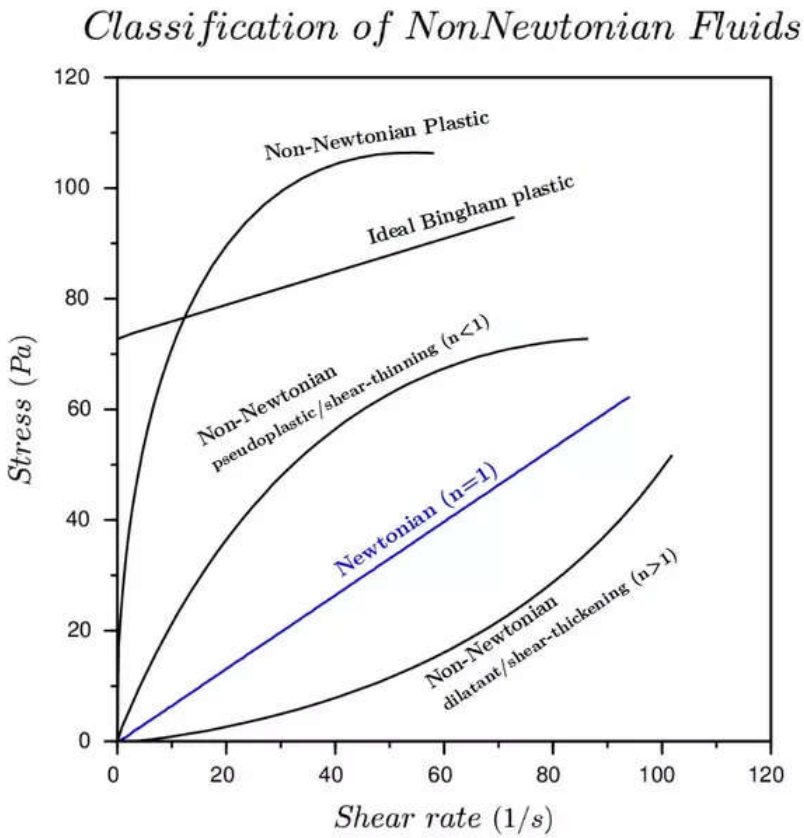
Fluids:

Newtonian fluid: air, water, cooking oil, gasoline, etc.

Non-Newtonian fluid: blood, honey, ketchup, toothpaste, lotion, paint, polymer, sediment, suspension, emulsion, etc.



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Governing Equations

Continuity equation:

$$\overline{\nabla}.(\rho\overline{u}) = 0$$

Momentum equation:

$$\frac{\partial(\rho\overline{u})}{\partial t} + \overline{\nabla}.(\rho\overline{u}\overline{u}) = -\overline{\nabla}p + \overline{\nabla.\overline{T_R}}$$

For Newtonian fluid, the viscous stress tensor is defined as

$$\overline{\overline{T_R}} = \mu[(\overline{u}\overline{\nabla}) + (\overline{u}\overline{\nabla})^T] = 2\mu\overline{\overline{D}}$$

For non-Newtonian fluid of Bingham-type, Papanastasiou's model is employed

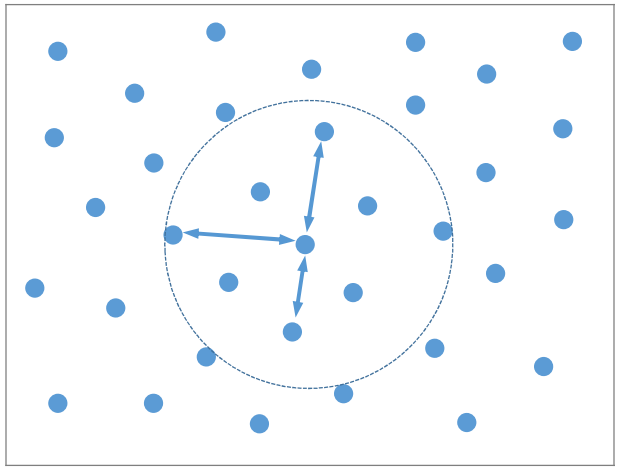
$$\overline{\overline{T_R}} = 2\{\mu + \frac{\tau_y[(1-\exp(-n|II_D|^{\frac{1}{2}}))]}{|II_D|^{\frac{1}{2}}}\}\overline{\overline{D}}.$$

Here $\overline{\overline{D}}$ is the strain rate tensor, $|II_D|^{\frac{1}{2}}$ is the generalized strain rate, τ_y is the yield stress and n is the stress growth parameter. In one-dimensional problems, $|II_D|^{\frac{1}{2}}$ becomes the shear rate γ. It is good to mention that the fluid flows and deforms significantly only when $|\overline{\overline{T_R}}| > \tau_y$.

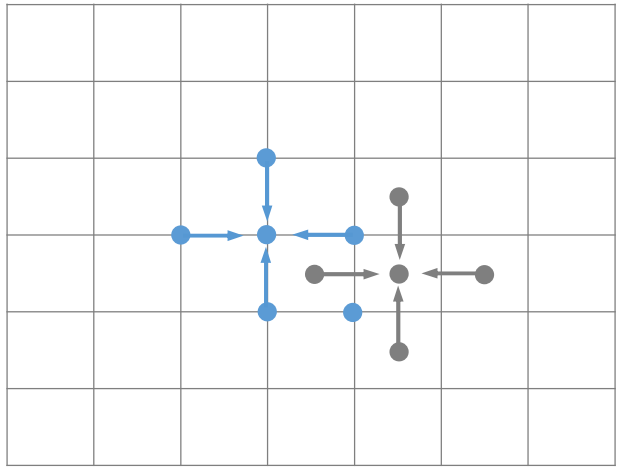
Numerical methods:

Grid-based methods: FDM, FVM, FEM, etc.

Meshfree-methods: Smoothed Particle Hydrodynamics (SPH), Dissipative Particle Dynamics (DPD), etc.



Particle-based Method (Lagrangian)



Grid-based Method (Eulerian)

Grid-based methods:

- Eulerian
- Values known at grid point and/or cell centers
- Finite-differencing approximation of derivatives
- New values at grid point and/or cell centers

Meshfree methods:

- Lagrangian
- Particles represent moving portions of fluid
- Values known at particle positions
- SPH approximations of derivatives
- New values at particle positions
- Update particle positions

Finite difference method:

Based on Taylor's expansion

Forward Difference: $\frac{\partial f}{\partial t} \approx \frac{f_{i+1,j} - f_{i,j}}{\Delta t}, \quad \frac{\partial f}{\partial S} \approx \frac{f_{i,j+1} - f_{i,j}}{\Delta S}$

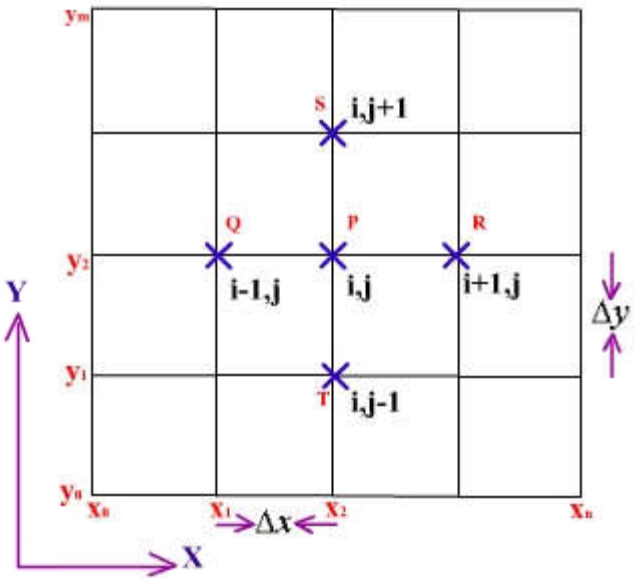
Backward Difference: $\frac{\partial f}{\partial t} \approx \frac{f_{i,j} - f_{i-1,j}}{\Delta t}, \quad \frac{\partial f}{\partial S} \approx \frac{f_{i,j} - f_{i,j-1}}{\Delta S}$

Central Difference: $\frac{\partial f}{\partial t} \approx \frac{f_{i+1,j} - f_{i-1,j}}{2\Delta t}, \quad \frac{\partial f}{\partial S} \approx \frac{f_{i,j+1} - f_{i,j-1}}{2\Delta S}$

As to the second derivative, we have:

$$\frac{\partial^2 f}{\partial S^2} \approx \left(\frac{f_{i,j+1} - f_{i,j}}{\Delta S} - \frac{f_{i,j} - f_{i,j-1}}{\Delta S} \right) \Big/ \Delta S$$

$$= \frac{f_{i,j+1} - 2f_{i,j} + f_{i,j-1}}{(\Delta S)^2}$$



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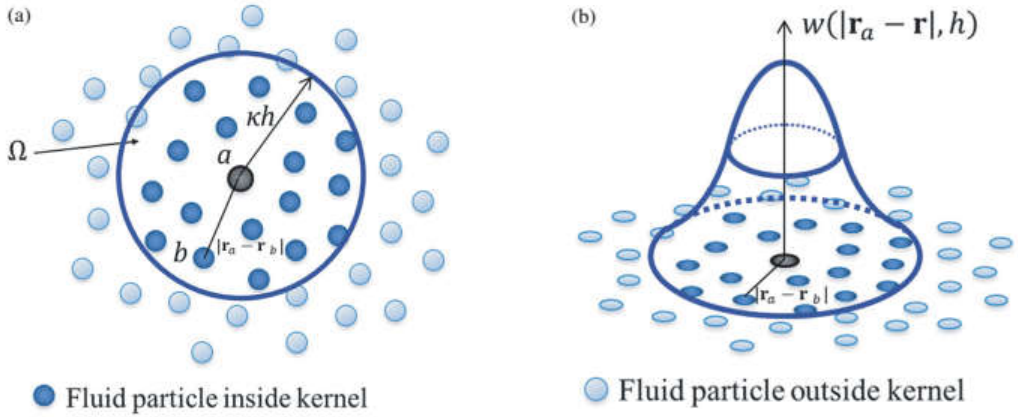
SPH approximations and derivatives



Kernel approximation

$$f(\boldsymbol{x}) = \int_{\Omega} f(\boldsymbol{x}')\delta(\boldsymbol{x} \quad \boldsymbol{x}')d\boldsymbol{x}' \approx \int_{\Omega} f(\boldsymbol{x}')W(\boldsymbol{x} \quad \boldsymbol{x}', \ )d\boldsymbol{x}'$$

Discrete approximation

$$f(\boldsymbol{x}) \approx \int_{\Omega} f(\boldsymbol{x}')W(\boldsymbol{x} \quad \boldsymbol{x}', \ )d\boldsymbol{x}' \approx \sum_{j=1}^{N} V_j f(\boldsymbol{x}')W(\boldsymbol{x} \quad \boldsymbol{x}', \ )$$

$V_j = m_j/\rho_j$ is the volume of particle j

Ω is the supporting domain; *h* is the smoothing length; *W* is smoothing kernel or function;

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Advantages of SPH

- Ease to program
- Can tackle large deformation and interface tracking
- Easy to model moving boundaries
- No non-linear convective derivatives to calculate
- Conservativeness

Further developments are required

- Particle splitting, variable resolution
- General Boundary Conditions
- Improvement of the accuracy of derivatives of high orders
- Computation speed up probably with the use of GPUs
- Hybrid scheme (e.g. FVM/SPH)
- Turbulence: advanced turbulence models for SPH are still poorly developed
- Multi-phase: multiphase algorithms need to be developed

Some applications

- Solid oxide fuel cells
- Combustion
- Multiphase flow – sedimentation of cloud of small particles
- Offshore farming
- Wave energy
- Mudflow, interaction between sediment and structures

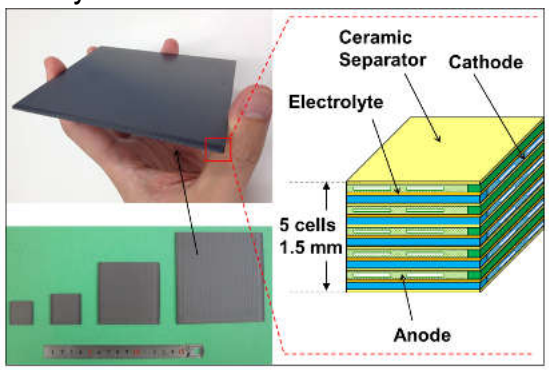
Solid oxide fuel cell

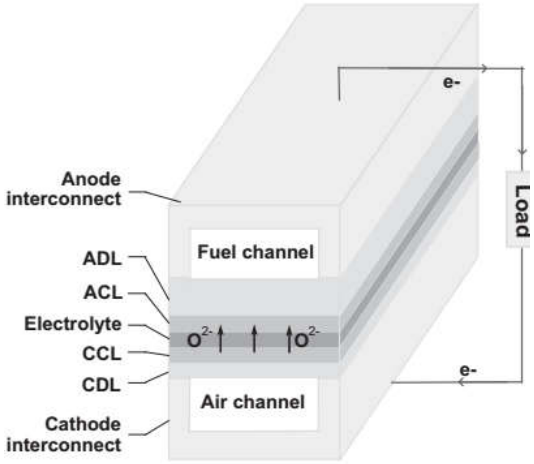
- SOFCs convert chemical energy into electrical energy at 500–1000 °C with high efficiency, low pollution and low noise.
- Fuels: hydrocarbons, natural gas, biogas, bio-ethanol, etc. A cell can produce ~0.7 V; to yield a higher voltage, many cells are stacked together.

$$CH_4 + H_2O \Leftrightarrow CO + 3H_2$$
$$CO + H_2O \Leftrightarrow CO_2 + H_2$$

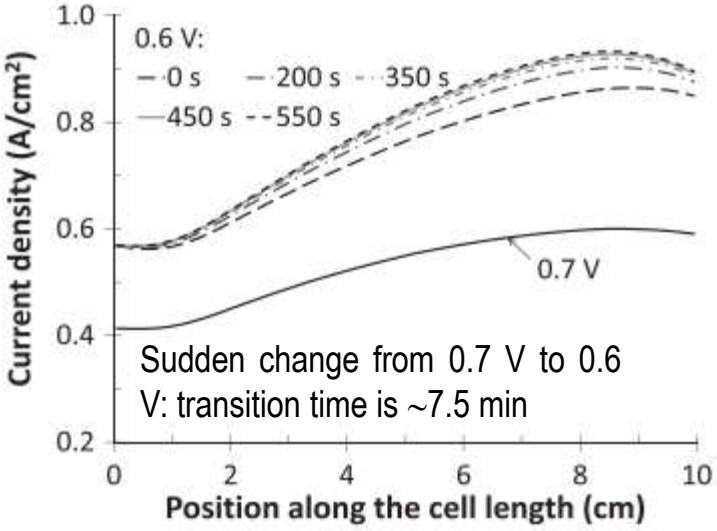
$$1/2\ O_2 + 2e^- \Leftrightarrow O^{2-}$$
$$H_2 + O^{2-} \Leftrightarrow H_2O + 2e^-$$

Ecobyfco.com





A repeating unit of a cell



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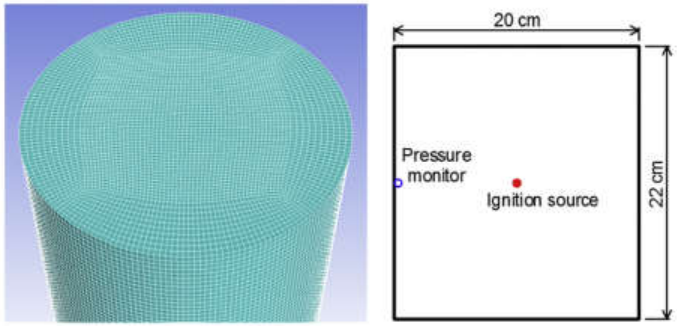
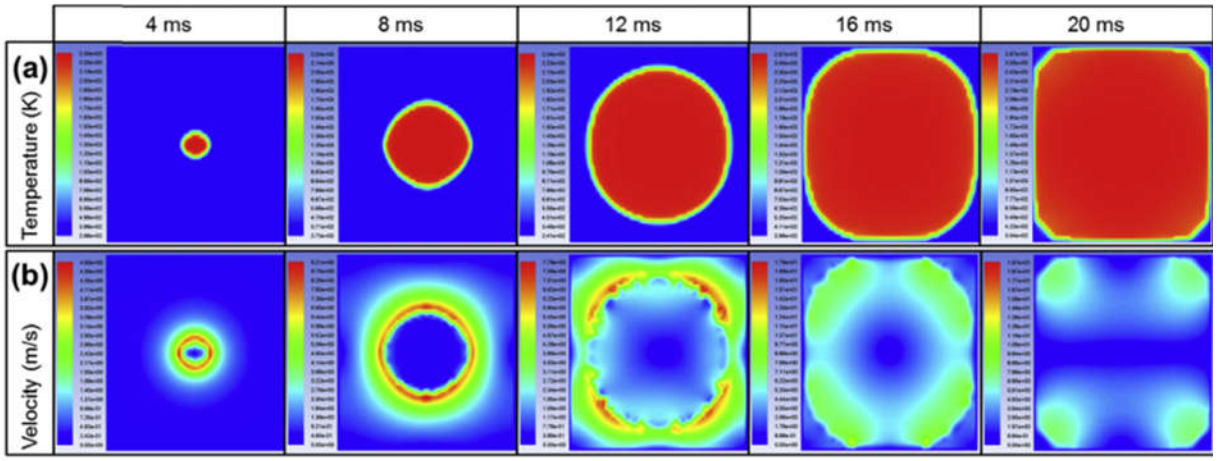
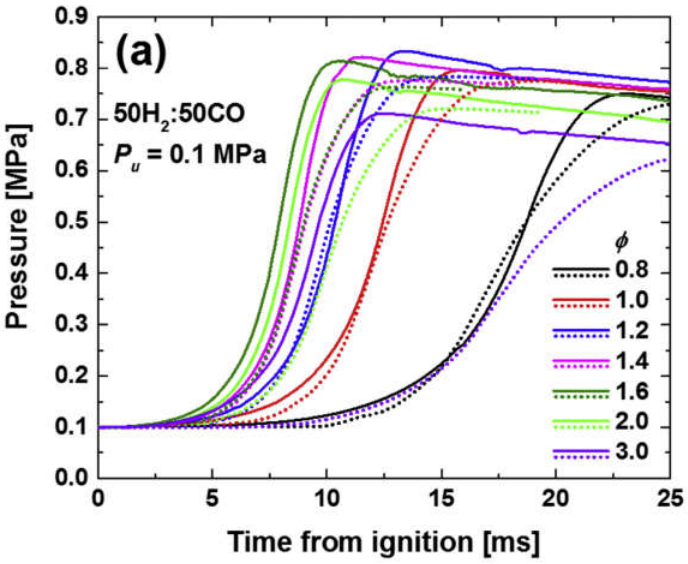
Combustion

- Syngas (mainly H_2 and CO) is a good candidate for green energy conversion.
- Explosion of syngas can cause severe damage to the surroundings.



Comparison between exp. (solid) and sim. (dotted) results at various equivalence ratio ϕ





Evolution of $50H_2$:50CO/air flame:
Initial pressure = 0.1 Mpa; Max temp. = ~2200-2500 K.

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Sedimentation of a cloud of small particles

Particle: 10 – 100 μm, no Brownian motion

+ $Re_p \ll 1$ and $Re_c \ll 1$: **Stokeslet**
+ $Re_p \ll 1$ and $Re_c = O(1)$: **Oseenlet**

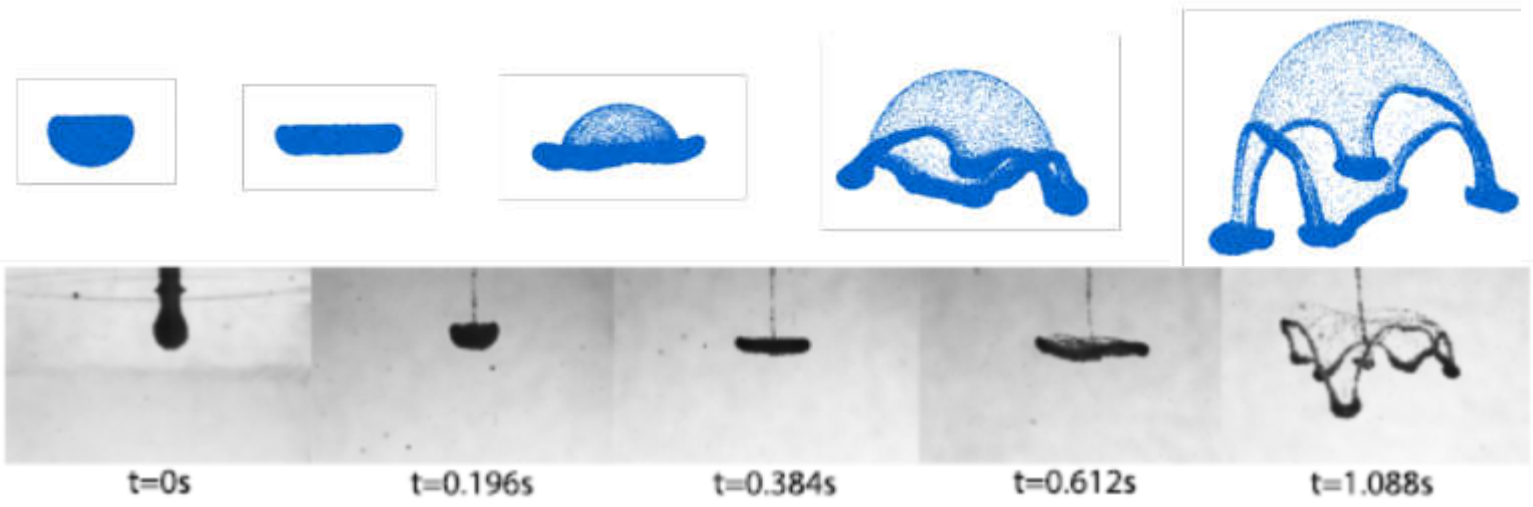
Velocity of particle *i:*

$$u_i = \frac{F}{8\pi\mu}\left[\frac{x_i}{r^2}\left[\frac{2l}{r}(1-E)-E\right]+\frac{E}{r}\delta_{i3}\right]$$

$$F = 6\pi\mu a v_0$$
$$E = \exp\left[-\left(1+\frac{x_3}{r}\right)\frac{r}{2l}\right]$$
$$l = a/Re_p$$

Sim.
Re_c = 2

Exp.
Re_c = 6.2



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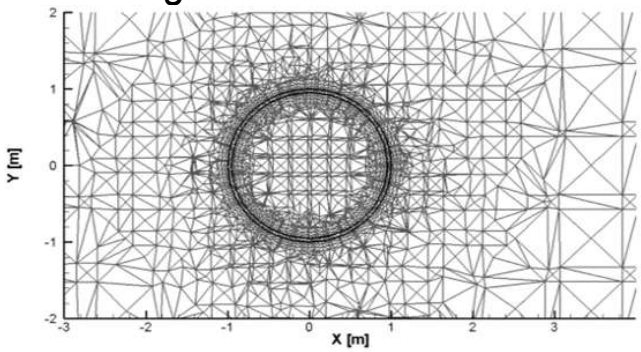
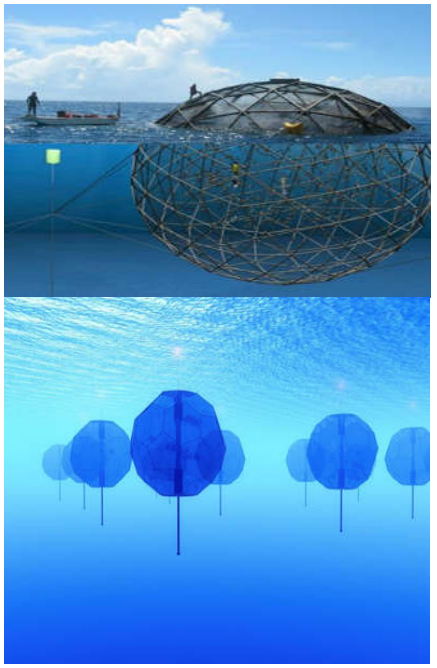
Offshore farming

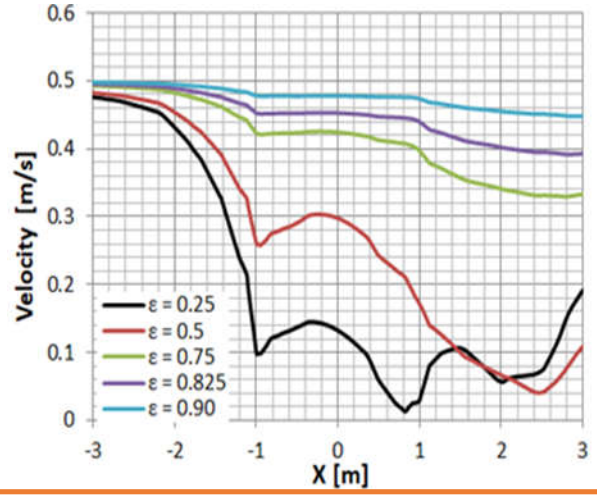
- Fishing industry is harvesting 2.5 times > the sustainable level
- Offshore: fresh environment, better flow circulation
- Spherical cage: suitable for rough oceans

The frame is modeled as a porous shell

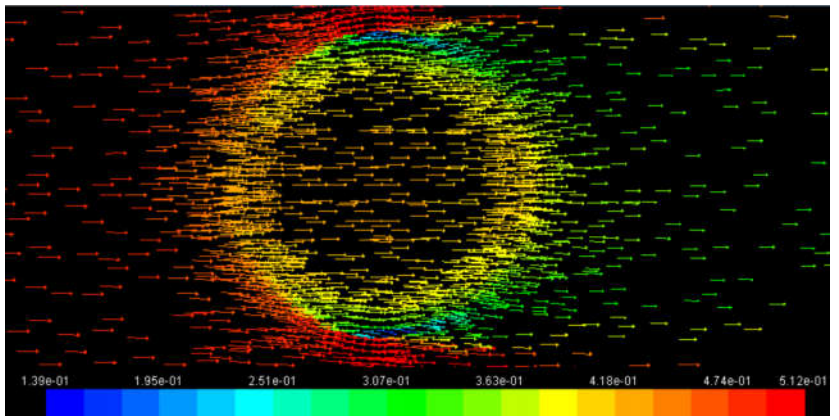




Velocity across the center line; effect of biofouling

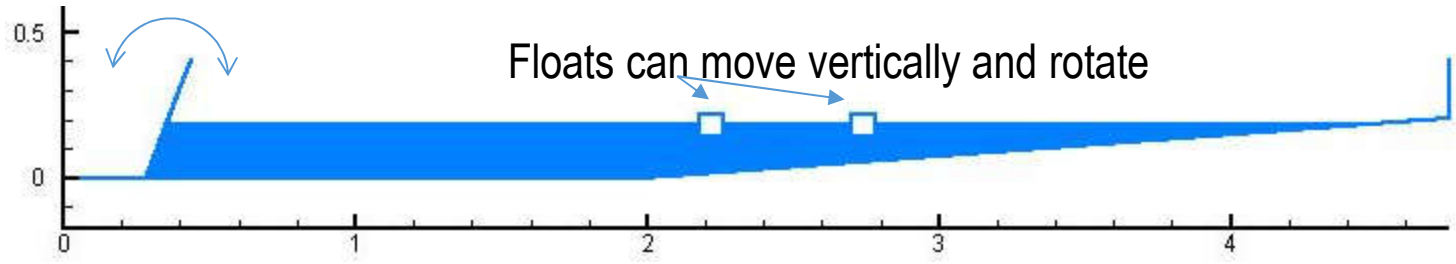


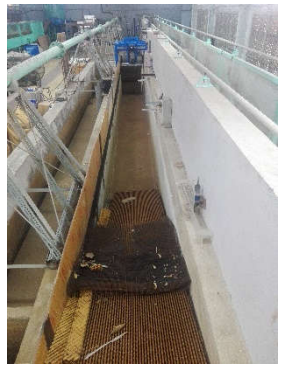
Velocity vector in the xoy (horizontal) plan



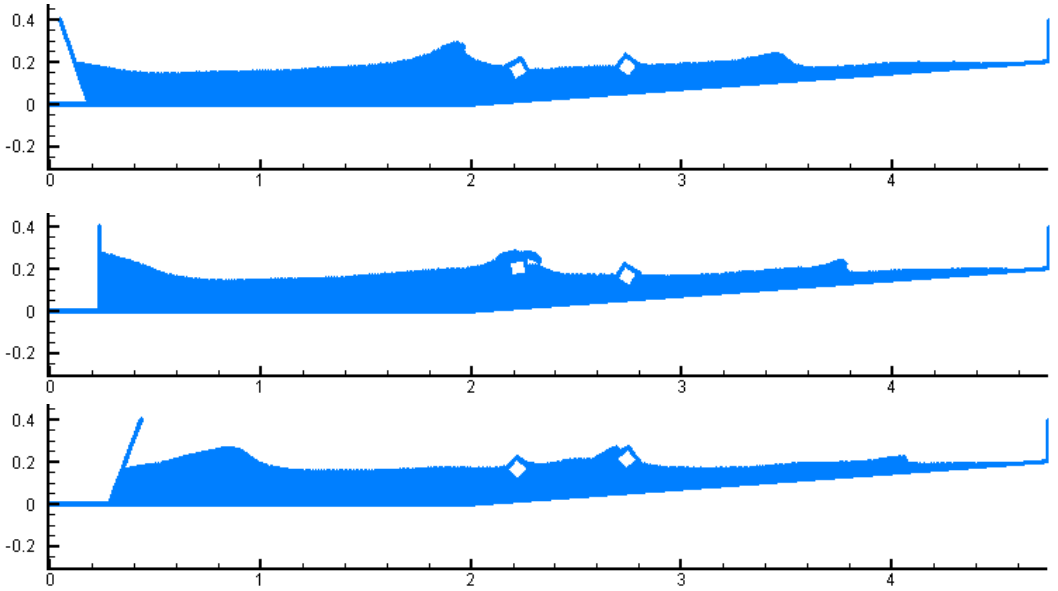
Wave energy

- Design a float that moves according to the wave, maximizing its kinetic energy, and then convert it into electricity
- Build an energy conversion system





Interaction between waves and object (SG=0.5)



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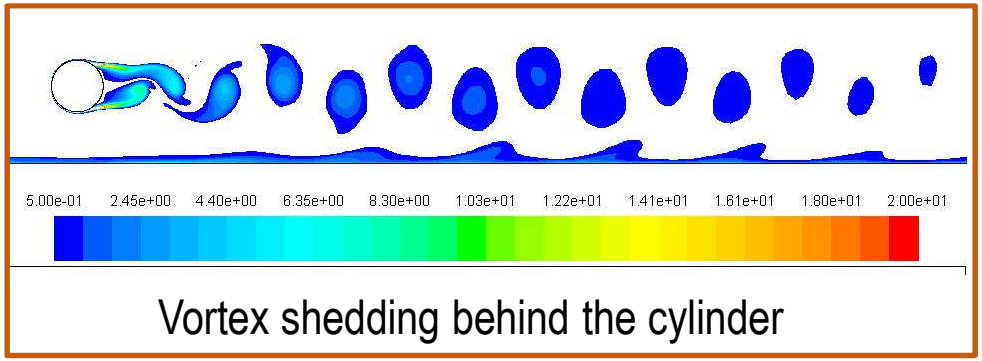
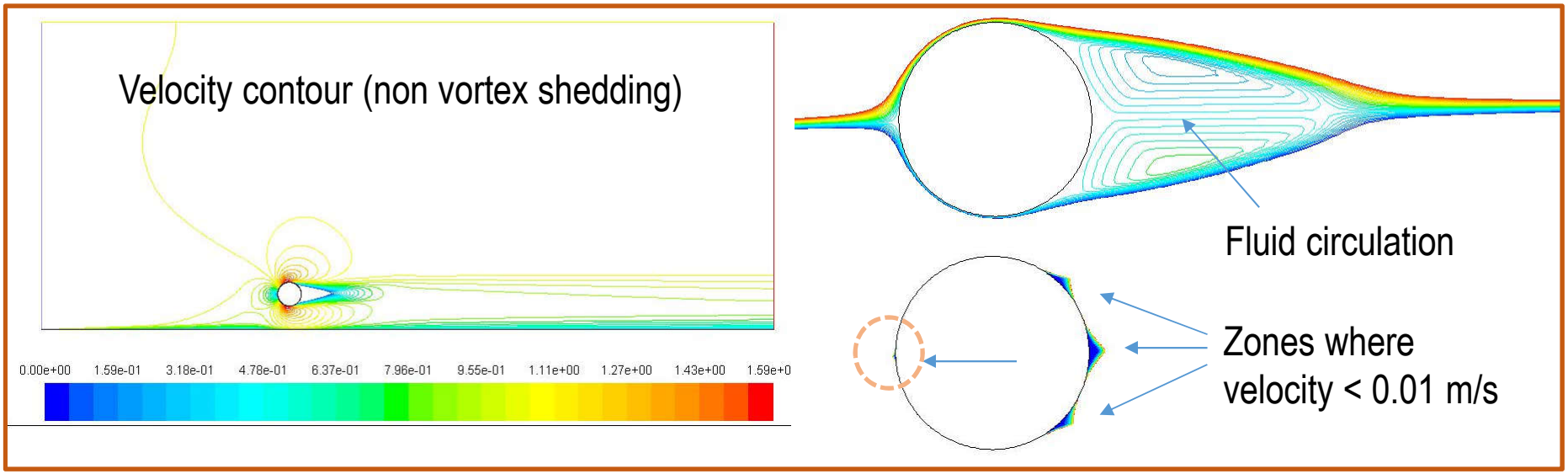
Mudflow, interaction between sediment and structures

Water: V_{in} = 1 m/s, D = 1 m, gap G = 1D, $\mu = 10^{-3}$ Pa.s, Re = 10^6



Bingham: V_{in} = 1 m/s, D = 1 m, gap G = 1D, $\mu_\infty = 10^{-3}$ Pa.s, Re = 10^6, yield stress = 20 Pa



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Remarks & Perspectives

- Various topics / applications
- Numerical tools: Grid-based methods using ANSYS Fluent; Mesh-free particle based using open source codes or our own codes.
- Experimental approach: a Rheometer would be equipped (the procurement is in progress)
- Projects:

    1. National Foundation for Science & Technology Development (Nafosted), Grant for 24 months (2018-2020): *Modeling and simulation of flows of non-Newtonian fluids using Smoothed Particle Hydrodynamics (SPH)*.
    2. Institute for Computational Science and Technology (ICST) at Hochiminh City, Grant for 18 months (2018-2020): *Numerical study of fresh concrete flow processes using Smoothed Particle Hydrodynamics*.