Implementation of Four Lenses of Innovation for Challenging Traditional Thinking and Existing Theory

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▪Introduction

▪Design Thinking

▪Case Study : Find the Fault location

▪Challenge Traditional Thinking
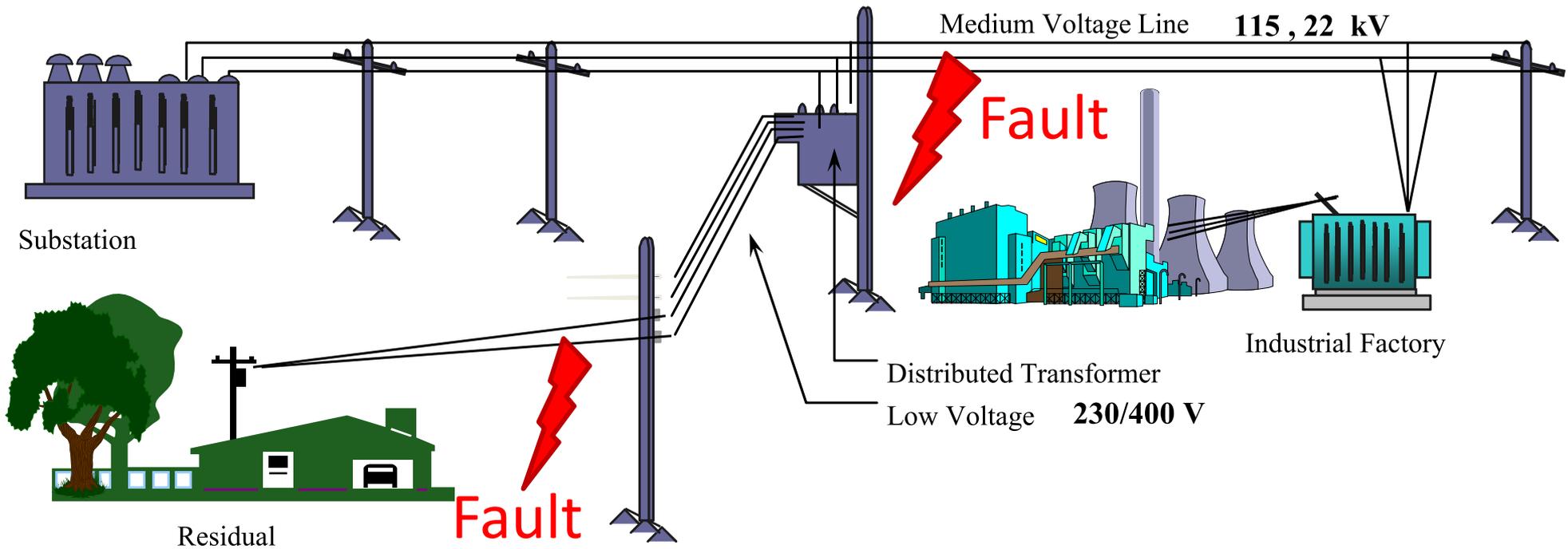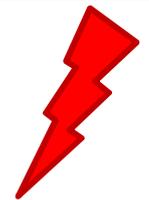 by Four Lenses of Innovation

▪Conclusion

Medium Voltage Line   **115 , 22 kV**

Fault

Substation

Fault

Residual

Distributed Transformer

Low Voltage   **230/400 V**

Industrial Factory

Figure 1: PEA Distribution System.

Overhead System → weakness → **Fault Problem**

Lead to
- ➤ **Voltage Sag**
- ➤ **Outage**
- ➤ **Unbalance Voltage**

Causes of Fault

Tree   Bird   Squirrel   Snake

Figure 2: Cause of Fault in Transmission System.

PEA : Solve problem to find the fault location by OMS and SCADA

❑ **Outage Management System (OMS)**
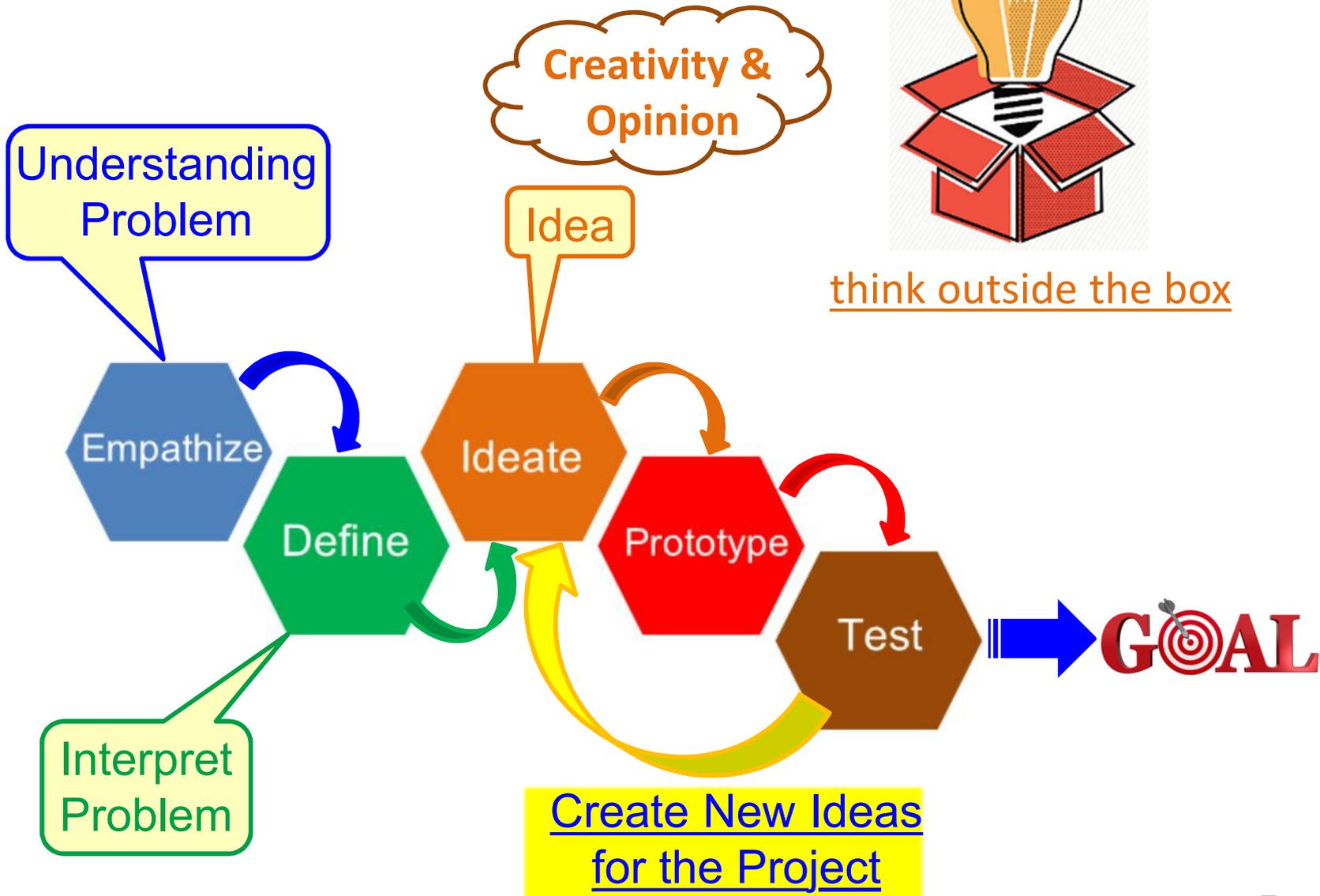❑ **Supervisory Control and Data Acquisition (SCADA)**

| Large Area | Difficult to search | Time Taking | Complaint From Customer |

obstacle

- Improve process by <u>Design Thinking</u>

Creativity & Opinion

think outside the box

<u>User-Centered Design</u>

Understanding Problem

Idea

Empathize

Define

Ideate

Prototype

Test

→ G🎯AL

Interpret Problem

<u>Create New Ideas for the Project</u>

5

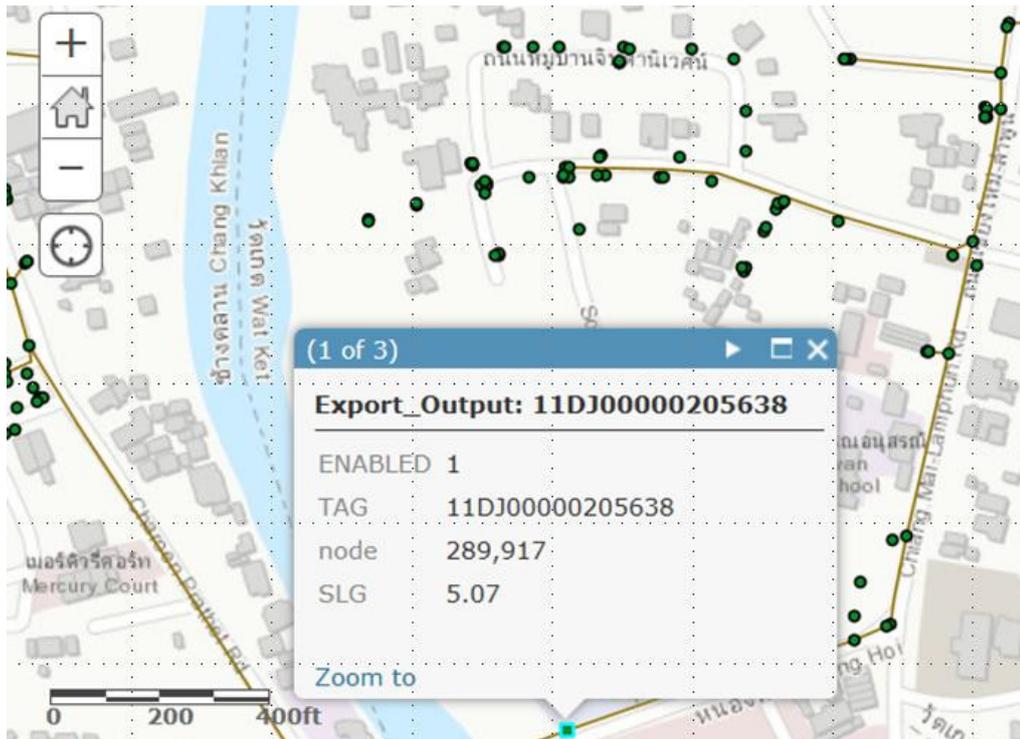# ▪ First Prototype (*Find the Fault location*)

Figure 3: First Prototype on Website.

❑ **Fault calculate for each point.**
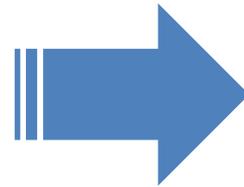❑ **Create the database**
   - Fault current
   - Fault location

Lookup Table
In GIS Portal Program

Still error occurred

Empathize and Define

Q: Cause of Errors → **A: Fault Resistance**

The Last Jigsaw

- ## Ideate → Prototype +Test

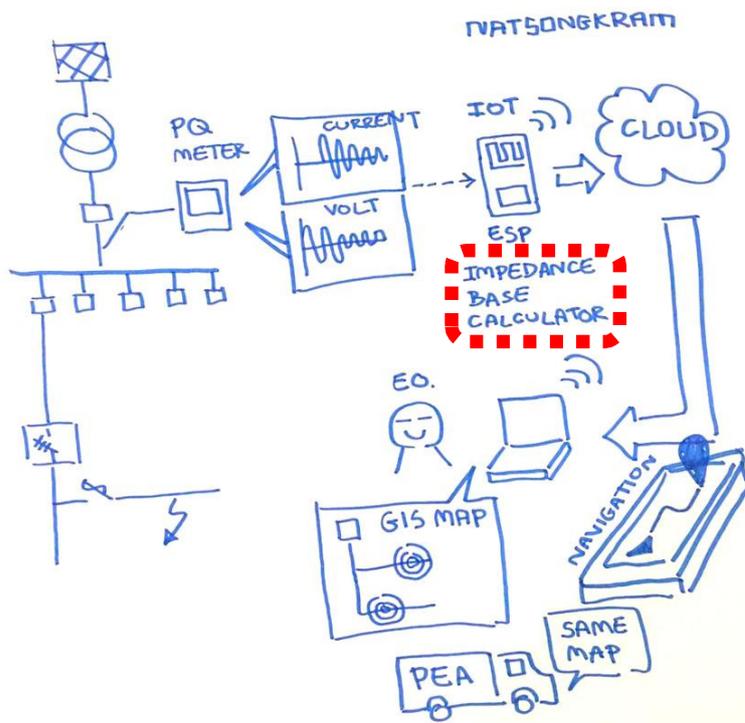**DESTINATION (DESTZ.) PROGRAM**

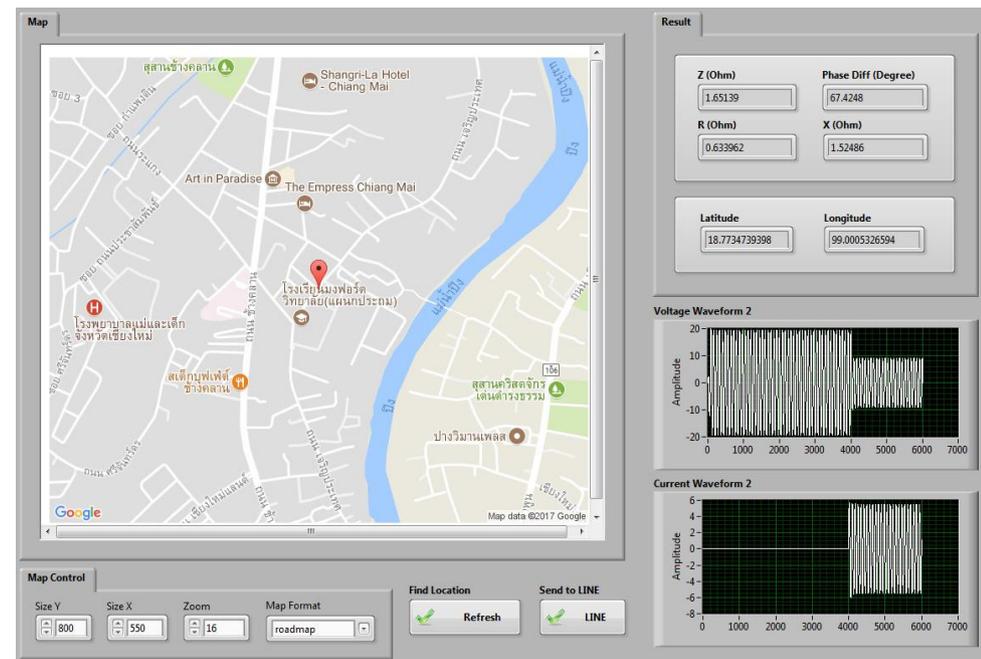**Figure 4: Second Prototype Concept.**

Figure 5: Second Prototype on Labview Program.
(The Fault Location as Shown on Map)

The advantage of this prototype

❑ **Easy to use the program.**
❑ **Decrease error of the fault resistance calculation.**

Engineer : Believe in the Traditional Theory

Literature Review from the other Researchers

Researcher focus to the new algorithm only.

Conceptual Block

- The way out of Conceptual Block

Challenging Traditional   **Harnessing Trends**
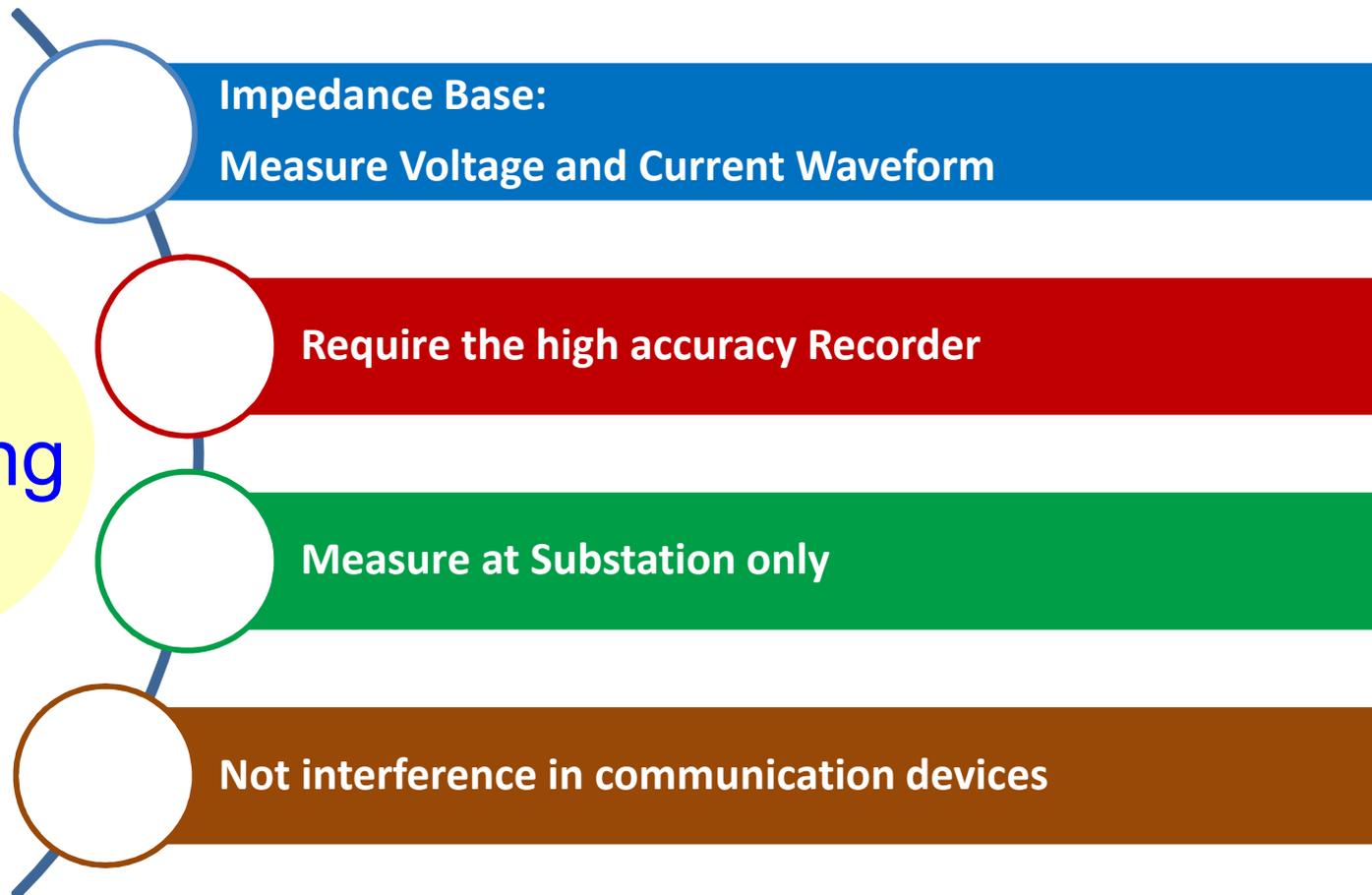

Leveraging Resources   **Understanding Needs**

Figure 6: Four Lenses of Innovation. .

Traditional and Existing Theory

Traditional and Existing Theory

Impedance Base:
Measure Voltage and Current Waveform

Require the high accuracy Recorder

Measure at Substation only

Not interference in communication devices

■ Challenging Traditional and Existing Theory

Challenging
(Ask question)

Can record Voltage Waveform to predict the fault location?

Can measure waveform at the other point?
(Except Substation)

Can detect the flow of fault current?
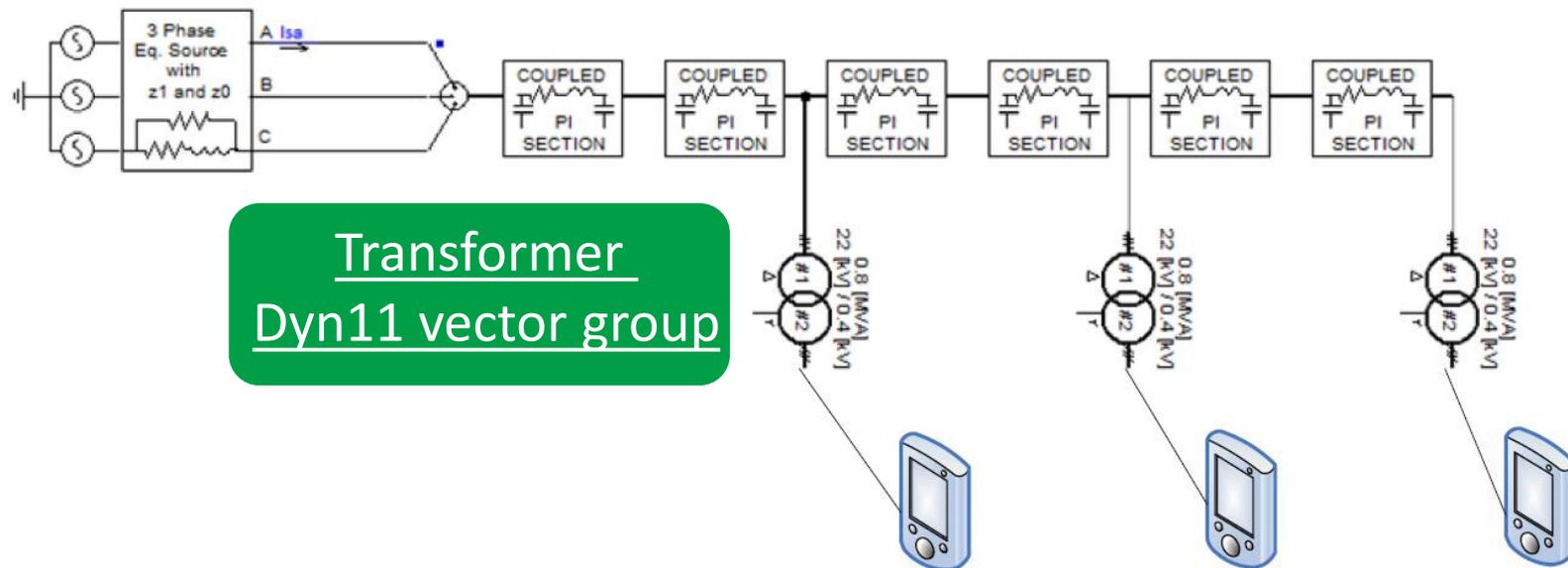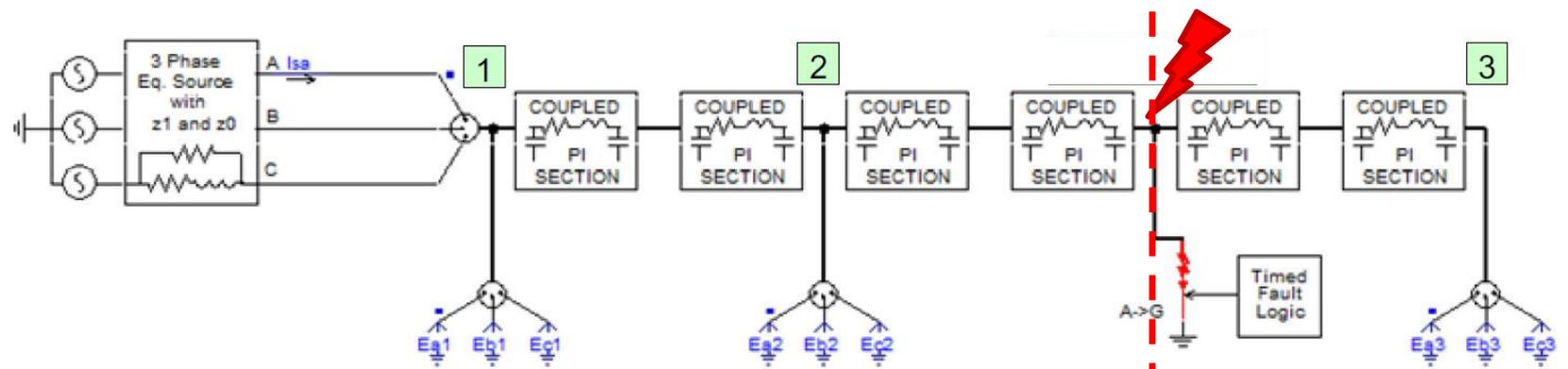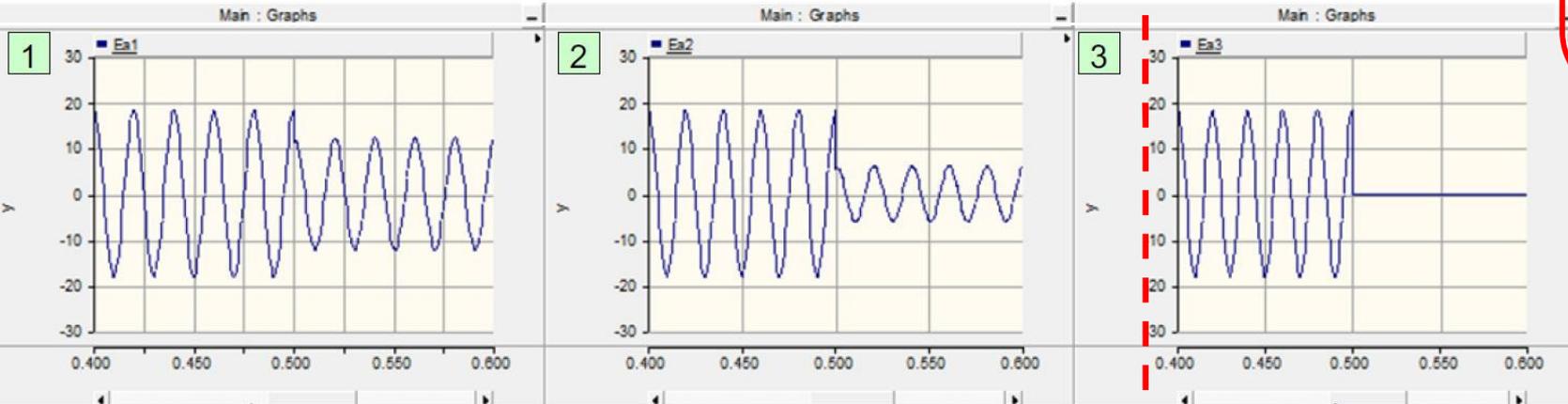
▪ Challenging Traditional and Existing Theory

Transformer
Dyn11 vector group

Figure 6: Install record device at low voltage side. .

Measure low voltage side at the other point.

▪ Challenging Traditional and Existing Theory

> ➤ **Low cost**
> ➤ **Voltage waveform only**
> ➤ **Not use impedance base**
> ➤ **Can find the fault Location**

Advantage

Voltage Sag   **Voltage Sag** ⬅   ➡ **outage**
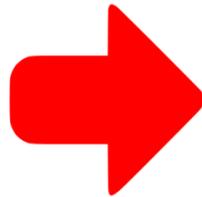
in front of fault point | Behind fault point

Figure 7: Experimental result when fault occur in transmission system. .

PEA Provincial Electricity Authority

■ Harnessing Trends

Wave of Change

Fast change in technology: Disruption

AI

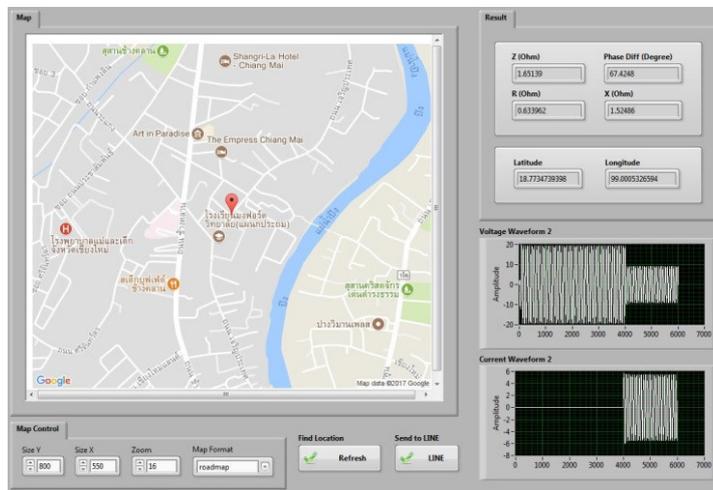Artificial intelligence

Cloud

Big Data

DESTINATION (DESTZ.) Program in this Project

- ■ Develop on LABVIEW Program.
- ■ Support AI Decision in the Future.
- • Easy to send the data on Cloud or other communication.

▪ Leveraging Resources & Understanding Needs

Leveraging Resources

Understanding Needs

In the Future

➤ **Install energy measuring and communication devices in the transformer.**

➤ **Record & Send the data for apply in this project.**

Understanding Needs

➤ **Know your customers' needs.**

➤ **What is the pain point?**

➢ Developer can apply the Four Lenses of Innovation in this project.

➢ Can ask a question to Challenging the Traditional and Existing Theory.

➢ Can create the innovation and program to find a fault location.

You can use the Four Lenses of Innovation to your work.

Thank you

Q&A