

Innovation project

**INTELLIGENT ELECTRICAL
FAILURE MONITORING (IEFM)**

TOPIC...

- Introduction: Background Plant Problem.
- Improvement idea.
- Innovation : Intelligent Electrical Failure Monitoring (IEFM)
- Future project.
- Summary.

INTRO...

Have you ever met these problems before ?

- **PEA feeder Trip (115kV or 22 kV) -> Load shedding -> Generator trip -> Plant blackout.**
- **UPS failure -> PLC controller power supply lost -> Plant trip**
- **Air condition system trip -> PLC controller overtemp.-> Plant trip**

Above are only example cases which effect to our feed gas production and plant reliability that we regularly meet in our working life and sometime can correct it before breakdown by continuous monitoring.

INTRO...

Failure history

2011

1 February 2011 : External fault from PEA 115 kV trip --- Load shedding
LOSS 4.1 MB

6 August 2011 : External fault from PEA 115 kV trip --- Load shedding
LOSS 10.4 MB

2012

31 January 2012 : External fault from PEA 115 kV trip --- Load shedding
LOSS 23.6 MB

10 November 2012 : Sales gas GSP5 trip from UCP Overtemperature.
LOSS 4.07 MB

2013

29 March 2013 : Load shedding GSP6&ESP from PEA 115 kV control power supply fault.
LOSS 16.28 MB

Etc.

Improvement idea ...

On call Situation Time frame.



If we can go to recovery plant after faults faster than usual at least 1 hr. , we can reduce production loss about 2.2 Mbaht (average).

Leader of standby team call to other member

30 minutes

30 minutes

> 30 minutes

Equipment failure
Or PEA feeder trip



Operator call standby team leader
or responsible person



Ready for
recovery process at site

Improvement idea ...



Temperature in control room



UPS



Switchgears

CLASS A equipment



Finding some equipment that can detect fault state of interested equipment.

Monitor status of equipment (Normal/fault). When monitored equipment fault, SMS module will detect state of change and then sent text message (SMS) to responsible person

Leader of standby team call to other member



30 minutes



> 30 minutes



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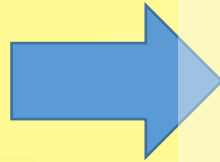
Ready for
recovery process at site

Reduce production loss = 2.2 MB/time

Operator call standby team leader
or responsible person



Idea for improvement...

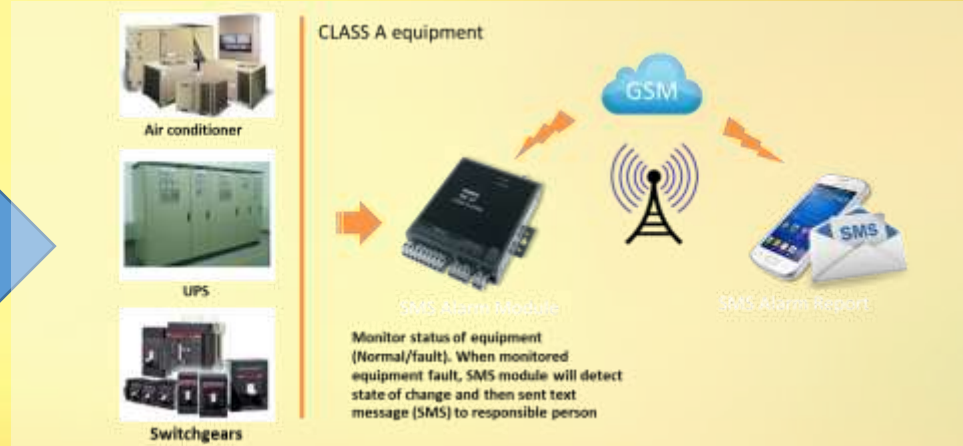


Wisco model RC-37 SMS Alarm module

Specification :

- 8 Alarm digital input
- Programmable SMS message, 50 Characters
15 users in group,
- 2 Digital Output Controlled by SMS
- 900 , 1800 GSM Network

Price : 15,000 Baht / unit



Disadvantage :

1. RC-37 doesn't provide analog input pin that mean we cannot monitor room temperature continuously.
2. Expensive
3. 1 Simcard 1 module; Lot of maintenance cost due to telephone charges.
4. Cannot expand digital input for serves additional equipment in future.
5. Maximum 1 Group with 15 users.



**from
movement**

**...
novation**

HEFFMAG

IEFM mark 1



Temperature in control room



UPS



Switchgears

CLASS A equipment



Monitor status of equipment (Normal/fault). When monitored equipment fault, SMS module will detect state of change and then sent text message (SMS) to responsible person

IEFM mark 1



Programming with Arduino
- Program structure based
on C/C++



**Compile & Download
to Arduino**



Arduino microcontroller



SIM 900 GSM shield.

provides you a way to use the
GSM cell phone network to receive
data from a remote location



SMS Alarm Report



SIM900 GSM shield

Feature



RC-37 module



IEFM mark 1

PRICE

Expensive (15,000 B/unit)

Cheaper (2,100 B/unit) ★★
Reduce cost = 12,900 Bath/unit (save 82.5%)

USER INTERFACE

GOOD ★
(RC-37 comes with interface program that easy to configuration.)

More Complicated.
(User must be familiar with C/C+ language)

INSTALLATION & WIRING

EASY ★

EASY ★

STABILITY

HIGH ★

HIGH (Comparable) ★

DEVELOPMENT OPTION

NO

YES ★
(Can modify source code to make other advance function)

NUMBER OF INPUTS

8 digital inputs/0 Analog input

12 digital inputs/5 Analog inputs ★
(can expend more than 12 digital inputs by using I2C bus with I/O expansion shield)

NUMBER of group message and SMS receiver

1 Group/ 15 receivers

Can create more than one Group ★
message which have more than 15 receivers by programing to Arduino

telephone charges (From sending SMS)

1 simcard / 1 module
(Lot of telephone charges depend on numbers of module)

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Finding and Eliminate weak point

How can we reduce telephone charges?



Finding and Eliminate weak point



1 Simcard 1 module; Lot of maintenance cost due to telephone charges.

There are 16 substations in GSP. Assume that each substation uses one module so we have 16 modules with 16 different telephone numbers. Every month we pay around 200 Baht for each number or around 3,200 Baht for whole system.

1 Month = 200 Baht × 16 module = 3,200 Baht

1 year = 3,200 Baht × 12 month = 38,400 baht

How can we reduce telephone cost ?



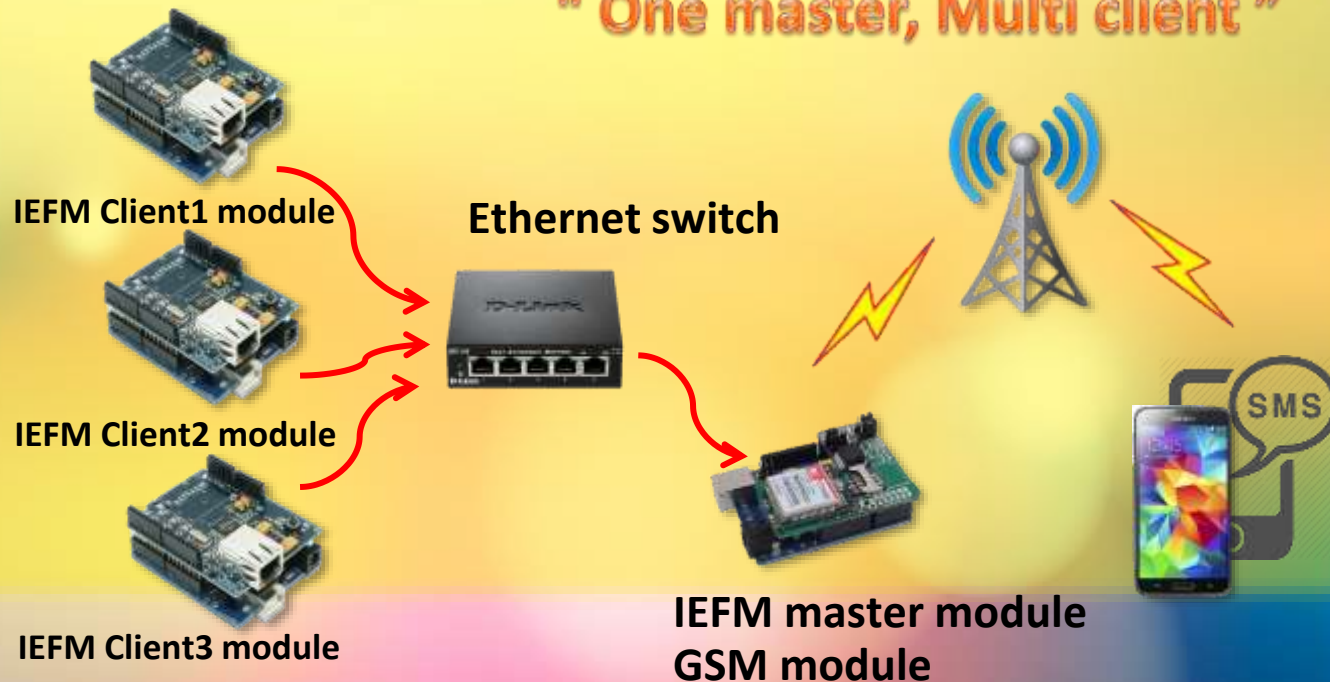
Finding and Eliminate weak point



I have a bright idea.
We can reduce the number
of GSM module by using
Ethernet protocol.

IEFM mark2

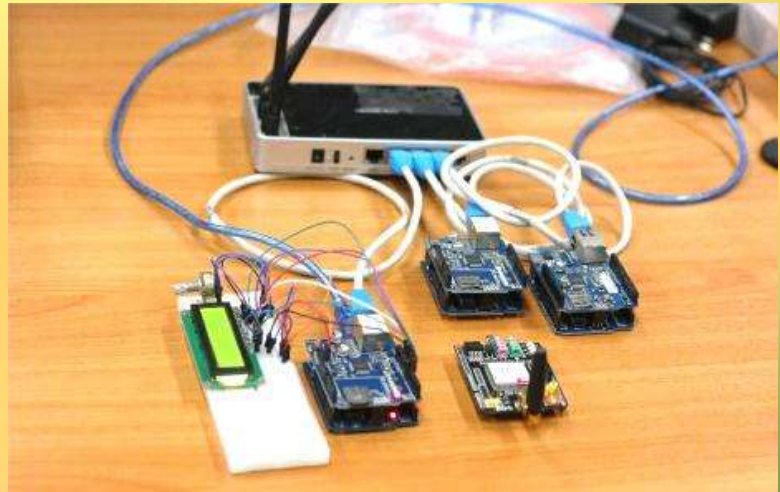
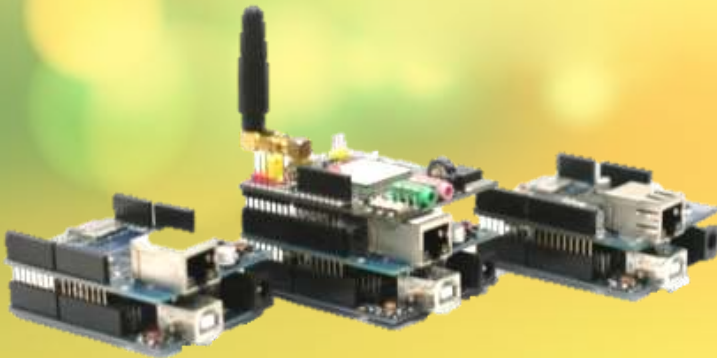
“ One master, Multi client ”



Finding and Eliminate weak point



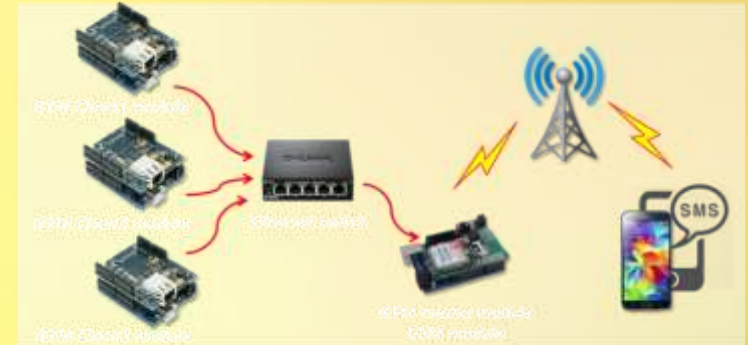
The Ethernet Shield allows an Arduino board to connect to the internet



IEFM mark 2 demo version

Finding and Eliminate weak point

IEFM mark2



Using Ethernet, IEFM master will ask each IEFM client for sent its current status. If one of them can detect fault, Master will know , and processes task to sent SMS to responsible person. (Use only 1 GSM shield at IEFM master)

“ One master, Multi client ”

1 Month = 200 Baht × 1 module = 200 Baht
1 Year = 200 Baht × 12 month = 2400 Baht

reduce telephone cost = 36,000 Baht / year



IEFM master



IEFM client



IEFM mark 2

Feature



RC-37



IEFM mark 1



IEFM mark 2

PRICE

Expensive (15,000 B/unit)

2,100 BATH/UNIT

Master = 500+380+1,600 = 2,480 BAHT
Client = 500+380 = 880 BAHT/unit

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(Lot of telephone charges depend on numbers of module)

1 simcard / multi module
(There is only 1 telephone number in system that can sent SMS to responsible person)

Develop to commercial (For future)



EXAMPLE.....

IEFM on smart phone application.



Develop to commercial (For future)



Develop Online Ground monitoring system with Microcontroller.

Online ground monitoring system measure instrument ground resistance continuously. When Grounding resistant trend to be increase over setting value, it will alarm and sent SMS to inform responsible person.

Target :

save cost from purchasing and installation online ground monitoring system at least 800,000 Bath by develop microcontroller base ground monitoring system.

GSP 5 - **Online Ground monitoring system : budget 1.3 MB**

Summary...

Benefit from using IEFM:

- Direct Benefit : *Reduce production loss 2.2 MB/time*
- Indirect Benefit :
 1. Save cost 14,000 Baht /Unit by using IEFM
 2. Save telephone charges 36,000 Baht/ year by using “ONE master , Multi client” concept

IEFM advantage compare with other manufacturer

1. Cheaper Product (save cost 94%)
2. IEFM has more inputs compare with the others.
3. IEFM can create more than one Group message which have more than 15 SMS receivers.
4. ONE master , Multi client” concept can reduce telephone charges from sending SMS.

Electrical innovation team



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