Design Integration of Man-Machine Interface (MMI) Display Drawings and MMI Database

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1. Introduction

The conventional Main Control Room (MCR) was designed using hardwired controllers and analog indications mounted on control boards for control and acquisition of plant information. This is compared with advanced MCR design where Flat Panel Displays (FPDs) with soft controls and mimic displays are used.

The advanced design needs MMI display drawings replacing the conventional control board layout drawings and component lists.

This advanced design also needs compilation of data for equipment operating status and plant parameter values in the form of a database (DB). The data is linked to related object of the MMI displays. Compilation of the data into the DB is generally done manually, which tends to introduce errors and discrepancies. Also, updating and managing is difficult due to a huge number of entries in the DB and the update must closely track the changes in the associated drawing.

Therefore, automating the DB update whenever a related drawing is updated would be quite beneficial. An attempt is made to develop a new method to integrate the MMIS display drawing design and the DB management. This would significantly reduce the amount of errors and improve design quality.

2. MMI Display and Soft Control

Advanced MCR design has the capability to quickly retrieve and display important plant information and perform plant control function using the FPD. An example of information FPD with mimics is shown below:

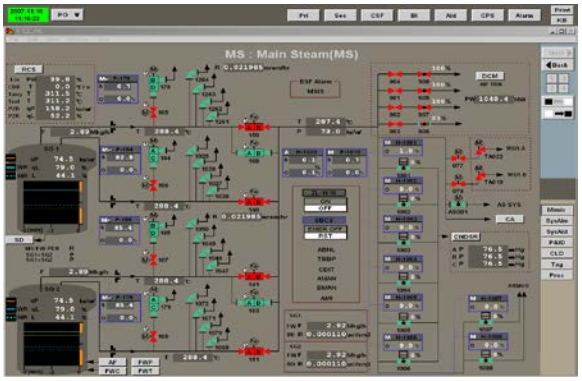


Figure 1. Information FPD

Equipment and plant process variable information is displayed superimposed on process mimics below:

Figure 2. Sample of Equipment symbol

Figure 3. Sample of Indicator symbol

In addition, the information FPD provides a plant control function in pop-up template of a soft control. Operator can click the symbol on the mimic to acquire a soft control.

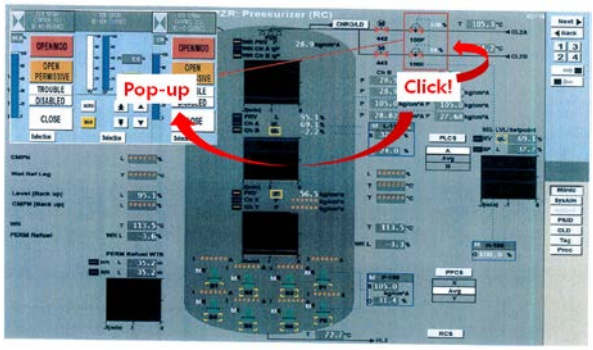


Figure 4. Pop-up Soft Control

3. MMI Data Base (DB) (with soft control information)

Display of process values and equipment status on the information FPD should be current. The soft control should also be readily available as a pop-up display whenever an operator needs it. In order to accomplish this, MMI displays and the MMI DB must tightly linked together and the MMI DB includes at least the following entries:

1) Object ID, 2) Tag No., 3) Description, 4) MMI function, 5) MMIS Information, 6) Soft Control Template No., 7) Soft Control Title (Nameplate), 8) Menu Function (i,e., pull-down menu), and 9) Link Information.

Current MMI DB is developed and being managed manually in MS Excel format. As pointed out earlier manual work has the potential for human errors and delayed updates lagging behind the related documents.

4. Design Integration Method

As mentioned, MMI display drawing design and MMI DB compilation for display implementation are done separately and independently. Thus inconsistencies,

input errors, and time lag issues become real between MMI DB and related drawings.

Therefore, method(s) of integrating the MMI DB and related drawings are explored. And a new design method of using a VISIO program is established. This method allows generating MMI DB automatically whenever a MMI display drawing is issued or revised. This new method requires creation of new objects (using symbol) to use for MMI display drawings. Each object has specific attributes and these uniquely identify a object on a MMI display drawing. These are also linked to other drawings such as P&ID, etc. or can be entered manually into the DB.

The relationship between MMI DB and other drawings (or DB) is shown below:

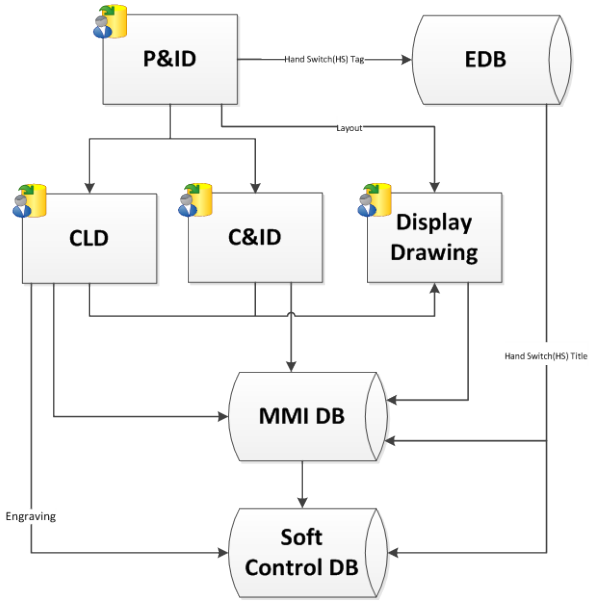
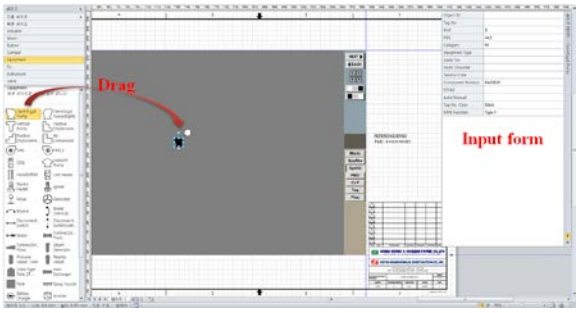


Figure 5. Relationship between drawings (or DB)

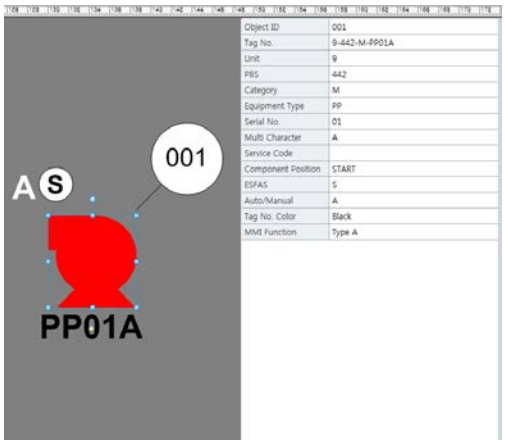
Required information for a MMI display drawing is entered automatically when P&ID, CLD, C&ID and Engineering Database (EDB) are issued.

The process of preparing the MMI display drawing is shown below:

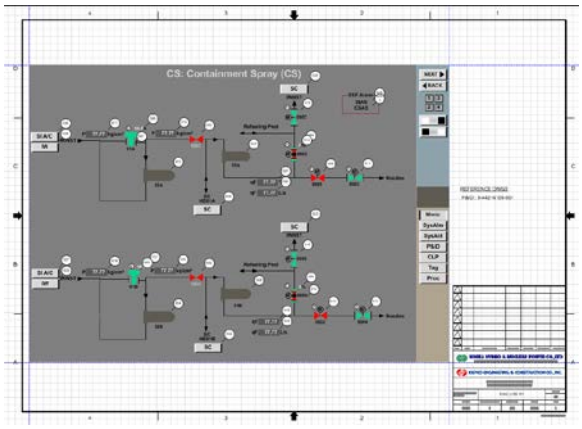
1) Drag to the board from library



2) Selecting or entering attributes in the input form



3) Completion of MMI display drawing



The MMI DB is generated automatically by an internal system process after a MMI display drawing is completed.

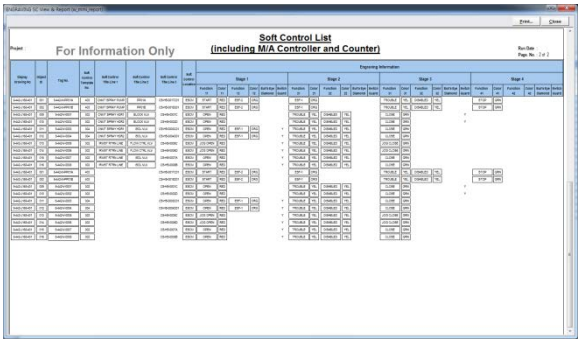


Figure 6. MMI DB

4. Conclusion

The design integration of the MMI Display drawing and MMI DB is explained briefly but concisely in this paper.

The existing method involved individually and separately inputting design data for the MMI display drawings. This caused to the potential problem of data

discrepancies and errors as well as the update time lag between related drawings and the DB. This led to development of an integration of design process which automates the design data input activity.

We expect this integration of design and automated input process would contribute to minimization of design errors and discrepancies with improved design quality.

REFERENCES

[1] NUREG-0700 Rev.2, U.S. NRC, 2002
[2] Human Factors Engineering Guideline Rev.0, KEPCO-E&C, 2014
[3] MMI Design Guide, Rev.01, KEPCO-E&C, 2016