SIPidms

(SIPTECH's Intelligent Drawing Management Solution) for Electronic Signal Flow Diagram (ESFD)

A SIPTECH CASE STUDY

Version: 2.0

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Electronic Signal Flow Diagrams

1. Background

This is a case study on the project done for KernKraftwerk Leibstadt AG (KKL), the largest nuclear power plant in Switzerland. This project covered the conversion of hand drawn Signal Flow Diagrams (SFD) used for the operation of the plant, to the digital format (ESFD) with database validation to automate the engineering documentation.

2. Problem / Challenge

KKL used a large quantity of SFD drawings prepared manually on the drawing board

- The electrical department are responsible for keeping these drawing up to date
- Plant modifications, normally carried out during the annual outage create the need to modify thousands of drawings each year.
- Drawing errors found in the existing drawings often from the time of plant commissioning create the need for additional drawing revisions.
- The paper documentation was over 20 years old and many documents have had numerous revisions in this period. Many drawing had become difficult to read due to repeated copying and modification process on the originals.
- Redline copies of these drawings were created by the electrical department and used for implementation of plant modifications.
- The implementation or planning of plant modifications was sometimes delayed due to previous undetected errors in the original paper drawings.
- A way of improving the quality of the drawings and at the same time reducing the effort in modifying them and increasing the efficiency and accuracy for plant modification was required – at a reasonable cost.

In light of the above drawbacks the KKL management proposed to improve the engineering documentation process and approached SIPTECH for a solution.

3. Method / Intervention / Solution used

3.1 Study of the requirements of the existing drawings

- The different drawing types were analyzed: general arrangement, signal flow diagram, panel, rack and module types etc.
- Differences between similar drawings from different suppliers were analyzed.
- Drawing formats, representation
- Linking of various drawing for integration and validation Security requirements

3.2 Standardization of the drawing format

- Existing drawing were prepared in various formats and sheet sizes, which were not uniform. Hence standard drawing format is designed and size of the sheet fixed to A3.
- Properties of drawing elements like line, text and attributes are standardized (color, level, thickness, line type, text size) were defined.

3.3 Creation of icons and template library

- The circuit elements and drawing formats are rationalized and created as unified icons and templates to suit the different types of ESFD and kept as library in different groups for easy browsing
- While preparing the drawing it could be browsed and picked from the library
- Before using these icons and templates, were sent to the client and get approved.

3.4 Design the logic for application development

- After studying different types and groups of drawings and analyzed the methods to prepare the drawing to interlink with each other through designed database
- Designing logics to develop the application for preparation of drawing and database integration
- Logics to carryout the plant modifications in the drawings
- Designing various output reports

3.5 Design the database

- After studying all types of drawings and its elements, logics, database structure is designed considering the validation, security and integration
- Modules, racks, components, wire, signals, interconnections, special components, svt label master are just a few of the database tables created with links in between.

3.6 Application design

- As per the logic designed, application is developed using Visual Basic as Front End, MDL (MicroStation Development Language) as the Drawing tool, initially with Oracle and later with MS SQL Server database as the Backend.
- Application tested with sample drawings in all aspects
- Handing over to drawing production team for drawing generation
- Application modified/ fine tuned based on the feedback from the production team

3.7 Drawing generation

- Using Visual Basic to open ESFD Software.
- Create drawing with drawing master data validation
- Fill up the drawing details using available database
- Browse for required product type and select the drawing template
- Load the customized MDL tool for drawing preparation
- Prepare the drawing using the icons from the library, place the signals & connection of wires.
- Complete the drawing and data are extracted from the drawings and stored in Oracle tables.

3.8 Plant modification

- Drawings carrying the red markings of modifications are segregated
- The soft copies of the given drawings and linked drawings affected due to these modifications are added in Plantmod level using the application.

- The affected drawings in the server are locked by the application not to edit by other users
- Affected drawings are opened with plant modification tool and modified in three different levels (deletion, addition and conclusion) as per the markings.
- The drawing modifications are depicted in colors (deleted items-Blue, added items-Red,) for the easy reference of the users
- After carrying out all the modifications drawings will be stamped as completed provisionally
- These drawings will be checked by the authorized and stamped as approved and concluded
- After concluding the drawings in the server are unlocked and updated.
- Linked databases are updated
- Various reports like affected drawings list, components list, wire list, signal list etc. for further operations.

3.9 Software tools used

Front end	:	Visual Basic
Drawing Tool	:	MicroStation V7
Core	:	MDL (MicroStation Development Language)
Report generation	:	Crystal reports
Database Management	:	Oracle

4. Results Achieved

- Drawing generation time reduced up to 80%
- Validation of existing data with extracted database
- Designed database structure reduces the time of updating various linked documents and becomes error free
- Thereby whenever opening and accessing the various engineering documents updated information is available
- Assures quality and updated outputs
- Reduces the time and efforts for carrying out plant modifications considerably and accurately

- Reducing recurring cost of document management
- Dynamic engineering support to the operation of plant

4.1 Inputs given by KKL

- Hard copies of the SFD
- Hard copies of the required Icons and Templates
- Guidelines about the plant operation
- Basic requirements of the Application

4.2 Deliverables by SIPTECH to KKL

- Soft copies of the drawings
- ESFD (Electronic Signal Flow Diagram) Software & ESFD Database.
- Complete documents about application development, report generation

5. Lessons Learned / Conclusion

- During this project, KKL has built up confidence in SIPTECH as a reliable partner for building customized applications using latest software for their engineering applications and SIPTECH has presented a tool for efficient and cost effective tool for the operation of KKL Nuclear Plant.

- With the completion of the KKL Nuclear Plant project SIPTECH is capable of doing this kind of projects to all Process industries.