Development of DB Linker to Connect the Main DB system to Fatigue Evaluation and Monitoring System

Wanjae Kim [a*], Jongjooh Kwon [a], Sung-Yull Hong [b]
[a]*KEPCO Research Institute, 103-16 Munji-Dong, Yuseong-Gu, Daejeon, Korea*
[b]*School of Mechanical Engineering, Yeungnam University, 214-1Dae-Dong, Gyeongsan-Si, Gyeongsangbuk-Do, Korea*
[*]*Corresponding author: wjkim@kepri.re.kr*

1. Introduction

For Korean nuclear power plants that await a thorough technical review for continued operation, it has been agreed that installing fatigue monitoring system can be a reasonable and effective measure to track and manage fatigue status of primary side components. In this context, FPro[1], developed by Structural Integrity Associates was successfully installed in Kori Unit1 and has been operated since 2006. In 2007, KEPCO Research Institute embarked on outlining three-stage development strategy for an advanced fatigue monitoring program[2,3,4] that can outperform existing solutions and is cost effective as well.

Three-stage strategy ranges from defining required concepts for monitoring to site application of the program. This program is name FEMS-Fatigue Evaluation & Monitoring System and now is in the process of computerization. In this paper, some considerations in interfacing program to other system are stated and also overall structure of the system is introduced.

2. System Structure

In this section, overall structure of the FEMS is outlined. Constituent process modules of FEMS are first defined and then modules/systems outside of FEMS are explained

2.1 Structure of FEMS

FEMS has 3 function centers, 3 internal function modules and 2 process modules and the database. 3 function centers are the major process modules of FEMS.

In the Data Management Center, input signal acquisition status for each unit is monitored and displayed for input signal management purpose. In case there are missing spots, end user may readily recognize them and do not proceed to the next step until the missing spots are completely filled. In Data Review Center, various fatigue data are summarized and presented. In this center, cumulative usage for each monitored component can be reviewed and also, transient histories as well as input data are viewed. Fatigue Analysis Center has two internal calculation modules and does the fatigue calculation and preparatory process for the calculation. The center first requests input signals collected after the last analysis date and provides with confirmation process in that transient(s) and the operation data for the specified period can be reviewed. Upon execution of the analysis, two calculation modules receive operation data and calculate usage factor[5].

ICC module processes operation data being delivered from outer system. ICC module scans every operation signal and gives alert for any defected data. Also, it monitors changes in signal and classifies transient type based on the logic rules.

Main and Common modules are general process modules that exist commonly for program management purposes.

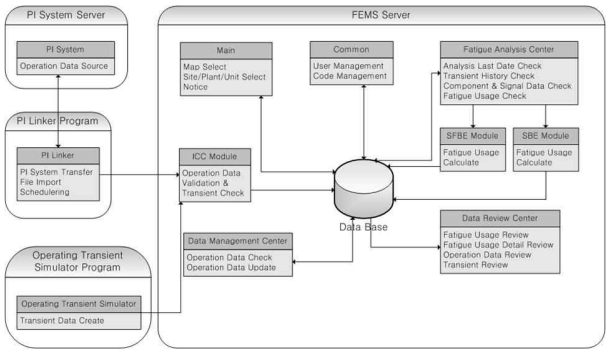

Fig. 1. FEMS and Constituent Process Modules

2.1 Structure of External Modules

FEMS gathers signals from 3 different sources; Main DB System, External files and Operating Transient Simulator. Major source of data delivered to FEMS is from the Main DB system. Signals from components are sent through the plant computers and assembled in the Main DB system. Therefore, this system is intended to maintain most recent data. In case of the possible failure in signal relay systems, FEMS can receive inputs directly from external files. Operation Transient Simulator has own its database and serves as a FEMS test purpose.

3. Interfacing Strategy

In this section, needs, analysis and strategy for interfacing are discussed and a reasonable interfacing method is established.

3.1 Requirements for Program Interface

As described in the previous section, FEMS has several internal modules which require operation data to function. And the data is mainly obtained from outer system, the Main DB system. So there must be, necessarily, interface between the two systems, FEMS-Main DB.

3.2 Analysis for Interface Program

Main DB system is first analyzed. Operation program for the system is programmed using .NET based languages and has DB Standard Development Kit to give more access to system application. FEMS is not able to interpret data packet delivered from Main DB because FEMS is web-based program and thus founded on Java. In such case, where two systems have different language bases, it requires additional interfacing program.

3.3 DB Linker

As a data translator, DB Linker is developed. This works as a channel which connects the Main DB system and FEMS. DB SDK in the DB Linker first receives operation data from the Main DB system. DB SDK interprets PI3 Protocol which the Main DB system uses and interpreted data becomes available only for .NET based program. Therefore, additional process which transforms .NET based data to web protocol as HTTP in order to deliver interpretable data to FEMS. Web connector in the DB Linker performs such process and finally data can be relayed to the FEMS.

With minor efforts to re-programming, DB Linker can be applied to link any plant system to web-based external program.

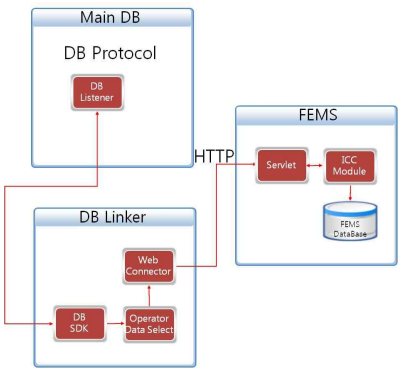

Fig. 2. Interfacing Program for Data Acquisition

3. Conclusions

In this paper, internal structure of FEMS as well as external modules has been introduced and function of each constituent process module was briefly explained. An interfacing issue rooted in the systems founded on incompatible languages was identified and the remedy was developed. DB Linker not only connects the Main DB system and FEM and relays operation data but also it processes data so that the data become interpretable to FEMS.

REFERENCES

[1] EPRI, User's Manual for FatiguePro Fatigue Monitoring System, Version 3.0, 2001.
[2] Jongjooh Kwon, Wanjae Kim, Development of Fatigue Evaluation and Monitoring System for Korean NPPs, Transactions of the Korean Nuclear Society, 2010.
[3] Gyeong-Hoi Koo, Jongjooh Kwon, Wanjae Kim, Green's Function Method with Consideration of Temperature Dependent Material Properties for Fatigue Monitoring of NPP, Internal Journal of Pressure Vessels and Piping, Vol.86, Issues 2-3, p187-195, 2009.
[4] Wanjae Kim, Jongjooh Kwon, Gyeong-Hoi Koo and Tae-Ryong Kim, Development of Characteristic Fatigue Usage Curve for Transient Based Fatigue Evaluation of Reactor Pressure Vessel Inlet Nozzle of Kori Unit 1, Proceedings of the International Conference on Pressure Vessel Technology, 2009
[5] Wanjae Kim, Jong Jooh Kwon, Hong Tae Kang, Gyeong-Hoi Koo and Tae-Ryong Kim, Development of Advanced Fatigue Evaluation Methodology for Monitoring Major Components in Nuclear Power Plant, Proceedings of the ASME 2010 Pressure Vessels & Piping Division / K-PVP Conference, 2010