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Development of a Web-based Evaluation System for I&C Systems of NPP

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1. Introduction

Since I&C systems in nuclear power plants are getting older with time, they have raised many problems with aging, obsolescence, high failure rates, and etc. But there are few pertinent methods to objectively evaluate the current status of I&C systems. In addition, even though there is a methodology, it is very difficult to apply to I&C systems of nuclear power plants due to complexity or reliability of the methodology.

Thus, to improve these problems related to evaluation and application of I&C systems, we are developing a evaluation system which embarks an objective evaluation methodology and works on internet for convenience. Users such as plant staff can take advantage of this system to evaluate the current status of I&C systems and make a maintenance plan, a replacement plan or an upgrade plan from the evaluation results.

2. Evaluation System Overview

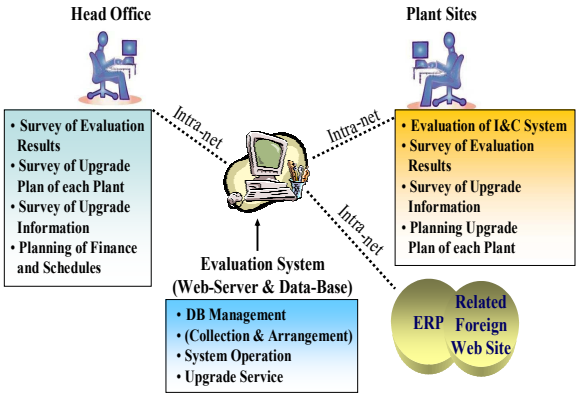

Figure 1. Practical Application of Evaluation System

The evaluation system has a structure based on server-client environment. Figure 1 shows a diagram describing the relation between server and clients. Head office and plant sites as clients are available to share related information through server.

With this system, plant sites can conduct the evaluation of each I&C system status, survey of results, survey of upgrade information and planning upgrade/maintenance plan. Also head office is able to survey evaluation results, upgrade or maintenance plan of each site and especially acquire some useful information for making finance plans.

The information gathered from clients as well as ERP(Enterprise Resource Planning) is kept at database of the evaluation system. The system server gathers the information related with I&C upgrade or maintenance, and controls database.

3. Method and Structure

3.1 Applied methodology for evaluation

Six evaluation factors were selected to objectively evaluate the current status of I&C systems and each factor consists of questionnaires corresponding to each evaluation factor [2,3]. The questionnaires are composed of questions requiring quantitative and qualitative answers. The applied evaluation factors are as follows [1]:

System Importance – the importance considering safety class, quality level, functionality in NPP, and failure mode effect on other systems

System Performance – the function and performance of the system satisfying the system requirements

System Maintenance – the status or ability of the system maintenance

System Robustness against Aging – the level of the system robustness against aging

Economical Efficiency – the current economical efficiency that the system has or can make

Continuity of Equipment Supply – the possibility that equipment can be supplied continuously

3.2 Implementation of Evaluation System

This Evaluation system is a web-based system. The system uses programming languages such as Java, JSP HTML, and statistic application. The system is based on web with web-server and Servlet-container that support the languages. Also the system includes a database which connects with Servlet-container. Servlet-container plays a role as a connector between web-server and database [4]. Registered users can have access to web-server using intranet. Figure 2 shows the relations between web-server, database and user.

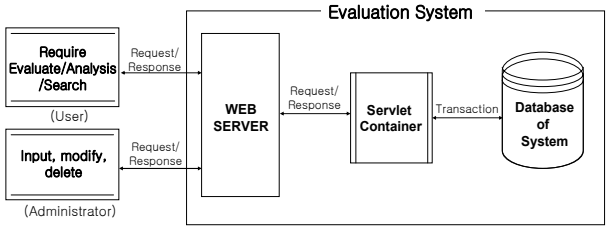

Figure 2. System composition diagram

3.3 Database Structure

As shown in Table 1, the database of the evaluation system has 13 database tables. Each table includes several attributes.

Tables	Description
IC_LOCATIONINFO	Information of plant location
IC_PLAINFO	Plant information
IC_SYSTEM	I&C system information
IC_USERINFO	User information
IC_APPRAISALL _EXEC_HISTORY	Information of evaluation results
IC_ APPRAISAL_EXEC _HISTORY_SUB	Information of user's answers related to evaluation questionnaire
IC_APPRAISAL _METHOD	Information of evaluation factors
IC_APPRAISAL _ITEM	Information of questions in questionnaires and their weight
IC_APPRAISAL _ELEMENT	Information of answer type for questionnaire
IC_LOGHISTORY	User action history within evaluation system
IC_FREEBOARD	User opinion
IC_NOTOCE _BOARD	Notice information
IC_DATABOARD	Useful information

Table 1. Database Tables

3.4 User authority and user interface display

The evaluation system has two types of user interface menu. One is for general users such as plant staff and head office staff, the other is for only administrator like a system manager. All general users must acquire an admission by the system manager to come into the evaluation system in advance. Of general users, those who are registered to evaluate I&C systems from each plant site have a special authority to access evaluation display of I&C systems as Fig 3. This display has the same user interface for all 6-evaluation factors

Fig 4 shows an example display of evaluation results that can present various analysis displays using a statistic application.

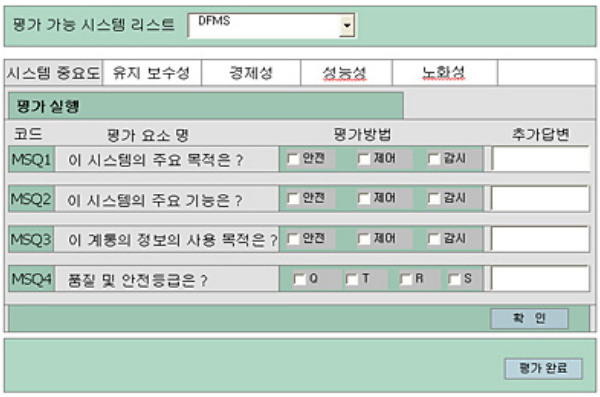

Figure 3. User interface display for evaluating I&C systems

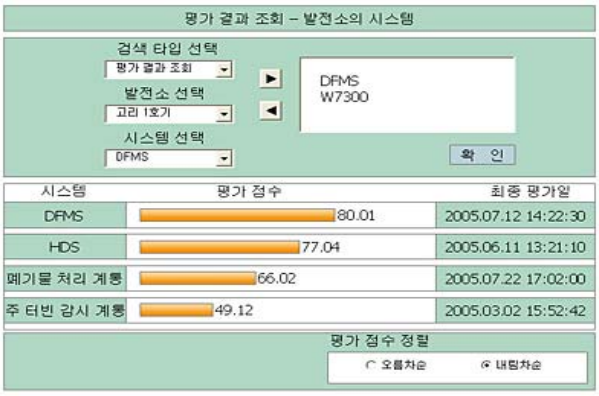

Figure 4. An example display of evaluation results

4. Conclusion

It is important to evaluate I&C systems in nuclear power plants for deciding on replacement, upgrade or maintenance. The proposed evaluation methodology for I&C system's status check has been tried to reflect quantitative and qualitative evaluations. This evaluation system proposes to perform I&C system's status evaluation with a web-based system containing the evaluation method. This system is being developed to consider objective evaluation, user's convenience, and storage of information for analysis.

REFERENCES

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