

A Study on the Design of Electronic SAMG Functional Modules

S.H. Park, J.H. Kim, K.I. Ahn

KAERI, Daedeokdaero 989-111, Yuseong-Gu, Daejeon, Korea, 305-353, shpark2@kaeri.re.kr

1. Introduction

As a part of the Ministry of Science, Ict & future Planning (MSIP) Project, we at KAERI are developing electronic SAMG (e-SAMG, severe accident mitigation guideline) for general SAMG for nuclear power plants. Due to computerized trends, various efforts related to computer systems have been carried out for safety systems in nuclear power plants. In particular, since the Fukushima accident, unexpected accidents or extreme damages have become a concern. With this status, a rapid and exact confrontation such as a computerized attempt in SAMG has been tried [1].

To develop an electronic SAMG, based on an analysis of the general SAMG, the architecture of e-SAMG was founded. The functional modules occupy important parts in the e-SAMG. This paper describes a study on the design of e-SAMG functional modules.

2. Functional Modules

When using SAMG, the users review the guidelines in SAMG and act appropriately according to the guidelines [2,3]. In e-SAMG, all contents are saved in a knowledge base, and are reviewed by users. Using e-SAMG, according to the user actions, functional modules are invoked. The architecture of these modules is shown in fig. 1. Under the direction of the main control module, each module communicates with other modules and acts appropriately.

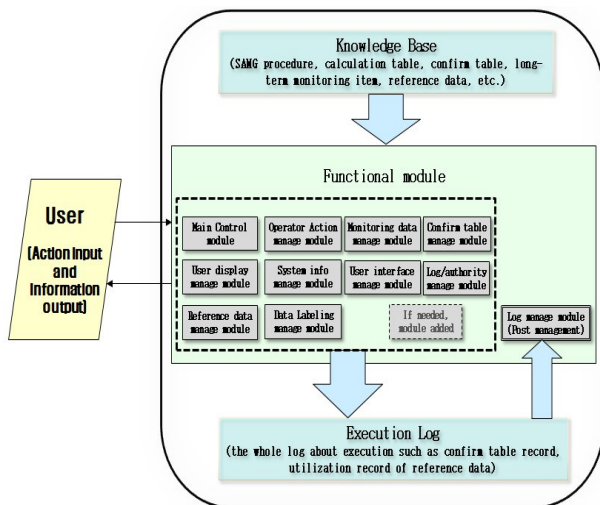


Fig. 1. The architecture of eSAMG.

2.1 Basic Module

When an e-SAMG is invoked, the main control module controls all actions until the end of e-SAMG, such as user actions for the guidelines, management for user information, and management for the execution log. The detailed functions are as follows:

- Main control module

This module is activated with the start of e-SAMG execution, and manages the lower part of the modules until the end of the e-SAMG execution. It controls the movement between guidelines. The actions in an MCR are the guidelines in emergency-01 and emergency-02. The actions in TSC are the guidelines in control-01, the guidelines from mitigation-01 to mitigation-08, guidelines in monitoring-01, and the guidelines in finish-01. The implementing details are analyzed and prepared.

- Management module for user action

This module controls all of the user actions and the following procedures according to the user actions. The details are the display of the guideline contents, the treatment of user actions, the review of information including confirmation, and records. The target data are numerical data, drawings, related negative influences, long-term monitoring data, and reference data. All of these data are loaded into the knowledge base.

The details of the movements for the main control module are implemented in this module. Mainly, the sequential movement, the branch of the conditions, and the skipping of procedures are specifically implemented.

The mutual actions with the main control module are also managed. It calls the lower part of the modules, and other modules for computerization.

- Management module for monitoring

This module continuously controls the monitoring data with the user action controls at the same time. It may need controls for the start/finish of the monitoring action, and the alarm/notice functions for the users.

The management needs to be controlled as target data such as the monitoring parameters and for long-term monitoring parameters. It needs simultaneous control with the user action controls.

- Management module for a confirmation table

This module is part of the user action control module. It controls the confirmation of various numerical data. In addition to the simple confirmation of data, the function for recording the numerical data is processed.

The data are treated as a unit in a separate file. The target data are of various types: severe threat

parameters for the reactor building, calculation tables being the basis for an action/decision, confirmation tables in the guidelines, concern data, drawings, figures, tables for device utilization, degree of device damage, and the negative influences of a mitigating action. The confirmation tables can be a one-time table or tables of periodic confirm/record.

- Management module for record

This module controls all of the records and documents during the user action of the guidelines. The target data can be one-time records or a repetition of records over a certain time period. The labeling functions for the records are also included.

- Management module for reference data

This module controls the referred data occurring during user actions, such as figures and tables in the guidelines. These are the data referred to for user actions, and require a review function. In some occasions, the functions of enlargement or reduction may be needed.

2.2 Modules for computerization

These modules are needed for a computerized process. They are not directly active for the user, but are inevitably needed for a computerized process.

- Management module for execution information

This module controls the information occurring during the execution. It records the user information at the start time of e-SAMG. It needs to minimize the user input action. It utilizes most of the information in the computer system. At the start time of e-SAMG, it will be recorded automatically.

- Management module for information storing and restoring

For related devices using a battery, in the case of a power shortage, this module controls the store/restore of all execution information. It is not only needed in cases of inevitable circumstances but also in cases of temporary storage.

- Management module for user environment

This module controls the user environment information such as a desktop PC, notebook information, and single or multiple users. All information of the user environment will be managed.

- Management module for system information

This module controls the system information. It includes the time, ID of the user using the device, and other related information.

- Management module for data scale

This module controls the data review. The size of the display device is limited. In some cases, it needs to enlarge or reduce the scale of the reviewed data. The "mispaint" program within the basic windows system will be used. It complements the limitation of the device screen size.

- Management module for execution log

This module controls the record of all user actions. This function is not in the off-line guidelines. However

in a computerized system, all the log records are basically recorded from the start to the finish of the e-SAMG execution. The main purpose is to confirm after the execution. However, it can be utilized as a simulation for training. The target data are all the execution logs such as the user decision, user choice, and referred data of the user.

- Management module for data labeling

This module controls the contents in the guidelines such as the addition or deletion of figures, drawings, and tables. It is used in case of modification of the guidelines such as the addition/deletion of contents.

The functions of a computerized transformation for the documents and the labeling for the electronic documents are included.

In this function, the management methods related with the knowledge base are also considered.

2.3 Other modules

These modules are considered optional. They are not essential, but may be needed. The concepts of the functions are prepared in the design processes, the details are decided later in the implementation process.

- Management module for user authority

This module controls the user authority. If the user is not authorized for using e-SAMG, it protects the execution of e-SAMG according to the user information.

- Management module for user windows

This module controls the usage environment of users. In the case of single or multiple users, it can be treated differently. It can even be used for information about change in users.

- Management module for keeping the log data

This module protects the log data from damage or modification.

3. Conclusions

A study of for the design of e-SAMG was introduced. During an emergency status of a severe accident, the items for the functional module during a rapid and exact action are surveyed. The results are being implemented in e-SAMG. The operators can be supported through the use of e-SAMG. Based on the design of functional modules, the implementation will be accelerated and the refined design can also be applied.

REFERENCES

- [1] Han-Chul Kim, et al., Evaluation of the Status of the Accident Management Guidelines in Korea and Foreign Countries, KINS, KINS/RR-986, 2013.
- [2] S. Lewis, et al., Severe Accident Management Guidance Technical Basis Report Volume 1: Candidate High-Level Actions and Their Effects, Technical Report, Electric Power Research Institute, Palo Alto, California, 2012.
- [3] Mohamed ElBaradei, et al., Severe Accident Management Programmes for Nuclear Power Plants, IAEA, No. NS-G-2.15, 2009.