

Features of Computerized Procedure System of Shin-Kori unit 5&6

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1. Introduction

The Computerized Procedure System (CPS) is one of the Man Machine Interface (MMI) resources of Main Control Room (MCR) of the Advanced Power Reactor 1400 (APR1400) [1,2]. The CPS has been continuously improved since it was installed in Shin-Kori unit 3&4 [3-5].

The Korea Hydro & Nuclear Power Central Research Institute (KHNP CRI) has found the points of improvement of CPS through CPS centered Human Factors Engineering Verification and Validation (HFE V&V) and Operating Experience Review (OER) of reference power plant [6]. This paper shows the main features of CPS of Shin-Kori 5&6 unit.

2. Features

The main features of CPS for Shin-Kori 5&6 include 'Priority among Lending States', 'File Format of completed Computerized Procedure (CP)', 'Synchronization/Asynchronization', 'Timer Objects', 'Instructions with Logic'.

2.1 Priority among Lending States

Procedure is closely related to plant status. Having carried out the procedures means that plant state has also changed accordingly [5]. The CPS supports four states of CP such as 'New', 'Desk', 'Logged', 'Completed'. The 'New' status of CP shows this procedure is not executed and logged. The 'Desk' status means CP is currently opened and 'Logged' status means procedure controller saved the CP or CP is automatically closed when the result of entry condition logic is TRUE. The 'Desk' status of CP is changed into 'Completed' when the termination condition of the CP is met.

The various states of CP can be shown on procedure directory of CPS in reference power plant. But if there is a 'logged' CP on procedure directory, an operator does not need to execute 'New' status of the CP. The status of CP has only one status among 'New', 'Desk' and 'Logged'. The respective completed CPs are only shown in the below pane of procedure directory when an operators selects the CP. The Fig. 1. below shows the process of procedure opening.

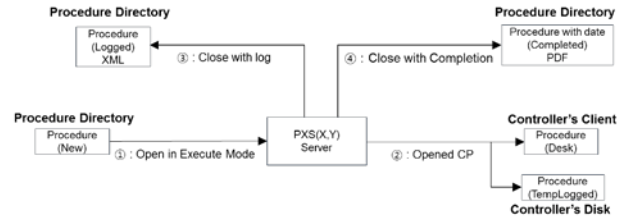


Fig. 1. Lending states of CP

2.2 File Format of Completed CP

The completed CP XML file is automatically created with time stamp in the non-volatile memory when the termination condition of the CP is met. But the CPS manager always has to have the same revision of CP if he or she needs to check the completed CP because the completed CP has only the execution result of CP. To remove the inconvenience the completed CP is automatically created in portable document format (PDF) in Shin-Kori 5&6 CPS. The CPS manager can check the completed CP without the same CP and completed CP shows identical style of online hard copy of CPS.

2.3 'Synchronization/Asynchronization'

The Sync/Async function is complicated concept of CPS because this function only operates in gross step level [3]. It means that the operator has to navigate to a selected gross step. But the operator does not need to navigate the other gross even though procedure controller selects other gross step because this Sync/Async operates in procedure level in CPS of shin-Kori 5&6 units. When the operator clicks the 'Sync' button CP is automatically synchronized with primary procedure controller of the selected CP. The primary controller is assigned by procedure writer.

2.4 Timer Objects

There are two types of time objects in previous CPS. One is 'Remaining time' and the other is 'Elapsed time'. The timer objects are fully improved reflecting result of HFE V&V. First, the 'Absolute Timer' is added to remove the burden of inputting the entry time of computerized procedure using soft keyboard. Second, the respective timer objects can have own label. This label of timer object is written by procedure writer. Third, the executer cannot reset time of timer objects

because timer object automatically counts up or down when the parent instruction is under execution status. In Shin-Kori 5&6 CPS 'Reset' button is added, therefore, timer objects can be reset by the executor. Last, the user interface of timer object is changed. The respective timer objects can be distinguished by added user interface(◀, ▶). The Fig 2 below shows the improved timer objects.

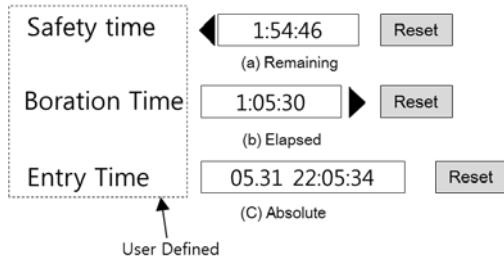


Fig. 2. Timer objects

2.5 Instruction with Logic

The procedure writer can embedded logic function into the instruction in order to evaluate instruction automatically. The instructions can be classified as 'Auto', 'ManualAuto' and 'Manual'. 'Auto' instruction always shows the result of instruction by calculating logic which is created by procedure writer. And 'ManualAuto' only shows the result after operator evaluation if the operators' result and system's result are different. 'Manual' means that it does not have the logic. In CPS of reference power plant, the operator has to click 'Logic View' to check whether this instruction has logic or not. The improved instruction with logic indicates the existence of logic. The operator can directly check whether this instruction has logic or does not have logic. The below figure 3&4 show the user interface of logic.

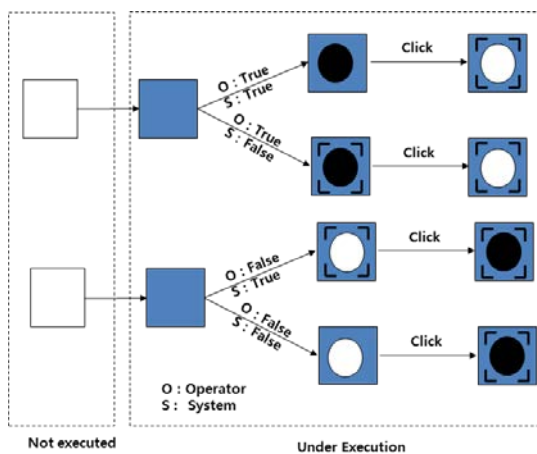


Fig. 3. Instruction with ManualAuto Logic

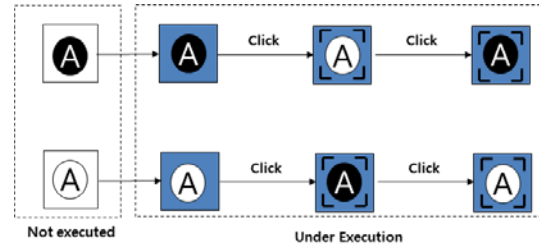


Fig. 4. Instruction with Auto Logic

3. Conclusions

This paper shows the main features of CPS of Shin-Kori 5&6. These are some of improvements of CPS. This prototype of CPS currently is implementing in CRI. The respective function can be more detailed after testing the prototype. These features will be applied to Shin-Kori 5&6 CPS after HFE V&V.

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