Design of New Overview Screens for the LABIHS Simulator

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Introduction

In digital control rooms, operators have to be constantly swapping among different display screens to control a plant, as only part of the information is visible at any one time. This is called "keyhole effect" and can lead to cognitive workload to the operators when trying to figure out the current state of the plant. The goals of the overview screen is to show the main components of the plant and to minimize this effect. In this work, three new overview screens for the LABIHS simulator were developed, taking into account the guidelines and recommendations for human factors engineering [1].

The New Overview Screens

A Reactor Operator – RO, a Secondary Circuit Operator – SCO, and a Shift Supervisor – SS compose the LABIHS simulator teamwork. Each operator controls and monitors the systems under his/her responsibility using a set of different interfaces: screen, mouse and keyboard. An overview of the process under control is available to the operators on the front wall of the original control room and on three LCD TVs in the improved control room. Fig. 1 shows the original overview screen of the LABIHS simulator.

Fig. 1 - Original overview screen.

Fig. 2 shows the three new overview screens developed to the LABIHS simulator.

Fig. 2 - New overview screens.

The left one shows the conditions of the plant with respect to its status, such as trip alarms, systems alarms, control and permissive alarms. Two computerized operator support systems show the status tree of the critical safety function and the accident/transient identification support system. The middle one shows an overview of the plant instrumentation and thermo-hydraulic processes. The right one shows the graphics of the pressure versus temperature in the primary loop (P-T Curve), the top view of the reactor core, showing the bars position of the Control Banks & Shutdown Banks, and the plant operation mode as well.

The Interfaces Evaluation Results

A preliminary evaluation of the new overview screens was carried out based on screen information presented to the operators to perform the emergency procedure E-0 steps [2]. The operators should operate the plant according to the E-0 procedure when the reactor is tripped or SI begins. The results showed a substantial reduction in the lack of information to the operator when the E-0 procedure was performed using the new overview screens (a reduction of 8/36 steps as compared to the original 21/36 steps).

References

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