

ROLE OF ANIMATED HUMAN MACHINE INTERFACE IN NUCLEAR POWER PLANT SIMULATION

Bindu, S.; Jayanthi, T.; SatyaMurty, S. A. V.; Swaminathan, P. & Raj, B.

Indira Gandhi Centre for Atomic Research, Kalpakkam - 603 102, India

E-Mail: bindu@igcar.gov.in

Abstract

The recent advances in Computer Science and Technology have revolutionized the way graphical user interfaces are used towards Human Machine Interface (HMI). The graphical user interface is so powerful, that the knowledge of a process or system can be transferred to plant personnel accurately and effectively within a short period of time. The techniques of animation can enhance the illusion of direct manipulation that many human computer interfaces strive to represent. This paper describes the role of human machine interface using animated information in Full Scope Replica type training simulator of Prototype Fast Breeder Reactor (PFBR). This paper covers general description of PFBR, the Full Scope Replica Simulator, the concept of simulation of plant dynamics, development of the animated core temperature distribution diagram and process flow diagram followed by its features. Also it covers how animated core temperature distribution and dynamic process flow diagrams are advantageous for operator training.

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Key Words: Animation, Full Scope Replica Simulator, Human Machine Interface, Process Flow Diagram, Prototype Fast Breeder Reactor

1. INTRODUCTION

Full Scope Replica Simulator is used for real time dynamic simulation of nuclear power plant operations for training purposes. The increasing demand for well trained power plant operators has led to the realization that the simulator is the most effective tool for such training. An actual nuclear power plant cannot be used for extensive training such as, start up, shutdown, malfunctions, incidents etc for safety considerations and reactor availability reasons. Only after years of experience, the understanding and knowledge acquired about the plant reach high levels. Even then it is unlikely that an operator would observe the effect of important malfunctions and transients and be able to adopt the best corrective procedures. Such reasons have led to use of simulators for power plant operator training. Full Scope Replica Simulator consists of complex mathematical models which mimic the real nuclear power plant operations. Process Models of the nuclear power plant are modelled in the simulator so that it can simulate real time physical processes. There is a need for operators to construct a mental representation of the nuclear processes and its operations for full understanding of nuclear power plant. A static diagram might aid this. However, it has been proven many times that animations are superior to static diagrams, especially when learning concerns a series of events in dynamic systems [1]. An animation can be defined as a series of rapidly changing computer screen displays suggesting movement to the viewer [2].

Animation techniques not only depict objects, they also additionally provide information concerning object changes such as position, colour, shape or orientation over time. It aims at giving an exact presentation of a process or procedure to facilitate generating an adequate

nuclear plant operation, but also safety in the nuclear industry. Because of this, training is organized, regulated, approved and monitored by government regulatory commission [10]. Animations help in mentally visualizing a process or a procedure with ease. It improves operator performance, as it is better than conventional alarm systems, captures operator attention and increase operator awareness as mentioned above in section 7.

It is planned to take up other subsystems of PFBR for animated HMI in future. Fuel Handling subsystem is one such subsystem where the operator will be greatly benefited by HMI, and hence it is planned to take up this subsystem first. The animated HMI of fuel handling includes display of 3D models like, Large Rotatable Plug, Small Rotatable Plug, with their rotating angle indications, Transfer arm translation motions, their sequence of operation etc.

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