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RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

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CONTRIBUTIONS TO BOOKS

- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

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- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

CONFERENCE PAPERS

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- Kumar S. (2011): "Customer Value: A Comparative Study of Rural and Urban Customers," Thesis, Kurukshetra University, Kurukshetra.

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- Garg, Bhavet (2011): Towards a New Natural Gas Policy, Political Weekly, Viewed on January 01, 2012 http://epw.in/user/viewabstract.jsp

OPERATIONAL EFFECTIVENESS OF VIRTUAL PANEL IN POWER PLANT SIMULATOR: A STUDY

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ABSTRACT

The emergence of low cost virtual panel simulators has shown positive signs and growth perspectives against the conventional full scope replica fossil fuel simulators. The need of the man-hour and the cutting edge technology force the virtual panel/ reality applications inevitable even in the real time simulators especially for sub critical and supercritical boiler based power plants. The impact of these technologies is studied with a group of trainees trained in both virtual panel and replica simulator. Further the paper discusses on the case study where in the operational conveniences with parameters of effectiveness, comfort and age factor are compared for the virtual panel and generic conventional simulator.

KEYWORDS
Plant-loading factor (PLF), Real Time Simulations, Virtual panels.

1. INTRODUCTION

Training the manpower for the enhanced capacity in the coming years cannot be imagined without replica power plant simulators. Especially in the new projects having high capacity power generation the simulator training emphasizes the reflections and skills to improve the plant-loading factor (PLF) of the power stations on the national grid. With the kind of mal-functions that can be emulated within 2-3 weeks on a full-fledged training, the trained personnel can appreciate the skill improvement that could have otherwise come in their lifetime service. A typical simulator has the following salient features for training/ research purpose.

A. SIMULATORS

All simulators have the following four components:

- An internal model of the world, or part of it; for example, a model of a vehicle traveling through a model geography, or a model of the physical state of a typical power plant.
- External devices to display the state of the model; for example, one or more video displays, audio speakers, or a simulated instrument panel.
- External devices to supply control inputs; for example, a steering wheel, a joystick, or simulated knobs and dials.
- An operator (or hardware under test) that "closes the loop" by moving the controls in response to what is shown on the display.

B. FEATURES OF A TRAINING SIMULATOR

The important features of Instructor Station essentially required for providing training to the operators / Engineer Trainees are

- Freeze / Run of process
- Various initial conditions for different loads can be stored and called at will
- Summaries in respect of important monitored Parameters and also in trend displays can be viewed.
- Slow and Fast time simulation.
- Insertion of external parameters like Grid voltage, Grid frequency etc.
- Override facility, Where the operator can override the I/O Points
- Complete simulation diagrams can be viewed in dynamic mode. These are the plant system Monitoring & control schemes.
- Training exercises can be generated for evaluating the performance of the trainee
- Backtrack to the specified condition of the simulation load

2. TYPES OF PROCESS CONTROL IN SIMULATOR

Though the simulators have been a mere replica of the power plant control room and its process, in the course of time the simulators and the basic control had witnessed a wide changes i.e. centralized control, Distributed control and Distributed control with Intelligent Instrumentation. The latest technology prefers Intelligent Instrumentation with an industrial computer like CA8000 (vertical/ horizontal mount) whose motherboard along with memory costs around 1500$ against a typical controller. Conventional operating system can be loaded to increase the user interactivity. The 210 MW fossil fuel replica Simulator is having three I/O nodes being supported by such a reliable system.

3. VIRTUAL PANELS AND ITS APPLICATIONS IN POWER PLAN SIMULATOR

Virtual Panels are a major add-on package option that simplifies access to monitored and simulated data by constructing realistic looking front panels from an extensive library of gadgets. You can use these panels to control a real piece of equipment, as well as simulate or create virtual equipment that can

communicate on a live bus. Virtual Panels can also be useful in emulating and testing a proposed front panel design, in order to simplify the user interface for data control and monitoring[2].

A. VIRTUAL PANEL SOFTWARES

AMPOL provides high-performance, feature rich, advanced software tools– dataMARS and dataSIMS – that enable realtime systems developers, integrators, troubleshooters and airline field engineers to streamline their work effort.

B. VIRTUAL PANEL CONTROLS

The excellent reliability and data logging features of intelligent instrumentation have given the clear edge for the virtual panel controls where in the control can be controlled by some basic movement on the keyboard/ mouse / joystick. The other features of the virtual panel control have made it to be a better alternative. Having 14 monitor's screen it is possible to have the simulation of 210MW simulator. The control can be through conventional UCB display, scheme display or even through a mnemonic keying on the command line

C. FEATURES OF VIRTUAL PANEL CONTROLS

- No physical movement / moving parts
- Lesser Maintenance ,Easy upgrade
- Paper/ink free and hence environment friendly
- High fidelity (to swap/ interchange)
- No transport delay and hence faster
- Cost / meter is lesser
- No need for I-O interfacing
- Faster and reliable
- No need for skilled instrument mechanic

4. FUTURE PROSPECTS FOR DISTRIBUTED INTERACTIVE AND REAL TIME SIMULATIONS USING VIRTUAL PANELS

A distributed interactive system increases the reliability of the operating life of the full scope Panels simulator by increasing the mean time between the repair (MTBR) and mean time between the failures (MTBF) [5].

D. Virtual Reality Simulators

A virtual reality simulator aims to give its operator a sense of presence in a computer-generated world. Usually the operator can see only the simulated display, and has no other visual referents. Because of this, the frame rate must be high enough to give smooth, no flickering animation, and any perceptible transport delay can cause nausea and disorientation. However, the virtual world is not required (or expected) to look like the real world, so the simulator may be able to do less work to prepare the display. A virtual reality application training modules have already been developed for critical operations like substation maintenance[1,4], nuclear reactor maintenance.

5. CASE STUDY

A case study was initiated on the trainees of 210 Mw fossil fuel simulator from January 2006 at National Power Training Institute (NR). The study was concentrated on select batches for Generic conventional coal fired simulator and the same persons were offered training for the same exercises on the virtual panel one-to-one simulator based on [3]. Some exercises like 50% load condition and full load initial conditions were taken as bench marking. The number of trips for a particular time slot (6-hrs) was studied in both the cases and the tabulation has been formed. Also some of the observed points are listed in Table.I.

TABLE I:COMPARISON ON THE OBSERVATION ON THE TRAINEES PERFORMANCE (using Trainee session log)

No	Working condition in a 210 MW Power Plant	Number of operations (Key Changes)		Number of Trips		Age group of the trainees with tripping of plant operation on virtual panel	
		Generic conventional Simulator	Virtual Panel Simulator	Generic conventional Simulator	Virtual Panel Simulator	Age>45	Age<=45
1	50% or Half load condition	**30**	**40**	**3**	**6**	**10**	**5**
2	100% load condition	**50**	**55**	**5**	**7**	**6**	**5**

In addition to the above the following points were observed.

- Operating level was often difficult.
- Lack of confidence / computer operating skill.
- Stress on eye / body was more.
- Younger age group (i.e) less than 45 years old had lesser trips in the operation comparing to the old age group
- Demand for bigger visualization was suggested.

6. CONCLUSIONS

With the change in technology, the modern power plants undergo a phase change with scheme-based control and the reduction in high speed processing gives an opportunity to go for virtual panel operations. The reduction in manpower per Mega Watt for power plant needs high skilled trained personals and supervisors monitoring super thermal power plants from a single control room. Such a demand in training can be fulfilled with low cast / high fidelity simulators based on the virtual panel simulator which may be a cheaper option for training and research institutions also.

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