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Man-Machine Interface Workshop Summary*

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Abstract

This report is a summary of the Man-Machine Interface Workshop that took place on 14 November 1991 as part of the 1991 International Conference on Accelerator and Large Experimental Physics Control Systems in Tsukuba, Japan. The conference was sponsored by KEK, the Japanese High Energy Physics Laboratory.

I. INTRODUCTION

The topic of man-machine (MMI) interfaces has received much attention in the general computing literature, (see, e.g., [1]). The Man-Machine Interface workshop at this conference was motivated by desires to provide an interactive forum for the discussion of how current methods and new ideas can be used to make communications between the accelerator control systems and the control system users as effective and comprehensible as possible. The goals of this workshop were two-fold:

1) To identify unifying principles in the design and implementation of man-machine interfaces for accelerator/physics control systems;

2) And, looking to the future, to encourage discussion of new, possibly speculative, man-machine interface techniques and their application to such control systems.

The 1989 ICALEPCS conference in Vancouver included a workshop on the use of workstations in accelerator control systems. Part of that workshop dealt with the problems and possibilities presented by the use of workstations as man-machine interfaces in accelerator control system environments. It is interesting to compare the changes in emphasis that have become evident in two years. Comments from the 1989 workshop emphasized several aspects of the man-machine interface including: the need for realistic feedback for analog controls whether implemented through physics knobs or a window interface; the desirability of multiple, non-overlapping screens on each operator console; and the importance of tools for rapid prototyping.

As part of the 1991 MMI workshop, we hoped to encourage discussion of a wide variety of topics, including: display methodologies, interaction techniques, human- and software-related engineering concerns, user construction of interfaces, and speculative aspects of three dimensional presentation and virtual reality. In this year's session, we were particularly interested in learning about the current use of windowing systems and third party interface builders, and the construction and maintenance of interfaces by users.

II. PAPERS

The Man-Machine Interface Workshop at this conference featured four invited papers and a discussion period. The papers were selected based on the abstracts submitted to the conference program committee. The full papers are available elsewhere in these proceedings.

Kevin Cahill described the uses Fermilab has made of the X-Window environment for accelerator control consoles [2]. Fermilab is using DEC Vaxstations. A single keyboard/trackball and set of knobs is interfaced to multiple screens using a locally engineered interface box. The X-Windows environment has been exploited to allow remote consoles across long haul networks and to support multiple consoles on a single workstation. A Fermilab console was actually running on a Vaxstation at KEK during the conference. Read-only consoles and consoles with limited command capability help to allay feelings of unease among their operators. In addition, all commands are logged on a central server.

Frank Di Maio from CERN discussed the workstations that are being introduced as part of the rejuvenation of the CERN control systems [3]. The rejuvenation effort is based on Unix workstations with X-Windows, Motif, and TCP/IP communications. CERN's first attempts included console emulation for some of the NODAL-based applications. The workstation environment includes a user interface editor and an interactive application builder.

A completely new system based on Unix, X-11 and the PHIGS graphics standard was described by Franco Potepan of the ELETTRA Synchrotron Light Source in Trieste, Italy [4]. The ELETTRA system has a very natural interface that allows direct access and manipulation based on CAD-derived pictures of the entire accelerator complex. This interface was an attempt to continue the desktop metaphor in the accelerator environment.

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Subrata Dasgupta of the Variable Energy Cyclotron Centre in Calcutta, India, talked about a method of portraying all four dimensions (x, x', y, and y') of the transverse beam phase space on a single two-dimensional screen [5]. His method used two-dimensional projections of suitably shaped three-dimensional solids. It did not provide as complete information as the usual ellipse representations, but did give a very intuitive feeling for what the beam was doing. He implemented these representations on an IBM PC.

III. DISCUSSION

In response to questions on control system security with proliferating consoles, Cahill said Fermilab handled such problems by limiting the capabilities of some consoles, by allowing the crew chiefs to observe all consoles, and by logging changes as they are made to the control system. Rusty Humphrey said that such security problems had never been raised as an operational issue at SLAC. Several other people indicated that control action logging was an effective way to determine cause and effect.

Questions regarding the use of Motif in interface construction were directed to Di Maio. He said they studied possible user interface management systems (UIMs) and decided that using the Motif interface was best. He noted that Motif was part of the environment already, and other products could be expensive and have an unpredictable market lifetime. Uli Raich commented that when using their knob widget the mouse served only to connect, the up and down arrow keys served to adjust.

In discussions related to how to present and interact with information via man-machine interfaces, Michael Crowley-Milling mentioned that consoles designed 5 to 6 years ago did not include keyboards, relying only on knobs, trackballs and touch panels. Since then, perhaps because of the widely accepted use of PCs and Macintoshs, keyboards have become an expected part of a console.

Regarding user construction of interfaces, Crowley-Milling pointed out that the NODAL interpreter at the CERN SPS resulted in the proliferation of displays. (In one example, a ship appeared on one SPS screen, sailed from screen to screen across the control room, and finally sank on the last screen.) Kevin Cahill said that with user expectations going up and the MMI environment becoming more complex, users themselves may not feel comfortable with building their own screens. Rusty Humphrey of SLAC noted that operators can go "berserk" in creating an extremely large number of approaches to screens. He said this trend is usually countered by senior operators who lose patience and get rid of some of the variety. The result can be a "relaxation oscillation" effect. Another conferee commented that he had success building prototypes in cooperation with operators, relying on programmers to put together the final production versions.

George Shering of CERN gave an informal summary of his view of the history of operator interfaces in accelerator controls. He said that beginning with the early LAMPF controls interface using Tektronics storage scopes, and continuing with the SPS controls at CERN, the accelerator community led the man-machine interface field. He noted that since the introduction of the Macintosh desktop metaphor in 1984 -- and now with Windows 3.0 for PCs -- the entire field has been subsumed by WIMPs (windows, icons, menus, and pointers). As a result, we are now the users of man-machine interfaces, not the designers.

IV. CONCLUSIONS

Two years after the Vancouver conference, similar topics are still of concern in the international controls community. More experience has been gained in the use of new interface techniques such as X-Windows and Motif, but much remains to be done. It should be very interesting to review MMI progress again in two years in Berlin.

The dichotomy between what is presented in a man-machine interface and how it is presented continues to be evident. The importance of building on higher level (e.g., accelerator) metaphors was mentioned during the discussion. While we recognize the importance of techniques for constructing man-machine interfaces, we hope that future sessions will place emphasis on the content of the interface as well.

V. REFERENCES

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