XVI IMEKO World Congress

Measurement - Supports Science - Improves Technology - Protects Environment ... and Provides Employment - Now and in the Future
Vienna, AUSTRIA, 2000, September 25-28

USER INTERFACE OF MEASURING INSTRUMENTS ON ENGINEERING EDUCATION

S. Takayama and K. Kariya

Dept. of Electrical and Electronic Engineering
Faculty of Science and Engineering, Ritsumeikan University BKC
Noji, Kusatsu, Shiga 525-8577, Japan

Abstract: According to the high performance and digitalization of measuring instruments, the construction of operation panel has become more simple. On educational viewpoint, this causes the degraduction of the efficiency of instrument operation and that learning. This paper shows the consideration of subjects concerning to user interface of the operation of measuring instruments and describes the potential possibility of operation panel in the virtual measurement system supported by personal computers. Especially, the viewpoint focuses on the navigation function on a virtual operation panel, which is not realized on actual measuring instruments.

Keywords: Virtual Operation Panel, Navigation System, User Interface

1. INTRODUCTION

Familiarity of the operation of measuring instrument is an important viewpoint in engineering education to identify desired signal and to assure quality of measuring data (precision, range,…). Many functions of measuring instrument need same number of operation components that control them. But, by reasons of form, cost and ease to use, it is impossible to arrange all operation components on the operation panel. Therefore, the operation of advanced functions is realized by the combination of plural operation components and the operation components popped up on a part of digitalized monitor screen. But, the concealment of these operations decreases ease of operation by users and causes to use ineffectively function of measuring instruments. And also, the method of concealment defers in the kinds of measuring instruments and manufacture companies. In engineering education, this lack of unity of the operation method of measuring instrument becomes a negative factor on education of measuring instruments, training of the operation and cost to buy them.

In case of the measurement that nature of measurement object is well-known, it is not necessary for a measuring person to take part in the process, by the reason of automatic measurement system like a self-adapting function and an executive function of constant sequences. But in case of the measurement that nature of measurement object is unknown, it is necessary for the measuring person to concern to the measurement purpose, detective elements of measurement object, the construction of engineering interfaces and operation sequences. For the measuring person, the measurement object, detective object and signal/energy are recognized as conceptual matters. On the opposite side, those static and dynamic actuations are acquired as an output from measuring instrument. The effective operation of measuring instruments enhances the desire of measuring person, and becomes a necessary condition to construct suitable measurement system. Then, for the measuring persons, the effective familiarity of the operation of measuring instrument is an important subject in engineering education.

In recent years, virtual instrument which is a novel measurement system(control, automation system) integrated with an actual measuring instrument and personal computer has diffused. The virtual instrument realizes many functions in virtual world by the personal computer, like data acquisition, processing, control, display, record, transmission function that are fundamental on an actual measuring instrument and other equipments. And other remarkable characteristic is flexibility on virtual operation panel. The useful characteristics are that

1) Operator can realize original operations by arranging operation components to any positions on operation panel,
2) Familiar common operation components are used on different sort of measuring instruments,
3) Familiar common operation interfaces are used on measuring instruments made by different manufacturing companies,
4) Operator can design novel operation components and arrange them on the operation panel.

XVI IMEKO World Congress

Measurement - Supports Science - Improves Technology - Protects Environment ... and Provides Employment - Now and in the Future
Vienna, AUSTRIA, 2000, September 25-28

In these days, there are many kinds of software package for virtual instrument. But most of virtual operation components and panel of them are the mapping from the actual measuring instrument in real world. Till now, the potential possibility of virtual world is not made full use. [1]-[3]

2. NAVIGATION SYSTEM ON VIRTUAL INSTRUMENTATION

Virtual instrument is a novel system integrated functions of actual measuring instrument and personal computer. The advanced and evolutional functions, especially on data acquisition and processing, are realized. But, it is considered that though efficiency and flexibility to the operation components are enhanced and advanced, the function of effective familiarity and easiness of the operation on measuring instruments that are desired in engineering education, are not enough. In this viewpoint, this paper proposes a navigation system as a novel fundamental function supported user interface of operation panel of virtual instruments to realize the effectiveness for familiarity and easiness of instrument operation. This navigation system is not realized in actual measuring instrument, and is the function to impress mostly the characteristic of virtual measuring instrument. Fig.1 shows the outline of system supported the navigation function in virtual operation panel.

2.1 Message Translation System (MTS)

MTS is a set of functions to coordinate different commands and data formats each external software modules and hardware interfaces, and to transfer them to control system software (OCS and NCS). Usually, software/hardware systems made in same manufacturing company have a common message system. But, in case of different companies, it is impossible to use an unified message system by reason of different operation methods and data formats. Main role of MTS is to translate bidirectionally the different messages each external software modules and hardware interfaces. MTL (Message Translation System) is a template library of different MTSs each external software modules and hardware interfaces.

2.2 Operation Control System (OCS)

OCS is a core software to control operation parameters. The Operation parameters received from User Interface are translated to common messages and to transfer to MTS. The messages from MTS are translated to the indication parameter and transfer to User Interface. And also, OCS selects
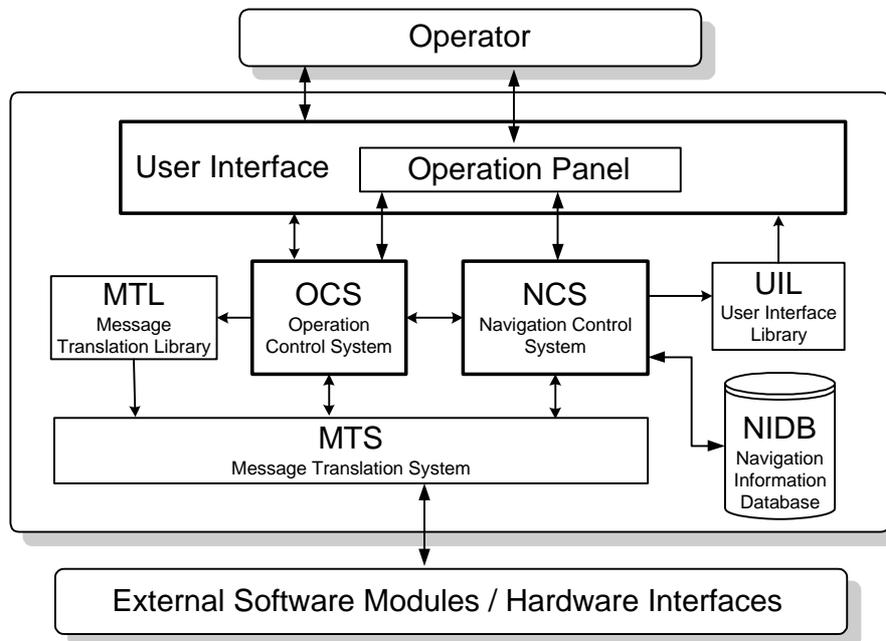

Figure1. Outline of System supported Navigation Function on Virtual Operation Panel

MTL according to external software modules and hardware interfaces.

XVI IMEKO World Congress

Measurement - Supports Science - Improves Technology - Protects Environment ... and Provides Employment - Now and in the Future

Vienna, AUSTRIA, 2000, September 25-28

2.3 Navigation Control System (NCS)

NCS is a core software for the navigation function on virtual operation panel. By monitoring the message translation in OCS and the interaction between Operator and User Interface, NCS generates the navigation information to present to Operator. NCS is classified into three kinds; active window navigation (by text, figure,…), audio navigation(by voice, sound,…) and key navigation(by dynamic indication of operation components…). Navigation Information Database (NIDB) is a knowledge database referred by NCS. User Interface Library (UIL) is a template format of User Interface. NCS selects the suitable format according to measuring systems, and changes User Interface.

2.4 User Interface

User Interface has three roles for operator. The first role is to communicate parameters and commands to OCS. The second role is to present the virtual operation panel from UIL. And another role is to present the navigation function of measuring system indicated by NCS.

3. FUNDAMENTAL FUNCTIONS OF NAVIGATION CONTROL SYSTEM

The guide function of actual measuring instrument is the function to support an operator in measurement system. The guide is the concept to present a manual of measuring instrument and an information of the operation components according to instructions by operator. On the other hands, the navigation is the concept to present the suitable operation method to operator according to measuring system and operation condition. This is the concept to navigate the operator aggressively and comprehensively on the operation of measuring instruments. Then, the navigation function
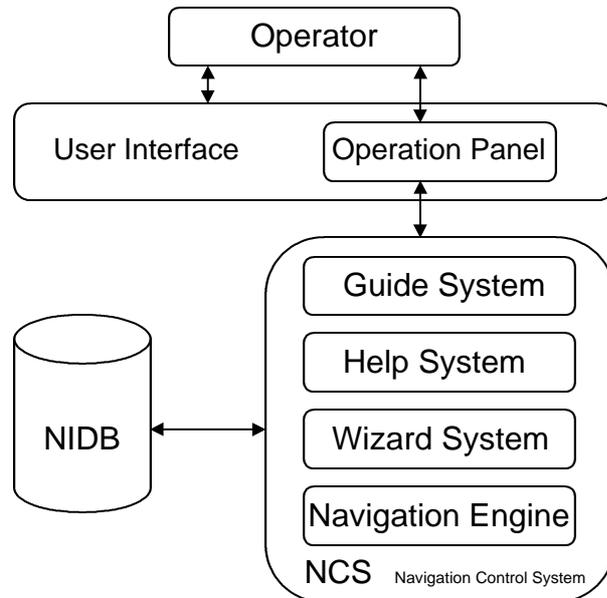

Figure 2. Main Functions of Navigation Control System (NCS)

needs a software engine and database that acquire the condition of measurement system and estimate a navigation information. NCS is constructed by several functions according to operation methods and contents to the operator. Fig. 2 shows the main functions constructed NCS.

Guide System is the function that shows the name of operation components and parameters that are indicated actively on the operation panel by operator, with images, characters and numerical values. This function enhances the recognition to use the operation panel of measuring instrument. And also, the function covers the indication of tuned operation components, warnings and corrections. Tooltip Hints are the typical guide function. This is the function to present a simple explanation of the operation component pointed by mouse cursor.

Help System is the function that shows the detail instruction and explanation of operation components that are indicated actively on operation panel by the operator, to an exclusive window. By using not only characters and images but also animations and audio, it is possible to enhance the operator's motivation to measuring system. And also, by hyper-link functions, the operator can browse related contents of the help information.

Wizard System is the function that set up parameters by showing items concerning to the instrument operation to operator. By this function, it is possible to decrease human errors of instrument

XVI IMEKO World Congress

Measurement - Supports Science - Improves Technology - Protects Environment ... and Provides Employment - Now and in the Future
Vienna, AUSTRIA, 2000, September 25-28

operation.

   Navigation Engine is the function that generates a navigation information by analyzing the operation condition through User Interface and referring NIDB. This is a core function of NCS integrated other functions. This function also presents the operation instruction to an exclusive window and displays the operation components dynamically.
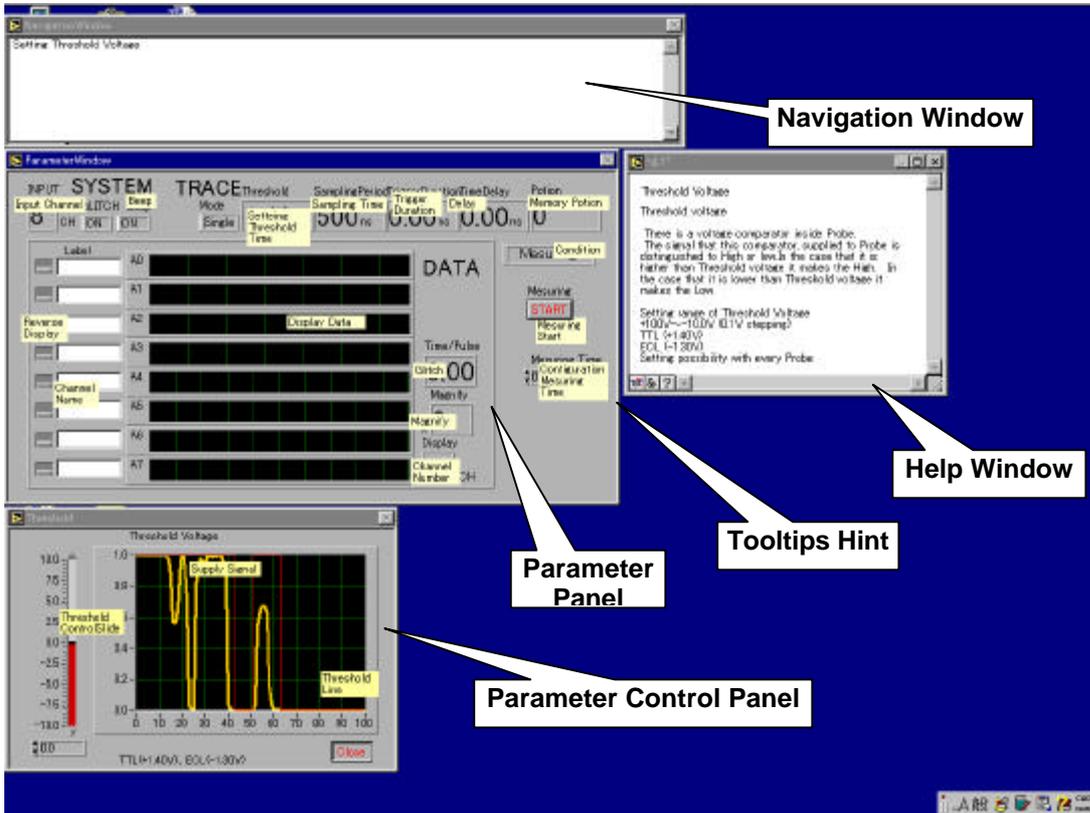

Figure 3. Example of Virtual Operation Panel supported by NCS to control Actual Logic Analyzer
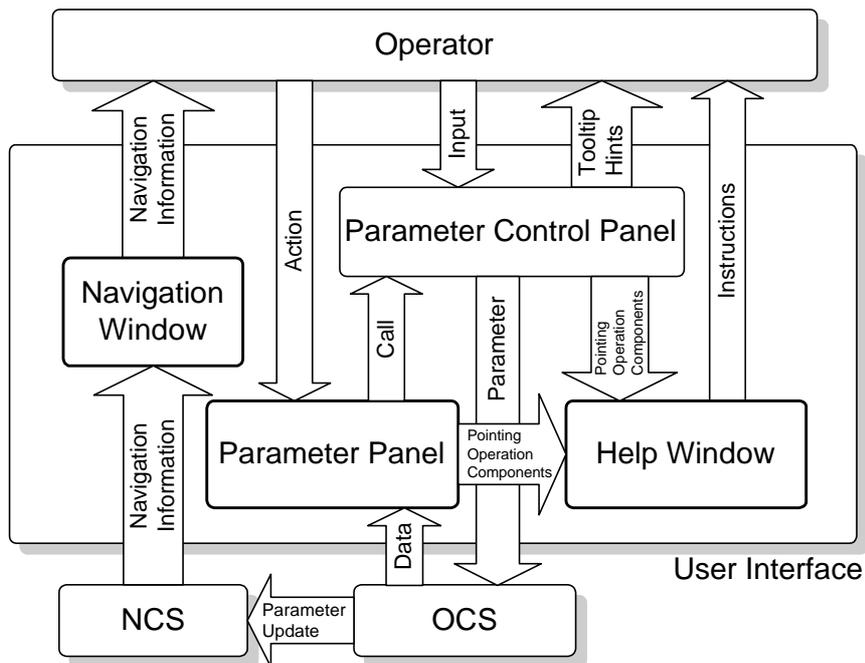

Figure 4. Flowchart of User Interface supported by NCS

4.   FUNDAMENTAL ELEMENTS OF VIRTUAL OPERATION PANEL

Fig. 3 shows an example of the virtual operation panel supported by NCS which controls an actual logic analyzer. This is the system connected the actual logic analyzer to a personal computer with GPIB cable. The operation panel is made by as an application software on Windows NT 4.0. Fig. 4 shows the flowchart of User Interface supported by NCS.

The fundamental operation windows in the operation panel are Navigation Window, Parameter Panel and Help Window. Parameter Control Panel is the secondary window called from Parameter Panel. By pointing of mouse pointer to the operation components on Parameter Panel in a short time, the guide function make Tooltip Hints pop up there. The navigation engine of NCS navigates the operation of Parameter Panel to the operator through Navigation Window. Each sentences in Navigation Window are identified to operation components in Parameter Panel with colors. And also, needless operation components are displayed with a faded gray. The help function presents the explanation of measuring method and operation components through Help Window. The content relates to the operation component in Parameter Panel pointed out with a mouse pointer. In an actual measuring instrument, the help function is presented with paper manuals. But, that is not ease of use in the experiment classroom in engineering education. In the virtual operation panel, this help function is superior in the operation as the content is displayed around Parameter Panel by a static text window or dynamic pop-up window.

5.   CONCLUSIONS

By the diffusion of high performance personal computers, the demand of virtual instrumentation system increases more and more in future. Then it is necessary to construct User Interfaces characterized in virtual world not only to copy the operation panel of an actual measuring instrument. The navigation system described in this paper can present the operator the chance to learn the explanation of operation components, instruments and the measuring method according to measurement object, not only the operation method. This circumstance enhances user's desire to measurement system and realizes the efficiency measurement without errors.

REFERENCES

[1] L. Volaitis, J. Dumas, E. Mastoras, "Comparison of the productivity by the programming language for the test application, LabView, HP VEE and C/C++", American Institutes for Research, 1997
[2] National Instruments General Catalog 2000, "The Measurement and Automation"
[3] Hewlett Packard General Catalog 1999, "Test & Measurement"

AUTHORS: Ass.Prof. Dr. Shigeru TAKAYAMA, Prof. Dr. Komyo KARIYA; Department of Electrical and Electronics Engineering, Faculty of Science and Engineering, Ritsumeikan University BKC;
Noji, Kusatsu, Shiga 525-8577, JAPAN
Phone: Int.+81-77-561-2685, Fax: Int.+81-77-561-2663, E-mail: s-tkym@se.ritsumei.ac.jp