



CONSTRUCTION OF THE MONITORING, PROCESSING AND LOGGING SYSTEMS SUPPORTING FOR MANAGEMENT, OPERATION AND MAINTENANCE OF THE DALAT REACTOR CONTROL SYSTEM

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ABSTRACT: From 1/2002 to 12/2003, We implemented successfully a project, entitled "Construction of the monitoring, processing and logging systems supporting for management, operation and maintenance of the Dalat reactor control system" under the assistance of the Ministry of Science and Technology. Its main results such as Testing Apparatus based on microcontroller for all functional boards of the Control Logic System of the Reactor Control System (RCS), Technical support CD -- ROM for Process Instrumentation System, software for logging automatically information from important systems of the RCS through LAN, program for failure management of Process Instrumentation System have been playing an important role for observation, operation support, maintenance of the RCS.

Through this project, the implementation group has grown up rapidly. The control and instrumentation group has been provided with some modern equipment, electronic components, and materials for maintenance work and research development in the years to come.

This paper presents typical results and discussions on our project.

INTRODUCTION

The Dalat Reactor Control and Instrumentation System consisting of:

- The Process Instrumentation sub-System (PIS) whose function is to measure and record technical parameters for controlling the reactor.
- The Neutron Flux Control sub-System (NFCS) for controlling thermal neutron flux.
- The Control Logic sub-System (CLS) has the mission to elaborate signals for controlling or scrambling the reactor.

Was designed, manufactured by former Soviet Union and has been put into operation since November 1983 with no considerable reconstruction or modernization.

After nineteen years of reactor operation, the RCIS has revealed ageing and obsolescence with rising up of failure frequency. As its components and equipment were produced in 70's decade, it was hard to find them out on market; the maintenance work became very difficulty. Besides, many completed parts and devices are taken off from production nowadays. As a contribution to solve difficulties in management of operation and supporting for the maintenance work, since January 2002, the Ministry of Science and Technology has approved a two – year project on "Construction of the monitoring, processing and logging systems supporting for management, operation and maintenance of the Dalat reactor control system".

This report will devote to the main following parts:

1. Project objectives

2. Typical results and achievements

3. Conclusions

PROJECT OBJECTIVES

The project has the following objects:

1.1. Construction of the testing, monitoring, processing and logging systems based on new electronics technology in order to support efficiently for the management, operation and maintenance works of the Dalat reactor control system.

1.2. Construction of a new network system of the RCS and user - friendly software for utilization of the reactor data by multiple personal computers via LAN, supporting a wide range of reactor works including operation, maintenance and management.

1.3. Development of the advanced software for operation and maintenance management.

1.4. Construction of a new strict technical management regime, which has to meet safety requirement, for PIS. It comprises regular maintenance work, systematic check-up of all reactor systems before operation, operator training and qualification and frequent shift inspections. This will allow the RCS to exhibit excellent performance in its operation both in reliability and safety.

TYPICAL RESULTS AND ACHIEVEMENTS

2.1. Installation of the computer room for the RCS (see Picture 1)



Figure 1: The computer room of the Reactor Control System

2.2. Construction and putting in to operation of the RCS' LAN. It comprises a Process computer (located in computer room), a computer used for design, testing and software development and computers of the RCS.

2.3. With the *Area Monitoring System and the Protocol system*, Improvement of the existing software in order to log information under type of Access database. Programming software for the purpose of saving data automatically via LAN with periodical record.

2.4. The Protocol System was developed to meet new requirements such as adding 30 digital input signals from the CLS, saving automatic data to process computer via LAN. For this purpose, its software was newly written by Visual C++ 6.0 language. At present, its main functions are as follows:

- To gather process input signals from PIS and CLS such as flow rate of primary and secondary cooling water loops, temperature at five places in the reactor tank and at the inlets, outlets of the heat exchanger, water level in the reactor tank, top and bottom positions of the control rods and so on, and to convert them into engineering data with their reliability validation;
- To display the process data with digital and graphic form on CRT display, storing periodically them in to one file, recording information on the position change of control rods at once in to another file. These files are stored not only in private hard disk but also in process computer via LAN, supporting a wide range of reactor works including operation, maintenance and management.

2.5. Design and construction of a testing apparatus (see Pic. 2) for functional boards of the CLS (137 boards of 11 different ional types of function). It was designed base on microcontrollers PIC 16F877 interfacing to PC by RS 232 port. The controlling software is stored in PIC' flash memory and the main program is written in Visual Basic 6.0. Using this apparatus, we carried – out quickly and exactly to check all operating and sparring boards of the CLS. This is the first time since it has been put into operation, we can do that. The main testing results can be summarized as follows:

- Average testing time for every board is reduced from about 2 hours to 10s.
- Failures of the tested boards are indicated detail and clear.
- The testing apparatus is also useful in a wide range of other Applications.
- The operating status of the CLS is very concerned. It is very imperative to offer active plan order to ensure reliable and continuous operation of the CLS.

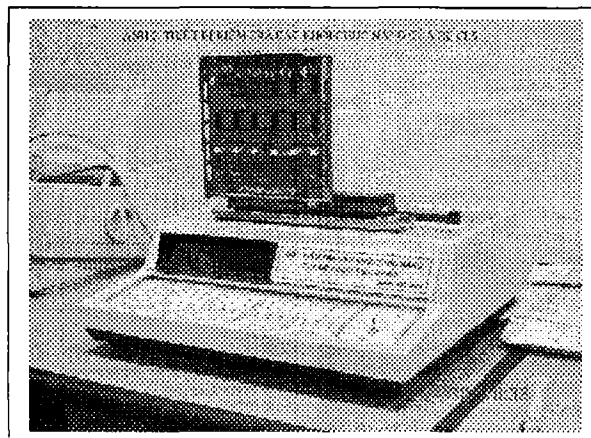


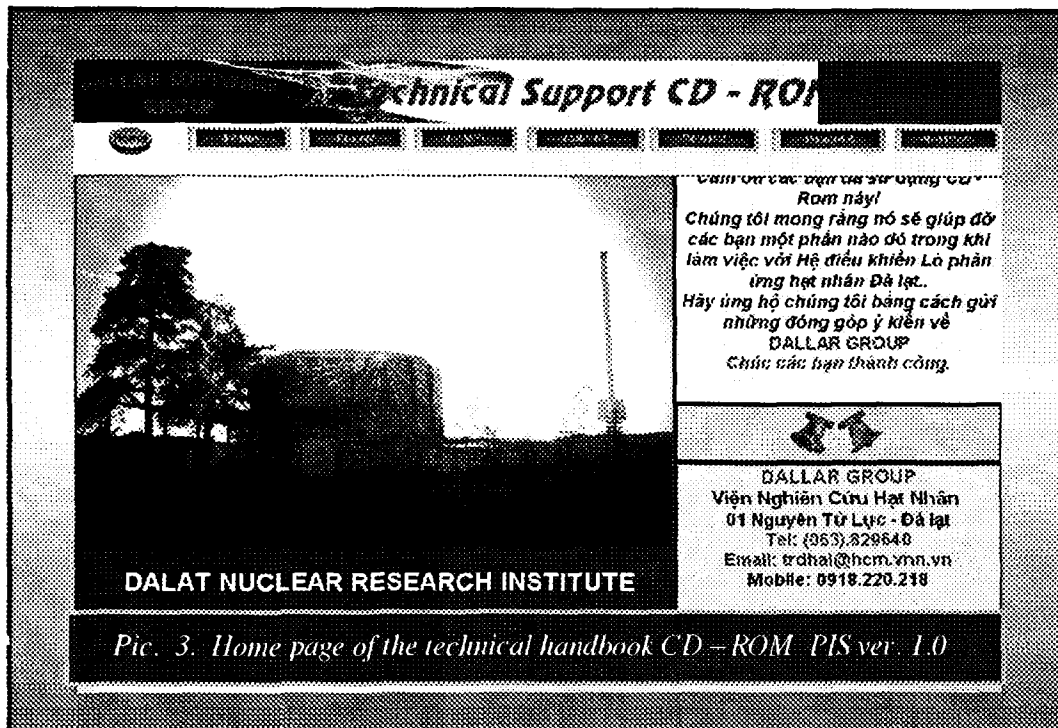
Table of testing result for the operating functional boards of the CLS
(With failure boards only)

Order	Sub system/board name	Not corrected functions	Order	Sub system/board name	Not corrected functions
1	BAZ1		6	BAR3	
	CAZ1	19 ^(*) /B2		CBC1	18, 19
	CBC5	18, 19, 20, 21		CBC3	20, 21
	CBC6	18, 19	7	BAZ	
	CBC7	16, 17		CCC3	11
	CBC10	4, 17		CCC4	9, 10
2	BAZ2		8	BKC	
	CAZ2	4, 5, 49, 50, 75, 76		CBU2	1,18,19,20,21, 49
	CBC1	2, 10, 14, 22, 23		CCC2	22
	CBC3	4, 17		CCC3	22
	CBC6	24, 25			
	CBC9	10	9	BKC1	
BAZ3		CBC4		10, 12, 23, 25	
CBC4	14, 15	CBC6		4, 5	
CCB9	10, 11	CKC3		1,20,21,22,23,31,32	
3	CAZ1	1	CKO1	1	
	BAR		10	BKC2	
	CCC1	27, 28, 29		CBC2	8, 21
	CCC3	30		CBC3	24, 25
5	BAR1			CBC4	3, 15
	CBC2	12, 14		CCC1	21
	CBC3	14	11	BKC3	
		CBC6		3	
		CKC2		20, 4, 31, 32	

^(*) Fault codes

2.6. Programming the failure management software using Access 2002 for the PIS. This software allows us updating or retrieving all data related to operation, maintenance, repairing and management of the PIS.

2.7. Design and construction of the technical handbook for the PIS. This handbook was written under electronic documentation. It is concerned with all of sub systems/apparatuses of the PIS such as installed position, design schema, wiring connection diagram, calibration method, and related documentations and so on. This handbook has been supporting not only for the maintenance/calibration works to become fast and convenience but also for training of manpower working in our group. Its home page is shown in Pic. 3.



Pic. 3. Home page of the technical handbook CD - ROM PIS ver. 1.0

CONCLUSIONS

2.8. The project implementation was carried out timely as planned.

2.9. The results obtained are very useful in a wide range of the Dalat reactor operation and exploitation including maintenance/repairing and management works on the RCS.

2.10. Through this project, the control and instrumentation group has grown up rapidly. A lot of modern equipment, electronic components, materials research development in the years to come were provided.

REFERENCE

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2. Trình Đình Hải – Technical documentation of the Protocol System.

1.3 - Nuclear Methods

