SPS ACCESS CONTROL SYSTEM : A NEW USER INTERFACE

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Abstract

This document describes the project to implement at CERN new trends in industrial control systems and integrate new requirements and functions requested by users. This project will be the testing ground for the specification of procedures in the Access Control and Machine Interlock of LHC. The last modification in the Access Control System to the primary beam areas was made in 1995, and this new project is to improve the fields of personal security, access security and the introduction of modern communication networks used in the industrial control systems. Inside the cycle model of project life, it is at the present time in the test phase in terms of security and exploitation inside the Accelerator Decelerator (AD) project. The presence of Authorization Management System (AMS) to guarantee the automatic information distribution of authorizations to controlled areas is in line with this project.
1 INTRODUCTION

The safety of personnel entering the accelerators, which involves radiation risk, is provided by the Access Control System that conforms to the following rules:

- All equipment related to beam circulation can only operate when nobody is inside the machine.
- Personnel are only allowed to enter the machine when dangerous beam circulation equipment is not in operation, radiation is at a safe level and has the Group Leader In Matters Of Safety (GLIMOS) authorization.

Considering the above rules and the related consequences, the design of the Access Control System consists of two complementary functional blocks: the Access and Search Interlock System (A&S) and the Machine Interlock System (MIS).

The purpose of the SPS A&S is to control the different items of access equipment (doors, separating grids, shielding doors, etc.) of the various buildings and sectors of the tunnel.

2 CURRENT ARCHITECTURE

2.1 Equipment

In general, the present systems of access have a complex structure (Fig. 1). The complete Access Control System of the SPS is based on the integration, at the ‘Safety Desk’ level, of the A&S and MIS.

The A&S and MIS have the same logical structure, based on local PLCs (managing local interlocks) which communicate to a central controller (managing central interlocks) through dedicated SINEC L2 branches.

The global system is also equipped with a dedicated ‘Service Network’ based on RS232 protocol, connecting the master controller to PCs into the local sites. This network is used to distribute the access database.

The main characteristics of the system are:

- 130 access elements (doors, grids, turnstiles, key distributors, search boxes, etc.),
- 600 keys (access and safety keys),
- 15 film-badge readers (Bar Code reader),
- 50 items of accelerator equipment (magnets, RF systems, dumps, etc.) for interlock functions,
- 26 Siemens S5-115-U PLCs,
- 1 SINEC H1 network,
- 6 SINEC L2 networks,
- HP-UX FactoryLink application software.

The system operator supervises the access system on workstations connected to an HP server running FactoryLink. This server is connected via the SINEC H1 network to the master PLC.
The central controllers exchange summary data with a master PLC located within the ‘Safety Desk’ of the SPS control room (PCR) using the SINEC H1 protocol. The master controller manages the integration of A&S and MIS through the ‘resultant master interlock chains’.

The flow of information, through SINEC H1 and L2, can be summarized as follows:
• The central controllers receive ‘commands’ from the FactoryLink supervisor and dispatch them to the local controllers;
• The central controllers receive ‘statuses’ from local controllers, dispatch them to the HP and process them in order to provide their corresponding resultant interlock chains to the master controllers.

Each system has its own hardware redundancy for data exchange between local, central and master controllers.

3 DISADVANTAGES AND INCONVENIENCES IN PRESENT SYSTEMS

3.1 Access database

In current systems, the access database is updated only once a day because the database transfer is performed by a modem at 9600 kb, and during this time (around 15 minutes per point), the access point cannot do normal operations, and the normal access is stopped.

It is impossible to check the database in access points because the file is binary and there is no software to edit or confirm the validity to enter of a specific user.

3.2 Identification and online help to users

For radiation protection, the users are provided with film-badges. To enter radiation-risk zones, it is mandatory to have a badge; in its bar code, only the CERN ID number of user and not the name is written. The current systems cannot know the name of the users and only the numbers are shown in end-user applications.

The operators are not informed when a user has a problem, and the only information possible is transmitted by an intercom system installed in each access point.

3.3 Exploitation functions

The present programs running in the local PC, exploitation systems and PLCs programs were made by an external company which did not leave any documentation in order to make changes in the process system, user interface, etc.

4 NEW PROPOSAL

The careful analysis of requirements indicates the type of solution we should look into. In order to implement all the functions and needs of users and exploitation system it is imperative to

• eliminate the current network diversity (SINEC L2, RS232, H1, Ethernet, and Twisted Pair), see Fig.1;
• provide a same user interface.
4.1 Hardware modifications

The main modification is to replace the current H1, Twisted Pair (TP) and RS232 by one Profibus bus. We gain speed in the case of TP and RS232 and in the case of H1 we have advantages with a fixed-speed communication.

In addition, the present systems of PC (386) with Serial Links are eliminated and replaced by PC Pentium or HP Lite with real-time hardware.

In order to link the present PLCs it is necessary to attach a Profibus Card to the S5 systems, or incorporate S7 systems with a capability of direct connection.

With these modifications we reduce the time of maintenance, error identification and costs of new installations. The new proposal is shown in Fig. 2.

![Figure 2: New system of SPS access system.](image-url)
4.2 Software modifications

The main modification is to eliminate the current software in the local stations and to replace it by LabView. This adds the capability of easy modifications, remote controls, to access real-time databases with Structured Query Language (SQL), user-friendly interface etc. LabView has the capability of using TCP, Serial, and Profibus devices.

Other important software modifications are in the HP; the current software with Factory Link has showed important errors and difficulties in modifications. One alternative to this software is DataView, but this modification is not in the scope of this paper.

We need to make some modifications to the PLC software to adapt it in address, etc.

5 CONCLUSIONS

Industrial control systems could now be unified using appropriate technology and modern tools. Using fieldbuses we may lose some speed, but we will gain in security and performance. All techniques and solutions described could be adapted for all the systems with needs of data transmission in industrial environments.

Bibliography