REMOTE TOGGLE ON/OFF OF SLOW CONTROL SYSTEM CABINET RACKS AT JINR ACCELERATOR COMPLEX NICA*

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Slow Control Systems (SCS) are electronic systems that are used to setup, monitor and enable operation of complex hardware for physical experiments. Detectors MPD (Multi-Purpose Detector) and BM@N (Baryonic Matter at Nuclotron) at NICA (Nuclotron-based Ion Collider fAcility) complex are some implementations of this system. For the purpose of this machinery, it will be necessary to simultaneously operate on either 64 or 128 cabinet racks. It is required to design a software that controls the system remotely because of hazardous environment for humans as there will be strong radiation and electric field.

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1. Introduction

Both MPD and BM@N detectors are still under construction, but it is predicted to be 64 to 128 cabinets and size of one rack is $1000 \times 800 \times 42\,\mathrm{U}$. Such setup utilizes slave/master [1] configuration and is scalable which allows to create the base software before it is completed. Because of substantial size of the whole setup and SCS itself, ability to have remote access is a crucial feature.

The other aspect that plays a huge role is reliability — in order to start the system, it is necessary to prepare the vacuum and very low temperature [2] for elements that are being used in NICA [3] complex. It takes a long time and is expensive. Because of it, we had to foresee how the development of the whole system may go and adjust it accordingly.

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The program for the purpose of turning on/off and monitoring the basic parameters is written in graphic programming environment LabVIEW. NI PXIe 8880 is the controller for master racks and NI cRIO 09039 is the controller for slave racks. The created program, turns on/off and monitors the basic parameters of the racks remotely.

For NI PXIe 8880, there are two different approaches. One is by providing specific voltage to the two pins located at the rear of the device. The other one is by using windows function called WOL (Wake On Lan) [4] which sends a magic packet of 6 bytes of all 1s followed by 16 repetitions of the MAC address for the controller you want to wake.

2. Results

The following program allows us to turn on/off the racks remotely. In order to reduce the number of external devices, it was decided that WOL is a better option than providing voltage. For shutting down, it was decided that windows console and the "shutdown" command will be used because of its simplicity and reliability.

The racks now can be accommodated altogether or separately. The program was initially created for 4 racks but it is modifiable to add more racks.

The final program is divided into two different password protected panels. Run Panel (Fig. 1) is for simple operations with predefined configuration.

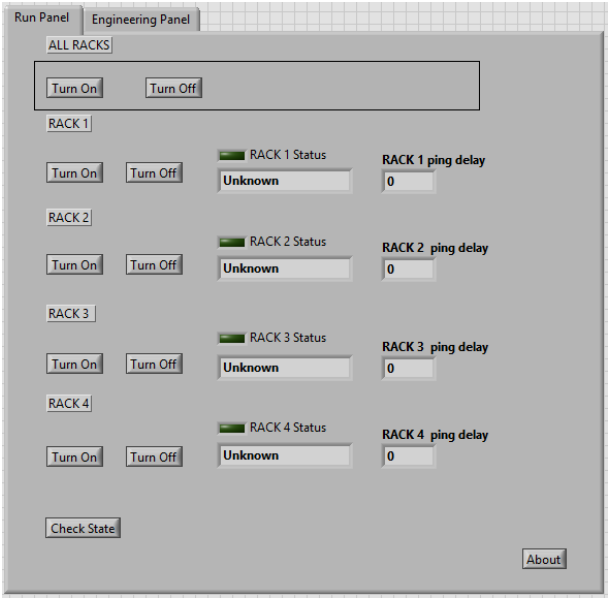

Fig. 1. Run Panel with lower level of security and without availability to set crucial parameters.

It allows easy turn on/off of those racks. After clicking check status, the program simultaneously checks the state of all racks using ping function in the windows console. For convenience and further development, delay time of every ping and timeout can both be adjusted in Engineering Panel because of every network's different arrangement. It is designed to be used for a non-qualified worker and it also prevents the user from any accidental changes. However, Engineering Panel (Fig. 2) allows to input and, what is more important, save and load every rack data. Last but not least, for such a considerate setup size, a delay of turning on all the racks is unavoidable. This amount of electrical devices needs to be turned on and off one by one. Due to a variety of options, setup can be both saved and loaded from a specified XML file.

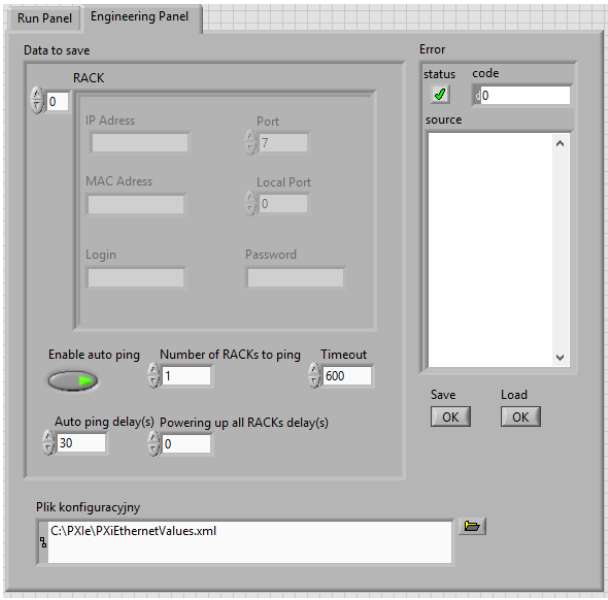

Fig. 2. Engineering Panel with higher level of security and ability to adjust all parameters of the program.

3. Conclusions

For now, prototypes of four racks are built, hence it is decided to keep the software also for this amount of racks and to utilize the benefit of modularity of SCS for further development.

Both software and hardware need to be designed thoroughly. Mainly, it is required for it to work for ten years, so all the accepted solutions can be reapplied in the event of any change or adjustment of the whole machinery.

The next step in developing this program and making the control more remote is setting up the VPN (Virtual Private Network) which will allow its control from the outside of NICA complex, thus including more people to further develop the software and also collect acquired data. Moreover, the delays of turning on and off can be more automatized by indicating them to run after the previous has been toggled instead of manual delay time input.

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