

A SIMPLE DAQ SYSTEM BASED ON LABVIEW, PHP AND MYSQL

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Abstract

A tiny and simple DAQ system has been designed and developed for the application to the control system in our institute. This DAQ system is based on on LabView, MySQL and apache, and shows good compatibility with LabVIEW-based system like the control system for the FFAG complex in our institute. The current status for the development, as well as the recent accelerator-related status in our institute, will be introduced.

INTRODUCTION

An FFAG accelerator complex[1, 2, 3] has been developed as a proton driver for the feasibility study on ADS performed in the research reactor institute, Kyoto University. The control system for this FFAG accelerator complex has some requirements on the flexibility, simplicity and reliability. The control system is required to have a sufficient flexibility towards major and minor modifications in the design and equipments of accelerator complex during the construction, and to achieve a certain level of easiness on its use and development for the people in our institute, who are little familiar to accelerator itself. Additionally, high reliability and stability from the points of the nuclear safety and the radiation protection are required since the combined operation with a nuclear fuel assembly is planned in the feasibility study on ADS.

To meet such requirements for the present control system, we have developed a control system [4] based on LabVIEW, known as its user-friendly GUI environment, and PLC known as one of the most reliable control devices in the field of factory automation. This control system for the FFAG complex has proven itself to have sufficient performance and to satisfy the requirements on the design through the construction and operation of the FFAG accelerator complex, in its operation for years. Based on this success, this control system has been applied to other equipments and facilities. One of such typical examples is that the application to the pneumatic transportation facility in KUR[5].

On contrary to the control system itself, little efforts have been made for the data acquisition system up to now. In most of the application cases, a simple data logging feature is included in VIs by using the functions of LabVIEW such as the chart VI. As the increasing demand on the systematic management of the data for the multiple devices and on the simplified method of DAQ for the users, we have started the development of a DAQ system for our control system.

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In this paper, the outline and current status of our DAQ scheme are introduced.

DAQ SYSTEM WITH ODBC DRIVER

At present, the FFAG accelerator complex in our institute is under modification to the injection scheme using H^- beam. The FFAG injector will be replaced to an 11 MeV H^- proton linac by the end of the fiscal year 2010. Additionally, the inclusion of the present control system to a new control system based on EPICS, intending to the inclusion of this FFAG accelerator to a larger accelerator complex for the pulsed neutron source. Therefore, the main application of the control & DAQ system for now is the devices and instruments equipped to the 5 MW reactor, especially the pneumatic transportation facility for the neutron irradiation [5].

The outline of the pneumatic transportation apparatus and the control system is shown in Fig. 1. The control system for this pneumatic transport system is the same architecture as that for the FFAG complex [4]. The low level sequences of PLCs for controlling the pneumatic transportation system has been implemented in PLCs, and the man-machine interfaces (MMIs) are developed with LabVIEW on conventional PCs. In addition to the controlling system of the pneumatic transportation apparatus and the monitoring system, related external systems such as radiation control systems and measurement systems for experiments are integrated. This integrated system might well be able to realize secure operating and management of the pneumatic transportation apparatus.

In this pneumatic transport system, a DAQ system based on the ODBC driver, LabVIEW and MySQL is developed. So called, a "SQL Command Generator" VI is implemented into every MMI PC as a sub VI of MMI VIs. Since

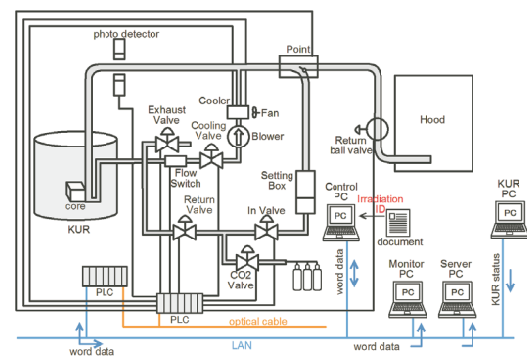


Figure 1: Outline of the pneumatic transportation apparatus and the new control system.

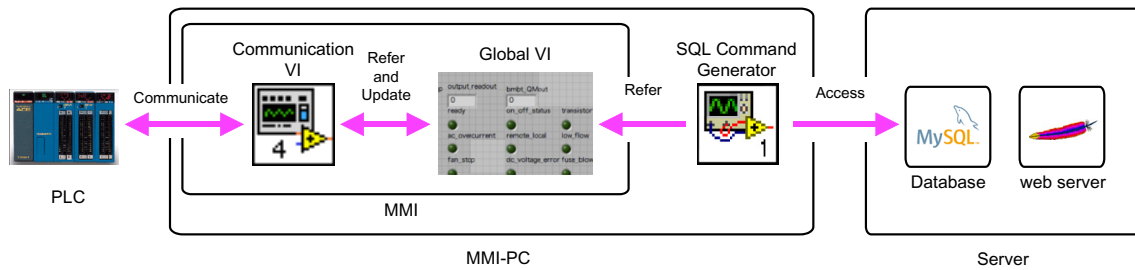


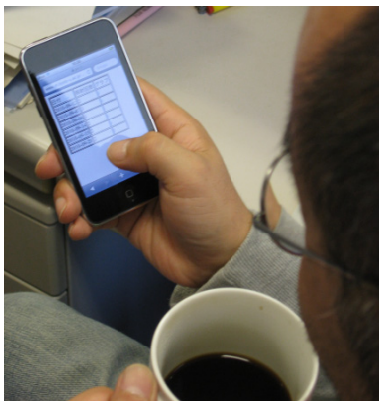
Figure 2: Architecture of the DAQ for the pneumatic transport system at KURRI. The DAQ software is implemented as a sub-VI to the existing MMI software for the control system. All the parameters are stored in the MySQL database and these data are available to users through the web server.



(a) Start page of the data browsing.



(b) A typical example of data browsing stored in the SQL server. In the present data browsing system, the graphs are generated by “PHP/SWF Charts” available from maani.us[6].



(c) Registered users are allowed to browse the status via conventional web browsers.

all parameters are expanded on the global VIs in MMI PCs in this control system, each implemented SQL Command Generator VI obtains the status and information of connected devices by referring via respective Global VIs, and send the SQL command by use of a MySQL ODBC driver to pass the data to the remote MySQL database server. The database server stores and manages various data, such as the start/stop time of irradiation, the pressure of CO₂ gas in the transport tube and the radiation levels in the pneumatic transport facilities, on a database constructed on a MySQL server.

For the access by users to the data stored in the respective database, Apache, which is the most popular web server application, is also installed in the server. The stored data can be accessed through the internet using common web-browsers installed in PCs or recent mobile phones (Fig. 3). Accessing logged data over the internet and receiving warning messages by e-mail are enabled in the developed systems.

DAQ SYSTEM WITH POST METHOD AND PHP

The present DAQ system for the pneumatic transport system works quite fine, but the application to other facilities are not straightforward because of the direct implementation of ODBC drivers into MMI software. This procedure requires the developers to handle SQL commands for the DAQ system. For example, once a developer decides to add another parameter to be recorded, they have to treat additional SQL commands.

In the common web-based services, the parameters in these services are often send along with their names by POST method, and processed by php scripts and stored in databases on SQL servers. In the control systems in KURRI, allocation tables for the parameters are defined and each parameter can be uniquely assigned by the names of the equipment and its respective parameter. Therefore, we are able to apply such conventional POST method procedure to our DAQ system.

The architecture of the php-based DAQ system being currently developed is shown in Fig. 4. This DAQ VI obtains all of the parameters from PLCs in the same commu-

Figure 3: Screen shots of the web-based data browsing system.

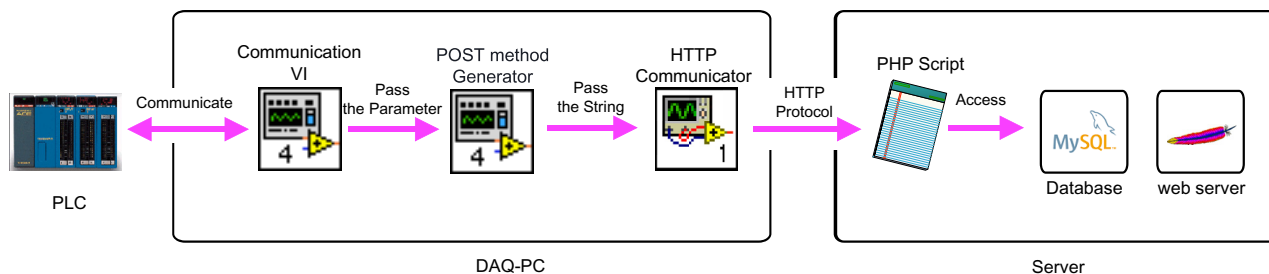


Figure 4: Architecture of the php based DAQ system developed at KURRI. Unlike the present DAQ for the pneumatic system, this DAQ system works as a stand-alone software. The web server is used not only for the data browsing by users, but also for processing the data transfer based on the HTTP protocol.

nication procedure as the communication VI uses. Then the parameters are converted to a set of chunks, in which the device name, parameter name and its value are sequentially listed. This DAQ VI also accesses a web page on an remote web server, in which the php script for the data processing is implemented. The data is then transferred by the POST method, and processed by the php script based on their assigned names to be stored in a table on a MySQL database. One table is usually prepared on a MySQL database for each device, and the proper tables are selected by the name of devices given in the is usually prepared by the equipment base. As long as the developers follows the same allocation table as used in the control system, the parameters can be stored without any initial settings except creating a corresponding table on a database with this scheme.

CURRENT STATUS

As for the DAQ systems discussed above, the DAQ system for the pneumatic transport system has been served for the actual experiments of neutron irradiation as soon as our 5 MW reactor resumed the operation in June 2010, and no troubles arising from the DAQ system are reported up to now. The php-based system has been almost finished the evaluation period, and the actual implementation is expected soon.

As for our institute, another accelerator project may be expected in near future. Recently, our research project “Promotion of Leading Research toward Effective Utilization of Multidisciplinary Nuclear Science and Technology”, which has the construction of an accelerator-driven neutron source as the key facility, is included in the list of recommended large projects to the Japanese government. This means we may have a possibility to build another proton/heavy ion accelerator with its energy of 30 ~ 100 MeV in our institute. We have started the re-organization of the developed VIs and ladder sequences for our FFAG accelerator complex and other equipment in our institute, as well as the training of the technicians in our institute for the expected developments on the control system.

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