§32. Web Based Experimental Management System

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To realize smooth procedure of routine works related to the LHD experiment, for example, the approval of the experiment proposal, or publish of daily experiment summary, the authors have developed the Experiment Scheduler for the LHD experiment (Fig.1). Because this is a web based application and the web pages are written only by standard HTML and JavaScript, the user can use ordinal browsers, such as Internet Explorer or Firefox, to use the application without installing any other software components.

When the leaders of the theme groups propose their experiment, they have to submit the proposal in advance and must be approved because the proposed experiment configuration might cause damage to the instruments in the vacuum vessel. Therefore, they have to attach the results of the particle trace simulation in the vacuum vessel with the proposal. Then the manager of the experiment will accept or reject the proposals. The person in charge also makes a daily schedule sheet. It has a fixed format. Filling the required fields of the form in the web page, the sheet is produced as a PDF file and is published in the web server. After the experiment is done, the leader uploads the summary report of the experiments, and this is also published in the web server. Figure 2 shows the activity diagram of this system.

The system is built using Ruby on Rails, a framework of web application written by Ruby[1]. Depending on the situation, the web page changes their contents dynamically, this interactive behavior is realized by AJAX[2] (Asynchronous JAvascript and XML). Generally, it becomes difficult to develop AJAX based applications because the developer has to use several computer languages at the same time, for example, perl for the server side programming and JavaScript for the client side. However, because Ruby on Rails encapsulates JavaScript and enables the developer to use only Ruby, it is easy to realize AJAX. Another benefit to use Ruby on Rails is it simplifies the database accesses. Ruby on Rails provides ActiveRecord. By ActiveRecord, the data conversion from the relational database to Ruby is automatically achieved just by following the naming convention, for example, the plural form for the table name and singular form for the corresponding Ruby class. Because this application must use the relational database to store the status of the procedure and the location of the contents, this function helped the authors to develop the application. Usually, Ruby on Rails application is run from light web server, such as lighttpd or mongrel. However, in order to coexist with the existent apache server, passenger module is used to run the Rails application.

Because the LHD experiment has been done by the cooperation with the researchers of other institutes, there is a request to use this system outside NIFS. However, because of the security reasons, it is difficult. This service permits users uploading and modifying the contents. This means that malicious users can alter the contents to upload the harmful software such as spyware or viruses. This system uses basic user authentication mechanism, but this is mainly for the privilege control and to prevent from modifying other users' content, and it isn't sufficient to prevent from malicious attacks. If this system is placed in public area, stricter authentication system is required. However, it ruins the usability of the system. Therefore, for the time being, in order to use the system, the user has to connect to LHD-LAN using VPN.

Fig.1 Experiment Scheduler

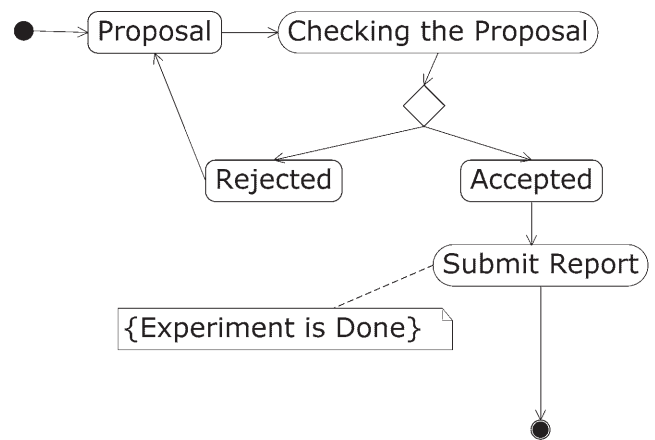

Fig. 2 Activity Diagram of Experiment Scheduler

1) http://www.rubyonrails.org/
2) http://www.adaptivepath.com/publications/essays/archives/000385.php