

## ePlanner SOFTWARE FOR MACHINE ACTIVITIES MANAGEMENT

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### Abstract

For Indus-2, A 2.5 GeV Synchrotron Radiation Source, operational at Indore, India, the need was felt for software for easily managing various related activities for avoiding communication gaps among the crew members and clearly bringing out the important communications for machine operation. Typical requirements were to have the facility to enter and display daily, weekly and longer operational calendars, to convey system specific and machine operation related standing instructions, to log and track the faults occurring during the operations and follow up actions on the faults logged etc. Overall, the need was for a system to easily manage the number of jobs related to planning the day to day operations of a national facility. The paper describes such a web based system developed and in use regular use and found extremely useful.

### OVERVIEW

Indus-1 and Indus-2, the Synchrotron Radiation Sources (SRS) at RRCAT Indore are national facilities operated round the clock to provide synchrotron radiations to users as well as carrying out machine studies. The concerned groups among which good information communication is considered essential include the beam line users, the operation crew, the machine sub-system experts and the management. Keeping sync among various groups is important and necessary for effective management of various activities and smooth running and utilisation of the facility. Large number of sub systems and frequent changes often required in various systems also call for effective monitoring of the system changes and communicating the same to all concerned. The Eplanner software was conceived to minimise various difficulties faced in day to day operation of this facility.

### SYSTEM REQUIREMENTS

Based on the previous experience and the feedback received from various system experts and machine operation crew members following basic requirements were considered before developing the ePlanner software:

- (1) It should be possible to use the software by multiple users simultaneously connected over campus network.
- (2) The ePlanner should be easy to use for especially non computer experts.
- (3) Only authenticated & authorized users should be able to use the specified modules of ePlanner. However it should be possible to get the logged data without authentication in read only mode.

- (4) It should be possible to query & retrieve the specific information from stored historical data in chronological order.

### SOFTWARE DESCRIPTION

Access to ePlanner has been protected with password so that only authenticated users could use the system. Each Section of ePlanner has different user group. System checks user's credentials using institute's central e-mail server. Hence users may use the software using their official e-mail login and password. This approach was adopted to avoid storing duplicate credentials for same person. Essential functions of ePlanner are depicted in Figure 1. ePlanner provides functionalities for Work Plan Management, Machine Shutdown Management, Beamline Booking Management, Standing Instructions Management, Electronic Notice Board (eNoticeBoard) and Information Display.



Figure 1: ePlanner Functions.

It is felt by Indus operation crew members that Indus Fault Logbook (FLogbook) which is a separate application used for tracking the details of faults occurring during round the clock operation of Indus-1 and Indus-2 should be merged with ePlanner so that all the information could be managed from a single software package.

### Data Input

Using HTML & JavaServer Pages (JSP) ePlanner provides the form (having text boxes, check boxes, drop down list, etc.) for entering/logging the related information. Logged textual data with attached document (if any) may also be sent immediately to system persons concerned through e-mail. A unique log-id is generated

for each logged entry so that historical data could be diagnosed in future by its log-id.

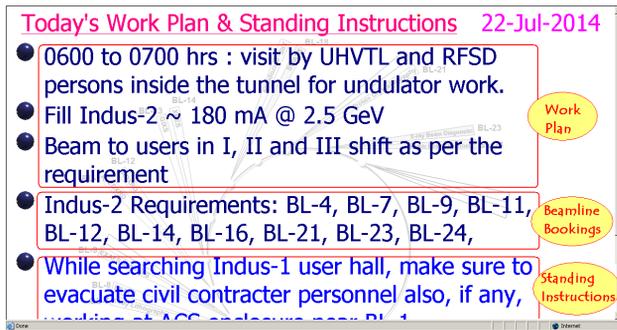


Figure 2: Information generated as per prescheduled work plan, beamline bookings and Standing Instructions.

### Data Output

ePlanner provides query forms for retrieving the logged historical data in chronological order. Some customized web pages have been designed which display the auto refreshed data from different tables of ePlanner database. For example as shown in Figure 2, data are being displayed from work plan system, beamline booking system and standing instructions system. These pre planned information are date wise stored in ePlanner database by machine coordinators/shift in-charges, beamline users and system experts.

Feature has been provided by the software to log comments on selected specific historical faults and email it to selected concerned persons. If needed the designated authorized person may delete the unwanted duplicate entries within the specified time limit.

### Software Design

Java Server Pages (JSP), JavaBeans and SQL databases have been used for designing & developing the various components of ePlanner. JSP with JavaBeans are used for developing the applications for web based environments. Java is main programming language used here for developing the complete ePlanner package.

## SOFTWARE ARCHITECTURE

The ePlanner Software follows the three-tier software architecture for designing & executing its building blocks. Here Web Browser resides on client machine and work as first tier or client tier. In our working environment we mainly use Microsoft Internet Explorer (IE) for accessing the web sites and web based applications hence we have developed and tested the ePlanner for IE users. ePlanner uses JavaServer Pages (JSP) & JavaBeans for developing the presentation/view and business/application logic. JavaServer Pages (JSP) technology enables Web developers and designers to rapidly develop and easily

maintain, platform independent, information-rich, web applications that leverage existing business systems.

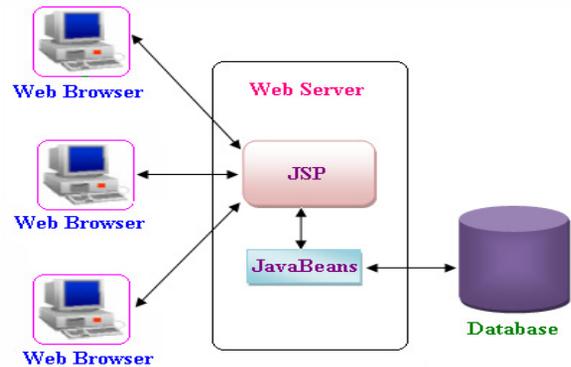


Figure 3: ePlanner Architecture.

JSP technology separates the user interface (content presentation) from content generation, enabling designers to change the overall page layout without altering the underlying dynamic content. Tags for content *access and presentation* reside in the webpage. Logic and programming code for content *generation* reside in reusable components. After receiving the client request, the JavaServer Page requests information from a JavaBean. The JavaBean can in turn request information from a database (Figure 3). Once the JavaBean generates content, the JavaServer Pages can query and display the Bean's content. JavaBeans components (beans) are reusable software programs that we can develop and assemble easily to create sophisticated applications.

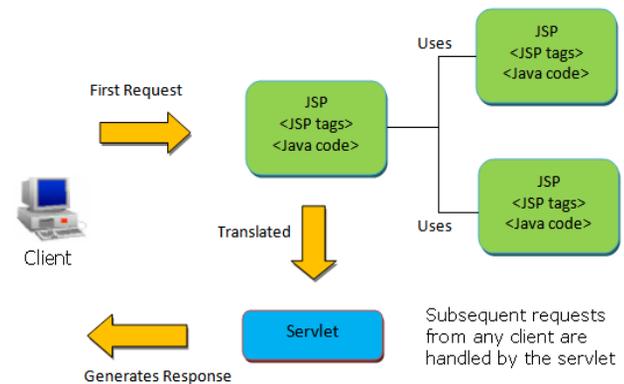


Figure 4: Execution of a JavaServer Page (JSP).

ePlanner uses JDBC (Java Database Connectivity) inside JavaBeans components for accessing the ePlanner database for inserting & retrieving the data.

The Type 4 Driver for JDBC has been used which provides JDBC access through any java-enabled applet, application, or application server. It delivers high-

performance point-to-point and n-tier access to SQL database across the internet & intranets.

The JavaServer Page is identified to the server by a *.jsp* extension; this tells the server that special handling is required. As shown in Figure 4, the first time a request is made for such a file, the *.jsp* file is translated to a servlet & compiled into an object. (For that reason, there can be a slight delay on the first request for a *.jsp* page.) The output from the object is standard HTML which the browser interprets and displays as usual. After compilation, the compiled-page object is stored in memory on the server. On subsequent requests for that page, the server checks to see if the *.jsp* file has changed. If it has not changed, the server uses the compiled-page object stored in memory to generate the response to the client. (Because the object is stored in memory, the response is very fast.) If the *.jsp* file has changed, the server automatically recompiles the page and replaces the object in memory.

We have used Apache Tomcat as a web server for executing & serving web components of ePlanner. Apache Tomcat (or simply Tomcat) is an open source web server and servlet container developed by the Apache Software Foundation (ASF). Tomcat implements the Java Servlet and the JavaServer Pages (JSP) specifications from Oracle Corporation, and provides a "pure Java" HTTP web server environment for Java code to run. Indus fault logbook (FLogbook) uses JavaMail API for sending the e-mails composed of the information logged by the operation crewmembers into FLogbook database. The JavaMail API provides a platform-independent and protocol-independent framework to build mail and messaging applications.

Microsoft SQL Server based relational database was designed to implement the data tier of ePlanner, which stores the complete information in related tables. Information related to work plan, beamline booking, machine shutdown, etc. are stored in its respective tables. Subsystem names of both the accelerators (Indus-1 & Indus-2) and concerned persons' details are configured in the application so that logged fault information or acknowledgement/comments could be mailed electronically using FLogbook.

## SOFTWARE DEPLOYMENT

The ePlanner software has been deployed on Apache Tomcat web server configured on a separate server machine. This server machine as shown in Figure 5 is on a separate network and connected with firewall. Firewall is connected with accelerators technical network (AccNet), campus network (RRCATNet) and Large Format Display Network (LFDNet). Large Format Display Computers are connected with LFDNet and installed at various places of Indus premises for

displaying the current work plan, beamline requirement, standing instructions, notice, etc. The customized web pages have been developed for this purpose which retrieve the relevant information from ePlanner database and display (auto refreshed) on Large Format Display Computers (LFDs). The URL of the application has been mapped in DNS of the networks so that it could be accessed uniformly from the machines of all the networks. DNS Server of accelerators' technical network (AccNet) is running on Domain Controller (DC) Server machine.

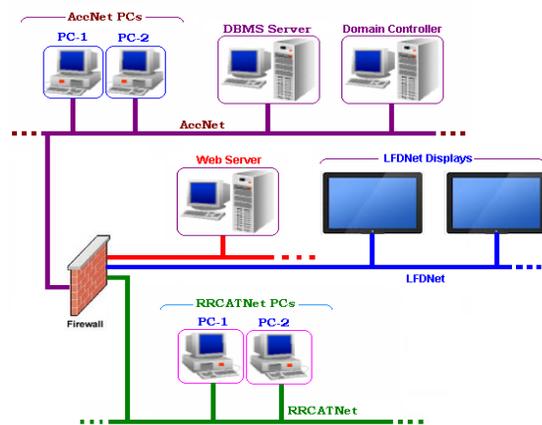


Figure 5: Software Accessibility over LANs.

## CONCLUSION

ePlanner has been deployed in the field and being used regularly for managing and monitoring the various type of day to day activities needed in round the clock operation of both accelerators (Indus-1 & Indus-2). The system is very useful for not only the accelerators operation crew members but also for machine/subsystem experts, beamline users and general visitors. The complete software was developed following the modular approach so the future enhancements could be accomplished in minimum time.

## ACKNOWLEDGMENT

This development represents the realisation of ideas of many people involved with its use. Authors acknowledge the active feedback and suggestions of the system experts involved in the regular Indus review meetings and Indus shift crew members. Support, encouragement and acknowledgement from senior management including Director, RRCAT has always been motivating.