

WEB BASED ELECTRONIC LOG BOOK FOR INDUS-2

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Abstract

Raja Ramanna Centre for Advanced Technology (RRCAT), Indore, India has a 20 MeV Microtron injector, a 450/700 MeV Booster Synchrotron, a 450 MeV Storage Ring Indus-1 and another 2.5 GeV Storage Ring Indus-2. Both the machines are national facilities and are run round the clock to provide synchrotron radiation to users as well as carrying out machine related studies.

In a multi accelerator complex like this, an effective system for electronically recording experimental data, machine status, events etc is considered essential. Considering the advantages of Internet technologies, a first version of web based Electronic Logbook (Elogbook) has been developed using HTML, JavaScript, java servlets and SQL database. This Elogbook will provide convenient way to review machine performance, help in problem diagnosis & improve communications among working teams.

MOTIVATION

The main motivation of this project is to help in effective monitoring & thus monitor and improve the performance of machines.

Indus-2 is a complex machine. It employs many sub systems, e.g. Vacuum System, R. F. System, M. P. S. System, Timing System, B. D. S. System, etc which must be running as per designated parameters to produce the synchrotron light. Varieties of computer hardware & software have been deployed for controlling each sub systems. Many computer terminals, DSOs, monitors, etc have been equipped in Indus Control Room for controlling the operation of Indus-2 remotely.

Seeing the complexities of systems & number of parameters responsible for operation of Indus-2, it was felt to have a logbook that would help electronically store all the relevant information (results, parameters, events, etc) as and when required by machine crewmembers during operations of the machines.

REQUIREMENTS

Following basic requirements were considered before developing the application:

- (1) It should be possible to use the application by multiple users simultaneously connected with AccNet (technical network) as well as RRCATNet (campus network).
- (2) The system should be easy to use for especially non-computer experts.
- (3) The information entered by the users should be precise and free of errors.
- (4) It should be possible to store the machine

snapshots at specific events e.g. at beam loss, etc.

- (5) It should be possible to view the stored information in a structured way as per different search arguments e.g. operator name, shift name, time stamps, etc.

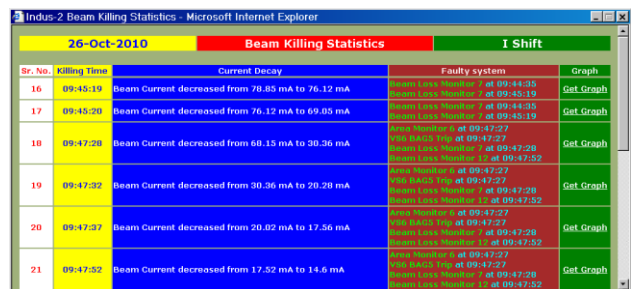
It was realized that if web based application is designed then it would not only serve the above basic requirements but also offer many new features, which would not be possible with other non-web based systems. Thus this system was conceived & developed using HTML, JavaScript, Java and SQL Database.

SYSTEM IN ACTION

Access to Elogbook has been protected with password so that only authenticated users could use the application. Function wise Elogbook may be divided into two sections, one for information logging and other for information retrieval.

Information Logging

This section provides functionalities for logging the text entries & machine snapshots at specific events. Entries to be logged include shift name, time stamp, shift aims, summary of work carried out, files saved, faults occurred, etc. With these manual entries machine snapshots which include important parameters from all the sub systems (e.g. MPS System, RF System, Vacuum System, etc.) can be at logged at machine healthy condition as well as beam loss event. Beam loss events are searched by the software automatically when beam current decays suddenly by a pre configured value e.g. 0.5 mA (**Figure 1**). For finding out the reasons of beam loss the application also searches the abnormalities seen by various sub systems at the time of beam loss event.



Sr. No.	Killing Time	Current Decay	Faulty system	Graph
16	09-45:19	Beam Current decreased from 78.85 mA to 76.12 mA	Beam Loss Detector 1 at 09-45:19 Beam Loss Detector 2 at 09-45:19	Get Graph
17	09-45:20	Beam Current decreased from 76.12 mA to 69.05 mA	Beam Loss Detector 1 at 09-45:19 Beam Loss Detector 2 at 09-45:19	Get Graph
18	09-47:28	Beam Current decreased from 68.15 mA to 38.36 mA	Beam Loss Detector 1 at 09-47:27 Beam Loss Detector 2 at 09-47:28 Beam Loss Detector 3 at 09-47:28	Get Graph
19	09-47:32	Beam Current decreased from 38.36 mA to 20.28 mA	Beam Loss Detector 1 at 09-47:27 Beam Loss Detector 2 at 09-47:27 Beam Loss Detector 3 at 09-47:28	Get Graph
20	09-47:37	Beam Current decreased from 20.02 mA to 17.56 mA	Beam Loss Detector 1 at 09-47:27 Beam Loss Detector 2 at 09-47:28 Beam Loss Detector 3 at 09-47:28	Get Graph
21	09-47:52	Beam Current decreased from 17.52 mA to 14.6 mA	Beam Loss Detector 1 at 09-47:27 Beam Loss Detector 2 at 09-47:28 Beam Loss Detector 3 at 09-47:28	Get Graph

Figure 1: Beam loss events

Multiple snapshots of machine (**Figure 2**) with comments from the crew member can be logged any time in any shift (as machines are being operated in shifts).

Indus-2 RF Status			
Station No	Cavity Gap Voltage (KV)	RF Slot Phase (Deg)	Cavity Vacuum (mbar)
Station-1	47.6	235.0	1.0E-9
Station-2	6.0	186.0	5.2E-10
Station-3	4.4	209.0	6.8E-10
Station-4	28.0	179.0	1.0E-9

Indus-2 Ring Pressure (mbar)									
Segment No	BAG-1	BAG-2	BAG-3	BAG-4	BAG-5	BAG-6	BAG-7	BAG-8	BAG-9
Segment-1	1.0E-9	2.7E-10	3.1E-11	5.8E-11	OFF	OFF	OFF	OFF	---
Segment-2	9.0E-11	4.5E-10	2.8E-11	4.3E-11	OFF	OFF	OFF	OFF	---
Segment-3	6.5E-11	1.0E-10	OFF	1.4E-10	1.0E-11	OFF	OFF	OFF	---
Segment-4	2.3E-11	3.1E-11	4.5E-11	1.3E-10	1.3E-11	OFF	OFF	OFF	---
Segment-5	OFF	4.0E-11	3.1E-11	2.9E-11	2.5E-11	OFF	OFF	OFF	---
Segment-6	3.2E-11	7.2E-11	4.2E-11	1.2E-10	1.0E-10	OFF	OFF	OFF	---
Segment-7	5.3E-11	4.1E-11	1.0E-11	---	---	---	---	---	---
Segment-8	6.0E-11	6.5E-11	1.1E-10	---	---	---	---	---	---
RF Station	1.3E-10	1.0E-11	---	---	---	---	---	---	---

Indus-2 BPM Positions									
BPM-1	BPM-2	BPM-3	BPM-4	BPM-5	BPM-6	BPM-7	BPM-8	BPM-9	BPM-10
X-Pas-1	0.184	3.792	-0.212	-0.453	1.316	0.500	0.404	-0.288	-3.976
Z-Pas-1	0.419	0.887	-0.10	-0.02	-0.074	0.1	-0.48	0.107	3.113
BPM-11	BPM-12	BPM-13	BPM-14	BPM-15	BPM-16	BPM-17	BPM-18	BPM-19	BPM-20

Figure 2: Machine snapshot

Information Retrieval

This section provides functionalities for searching & retrieving the information logged in Elogbook relational database by the crew members during operation of Indus-2. For minimizing the errors, information query form has been designed using the drop down lists for selecting predefined query arguments. User can query the information according to shift name, physicist name, shift in-charge name or date. The searched information is displayed in chronological order with link to machine snapshots.

CONCEPT

The system follows the three-tier software architecture where Web Browser, Java Servlets and DBMS Server reside on client, middle and data tier respectively. Java Servlets in middle tier connect clients built using HTML or applets to back-end servers.

Client Tier

For interacting with the system, the client tier (user interface part) has been designed using HTML and java script. JavaScript codes have been incorporated in HTML query forms for validation of data filled by users at client end. A client communicates its requirements to the servlet, using HTTP and the business logic in the servlet handles the request by connecting to the DBMS Server.

Middle Tier

Java Servlets, which act between client and data tier were chosen to implement the middle. Servlets are server side java programs which create the web pages on the fly. Servlets use JDBC APIs (using SQL) for communicating to SQL Database. 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.

Java Applet is embedded in HTML pages to draw the graph for displaying the beam current trend at beam loss events. Applets are java programs that are designed to be

accessed on an internet server, transported over the internet, automatically installed, and executed by the java compatible web browser as part of a web document.

Data Tier

SQL relational database has been designed for implementing the data tier of Elogbook, which stores the complete information in related tables.

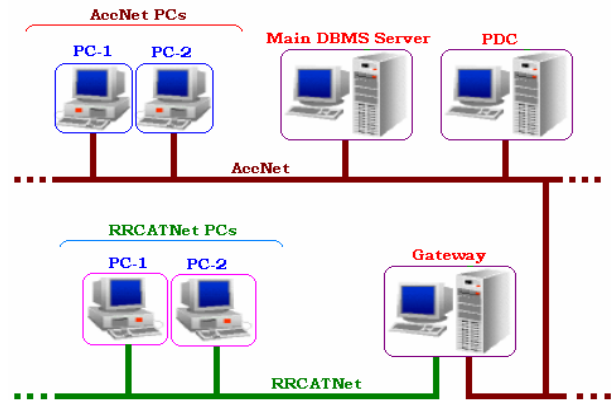


Figure 3: Application accessibility

APPLICATION ACCESSIBILITY

The Elogbook application has been developed & deployed on web server configured on Gateway computer (Figure 3). This computer is connected with technical network (AccNet) as well as campus network (RRCATNet). The URL of the application has been mapped in DNS of both the networks so that it could be accessed uniformly from both the networks.

CONCLUSION

The first version of Elogbook consists of limited functionalities. More features would be added as per the feedback from crewmembers, system experts and group leaders. The system is very useful for not only the accelerator crewmembers but also for machine/subsystem experts for improving the overall machine performance.

Presently, we are using windows based infrastructure and if we switch to linux based infrastructure then very little modifications are required in codes of the application during porting.