Re(de)fining visualization at World's largest refining hub

Barco exploits its new Ecological Interface Design concept to achieve objectives

by Bhavanashi Ramakrishna

Reliance Industries Limited & its petrochemical enterprise Reliance Petroleum - their very name springs awe; a reputation, and an ambition for big stakes in every realm. While that in their business domain is known, the same in their harnessing technology and putting it to inspi'rational' use is a big business case in itself. The best to showcase this in all its magnificence is the business behemoth's second oil refinery at Jamnagar in India's north western state of Gujarat.

It's a case of big players coming together to weave in what is claimed to be the world's largest, first-of-its-kind video wall integration for the petrochemical sector. Taking centre stage in the honour is Barco India, in association with Honeywell India and Design Directions India. ***SIA presents an exclusive on what had hitherto been a closely held prerogative.***

The Big Ambition

When Reliance Petroleum – the prestigious subsidiary of India's largest private sector enterprise Reliance Industries Limited – commissioned its second crude oil refinery at its existing facility at Jamnagar, in the Indian State of Gujarat over two years ago, the mega initiative not only meant the emergence of the largest 'refining hub of the world' with a combined capacity of over 60 million tonnes of oil refinement per year but also unveiled an incredible 'visualization.'

The US$6 billion complex was completed in a record time of 36 months. Together, the two refineries make a fully integrated entity with manufacturing, refinery, aromatics/petrochemicals, captive power plant complexes, a port and a terminal for pipeline network access, sprawling over 7500 acres- more than one-third of London or Mumbai's geographic spread.

To monitor, control, coordinate and optimize activities at such a gigantic site, Reliance set up an ultra-sophisticated Refinery Control Building, with an ambitious technology play - the centre of which is the largest video wall to date in the global oil sector. While visual solutions major Barco had a major stake in the exploit with a totally new concept called Ecological Interface Design – through a first-its-kind digital mosaic – it is also shared by automation solutions specialist for energy sector Honeywell Automation India who provided fire and gas and CCTV system solutions, and Pune-based award-winning designer firm Design Directions India who weaved in the graphic design for the venue.

The most significant aspect of this success story of ambitious integration was that the consultant-integrators were involved right from the stage of building ground-up. Barco's proven credentials in visual solutions for the energy sector – shown in large video walls for Saudi's Aramco Operation Coordination Center and China's EPC – and its track record with Reliance's previous projects brought it on-board, while the other two stakeholders too had their expertise taken into consideration by the energy conglomerate.

Design: Benchmarking New High of Sophistication

The project brief was arguably ambitious. The Central Control Center, besides helping monitor and control processes across the entire network of complexes, had to serve as a tool to optimize plant performance, i.e. maximize production, quality, efficiency and safety, and even support business. It essentially meant a total automation, able to handle practically every condition with minimum, if not nil, human intervention.

To achieve that objective, high-level, next-generation information and visualization technology solutions were needed. Working in close cooperation with the Reliance team, Barco had to work out a total visualization solution that included system design, software, hardware, configuration and integration.

The biggest challenge posed was to create the definition for the displays, as Reliance's vision specified for a totally new concept of visualization, going much beyond pixels and ergonomics. Together with Honeywell and Design Directions, Reliance and Barco undertook a stepwise and planned exercise to analyse all plant processes, decide what aspects had to be visualized, identify the requisite visual tools and then work out a clear structure for the information.

"As control rooms become increasingly centralized, they get ever more complex. Operators are overwhelmed by the data on the wall and on their desktops, coming from all kinds of sources," says Guy Van Wijmeersch, Market Director at Barco's Security & Monitoring division. "This overload hampers real-time insight and situational awareness, which makes the control process slow and error-prone."

To avoid this, the project team decided to only visualize key performance indicators and ensure it would be easy to understand for all the workstation personnel concerned. Due diligence of repeated rounds ensured they evolved the vision to reality.

"It was essentially creation and provision of FDS (Functional Design Specifications) that included complete system architecture with both software and hardware integration," explains the Barco India spokesperson, "sophistication and simplicity had to go hand-in-hand."

Going by the FDS, Barco installed eight large rear-projection video walls- four for the Refinery and Utilities, and the other four for Power and Petrochemicals. Each of the walls was created using as many as 24 DLP display cubes of 67-inch width each, done in six rows of four cubes each, representing a major array of the company's operations. In addition, a wall of six 67-inch DLP modules, done in two rows of three modules each, was set up in the War Room. It, therefore, meant that as many as 198 DLP cubes with XGA resolution have been incorporated into the facility- making it the largest for any energy major in the world.

Specifications for the projection system and image display- such as long lamp life, automatic calibration, redundancy, ease-of-use, high quality, etc. were all addressed with meticulous attention. The visualization solution is entirely networked through a high-speed Ethernet connection, towards ensuring a highly reliable, flexible and scalable environment.

The network was weaved in, in such a way that operators can receive all possible types of data and video from all sources, which is then visualized in a scalable vector graphic format. Besides depicting Reliance plants with various equipment set-ups and pipelines and mission-critical parameters like temperature, volume pressure, etc., the video wall also provides detailed process environment support, like dependencies on upstream and downstream processes - constraints associated with production process etc.

Digital Mosaic: Heart of the Design

The visualization vision evolved by Barco was based on the Ecological Interface Design (EID) concept, a unique way of displaying dynamic data. "EID aims at developing a user interface that makes constraints and complex relationships in the work environment perceptually evident to the operators," Van Wijmeersch explains. According to him, the key to this interface is the graphics. If designed well, graphics turn data into useful information, thereby helping operators effectively collaborate in the working environment; maintain situational awareness; understand the big picture; detect incidents almost pro-actively; assess them and respond quickly and accurately before they escalate.

A Digital Mosaic Suite, which Barco had developed for the Aramco Oil Control Room in Saudi Arabia and customized to meet Reliance's needs, played a key role in this process. "Digital Mosaic retrieves data from a wide range of data acquisition systems; analyzes it to trigger a scenario interaction with Barco's Apollo Wall Management Software and then visualize it on Barco's video wall in high-quality, scalable graphics," explains the Barco India spokesperson. "It was actually a big challenge to weave in a single solution that integrates both software and hardware," she adds, "the Digital Mosaic, based on EID made it not only possible but admirable."

The audio component of the solution was weaved in by Barco's Belgian headquarters which sourced the equipment from the European market and integrated it in association with Indian team.

The Safety Challenge: Closed Circuit Monitoring

Being the largest petrochem plant that the Reliance project is, likeliness of toxic or combustible gasses would be some of the possible hazards that needed to be handled with clinical precision. The setting demanded an integrated detection mechanism that senses and provides early warnings of any smoke, heat, fire or gas leak possibility, and a CCTV system that captures and presents the situation on real time basis. The system had to include detectors, alarm panels, suppression systems and manual call points with strong execution capability.

Honeywell roped in the full, integrated spectrum of gas sensing technologies - electrochemical, catalytic bead, open-path and point Infrared. The system included Honeywell fire alarm panels supporting XP95 protocol that could talk to third-party manual call points; Honeywell Digital Video Manager that brings streaming data from CCTV to a single location; and dual redundant Honeywell Safety Manager integrated into Honeywell's Experion Process Knowledge System (PKS) offered a one-stop solution to bring all the alarms together.

The systems also included Honeywell's popular Operator Training Simulator (OTS), Invensys DCS, and Historian System, besides different video streams, explains Ajay Deshmukh, Product Marketing Manager at Honeywell Process Solutions that worked on the project, "We had to integrate as many as 20 interfaces."

"It wasn't an easy task though, for the very nature of the project," Deshmukh recalls, "it indeed demanded a high-quality expertise which we had and put in." According to the Honeywell executive, the most challenging part was the alignment of systems with the curvature architecture of the space. "That the angle of separation between two connected displays was a mere eight degrees, aligning CCTV systems with the displays posed a big challenge," he says, "however, we achieved it with clinical precision."

The Digital Mosaic was arguably the central attraction of the whole process, Deshmukh admits, adding, the hardware part of it is truly incredible, he compliments, while the manner in which it is integrated with the software made it all the more unique.

It's not totally first time that such an install was made in the country, the first being that at Jindals' steel plant at Raigarh in Chattisgarh. However, it is much lesser in scale, while the Reliance Petroleum's install transcended all notional parameters to scale truly big.

It is thus the first refinery control room in the world to implement the concept of complete integration of process systems with latest information and visualization technology, facilitating high level collaboration across the entire ecosystem of the site. Quality of supervisory information help operators gain insight into the overall performance of plants in terms of throughputs, capacity utilization, material balances, yields, etc. and current status of its equipment, while safety KPIs help keep the pulse on safety. Event-driven graphics enhance the management of abnormal situations, like a power or steam failure.

By centralizing all control activities in one Control Center, Reliance achieved enhanced control and, consequently, optimized plant performance and safety. The 60 panel officers who ensure the control room is manned 24/7, now have all the tools they need to acquire real-time insight into every process and take decisions promptly.

It's indeed re(de)fining visualization!

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