

Liquid Power Plant Increases Productivity and Profitability with Liquid Power Web Server Solution

A liquid power plant needed the ability to access plant-wide data in order to more accurately monitor its operations.

Main Objective

In 1997, the client had automated its liquid power plant using Wonderware InTouch and Sequencia Open Batch. The plant then installed InTouch Industrial SQL to access the InTouch data — along with a second SQL Server to access the Open Batch data. Having to use two separate servers was not ideal; plus, the InSQL product's client tools were difficult to configure and expensive to license. The client's main goal was to implement a better tool to efficiently access all plant data. MAVERICK Technologies recommended Microsoft's Internet Information Services (IIS), formerly called Internet Information Server, and Active Server Pages (ASP). Over time, MAVERICK and the client have worked together closely to adapt these tools to meet the client's specific needs and requirements.

Customer Results

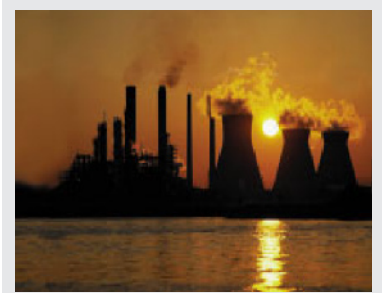
The Web-based solution that MAVERICK developed for this client began as a simple way of displaying information widely with a common client. What began as a centralization of data has progressed to an indispensable tool that monitors and is involved with all aspects of the plant's operation. The common interface from application to application has rendered the solution's usage functional and intuitive. The open scripting methods and accessible scripting language gives the client's team members easy methods for altering or upgrading the solution's components. The solution has evolved into a centralized information data store that has made the plant run much more efficiently and economically.

Application Description

Once it was agreed that Open Batch contained much of the desired data, a relational database structure was suggested to handle the Open Batch data. Open Batch came with an ODBC connector for archiving its processes to SQL Server. The archiving can take place according to various triggers, including end-of-batch and end-of-batch-process. However, all of these data are stored in one large journal table, which requires writing stored procedures to parse and move the data into a relational format.

Quality Control

- All batches are tested for conformance to specifications, and a sample is kept for future reference.
- The laboratory results are entered into the database alongside the automated portions recorded from Open Batch.
- In this way, a single batch or combination of batches can be quickly checked for conformance, greatly facilitating quality control.



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Processes and Methods

The processes tracked and modeled in the relational database include: upstream, downstream, inventory and phase data.

- Display of the data is accomplished using ASP, Microsoft's application server technology designed to work with IIS.
- IIS comes as part of the standard install for Windows NT Server 4.0, while IIS upgrades have appeared as part of service packs and the Windows NT 4.0 Option Pack. IIS 5, the most recent release, comes as part of the standard install for Windows 2000.
- The Windows 2000 Server addition contains more bells and whistles than Windows 2000 Professional (workstation); however, either one can easily display ASP pages.

ASP Aspects

One of the more useful aspects of ASP is the easy usage of ActiveX Database Objects (ADO). This allows for extensive connection with any ODBC-compliant database. In essence, if something exists in a database, it can be displayed in ASP. Once the relational database is in place, data can be displayed and edited in any manner.

User Benefits

All data can be viewed and edited via a Web browser, meaning that client licensing is not an issue. MAVERICK has specified that the preferred Web browser is Microsoft Internet Explorer (IE), version 4.01 or later. One reason for this decision is that ActiveX components are sometimes used as part of the display, and Netscape does not display ActiveX without a separate (purchased) plug-in. Another reason is that HTML and JavaScript do not always translate cleanly between IE and Netscape, and providing alternate pages for IE and Netscape increases development time.

Security Concerns

One of the great concerns of a Web-based approach to viewing data is the issue of security. Specifically, it was deemed appropriate that some elements of the site should be viewable by everyone, while other parts should be viewable and editable by a select few. Therefore, MAVERICK had to duplicate the kinds of permissions that one might expect by standard Windows user permissions. This issue was solved with the implementation of a user table within the database with username, password, full name and other fields. Some of the other fields delineate whether or not the given user is a resource or is currently employed by the organization. Using SQL queries, one can extract users based upon their overall permissions and match viewer and editing capabilities based upon the rights granted from the database. For example, if a given user is no longer employed, that user cannot log on to the Web-based solution, but the data entered while they were employed remains intact.

Training

With the Web-based solution, all aspects are easily modifiable, and many components are simple enough that members of the client team have been able to learn how to make modifications themselves. Most of the ASP pages are authored using VBScript, a scripting language similar to Visual Basic and Visual Basic for Applications. In addition to the training MAVERICK has given the client, there is a great deal of documentation available on VBScript and ASP, meaning that the client team has been able to continue their education on their own.

Support

Since most elements of the Web-based solution are scripted, it has proven simple for MAVERICK to provide support and training. Pages can be viewed and edited by a member of the MAVERICK team, then e-mailed to the client, and the new page can be subsequently installed. Members of the client's team who are familiar with the Web-based solution have been able to make alterations with telephone and e-mail support.



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Additional Applications

Once the initial upstream / downstream data were made available with the Web-based solution, it was found that yet more data were desirable and readily available. The solution was quickly seen as an ideal central repository for many applications, some of which shall be detailed here.

Nonconformance Applications — At the client's request, MAVERICK developed an extremely useful application for tracking troubles and / or nonconformances regarding:

■ Machinery ■ Product ■ Computers ■ Shipping ■ Others

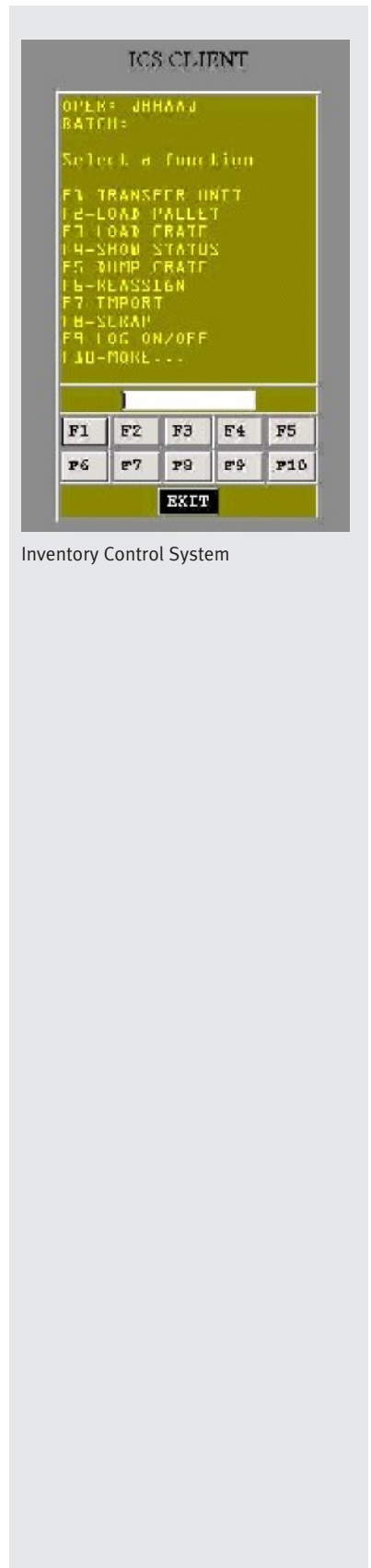
The idea is for each authorized user of the Web-based solution to be able to enter a report with many of the required fields predefined, so that filing a report is a relatively painless process.

The date and author of the report are automatically assigned based on login information. Each user is assigned to a human resource, and resources are defined in the Security / Logon database of the Web-based solution. Various locations, types and customers are predefined in look-up tables that dynamically populate the forms for entry of the nonconformance application. If a solution or correction is devised for the given nonconformance, a corrective action report (CAR) can be created, similarly auto-populated with choices from look-up tables from the database. More than one nonconformance can be "assigned" to each CAR.

Example: A certain pump, P-135, has been failing periodically, and the same or similar set of steps is required for correcting each failure instance. The set of steps required for "fixing" the pump are detailed in the CAR, while each instance of failure is recorded in an individual nonconformance database application. A report can be generated to show how many times the pump has failed (listing of nonconformances) and the steps taken to correct the problem (listing of CARs; in this case, a single CAR).

Inventory Control System

Previously, it was mentioned that inventory is being tracked within the Web-based solution. This was partially true in the initial stages, primarily due to the reports of Open Batch. In other words, it was fairly easy to see how much product was being created. However, the product itself has many time- and temperature-sensitive components that are stored in bags on pallets, as well as in containers called gaylords. These pallets and gaylords are barcoded. MAVERICK wrote an ASP application that allowed the users to scan the barcodes with portable scanners or to manually enter the barcoded information into an ActiveX duplicate of the portable scanner (displayed in a Web page). Again, the display of the ActiveX scanner module requires the use of Internet Explorer rather than Netscape. The scanned or manually entered information is then stored in a relational database, along with the time the product was accounted for, as well as who did the accounting. MAVERICK provides charts and tables detailing the current inventory of pallets and gaylords, based on areas of the plant. In a glance, a user can see where future product should be stored, as well as which pallets and gaylords have been around the longest.



Inventory Control System

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Statistical Process Control

As the Web-based solution continued to evolve, the development team of MAVERICK and the client discovered new uses for expansion of the overall application. A natural growth was into the area of statistical process control (SPC). The procedure in place at the plant had required a great deal of hand-entering of data into an off-the-shelf statistics program that would then display standard deviations, linear regressions and charts, based on the data entered. This was a time-consuming process that could take hours. Since the data required for SPC already resided on the Web-based solution, it was decided that the process should be automated. Gathering the necessary data from the SQL Server, assigning variables and performing calculations was a relatively simple task. What was needed in addition to numbers was a means of displaying the results graphically.

ActiveX Graphic Solutions

There are a number of ActiveX components for graphic display; however, the bulk of them are designed to be used in a compiled application, such as Visual Basic or C++. The team's need was for a Web-enabled ActiveX control that would be flexible enough to show strip charts, histograms, pie charts, bell curves and scatter charts, to name a few. The team settled on Chart FX from Software FX. In this ActiveX control, the team found a versatile tool that allowed them to display information graphically, based on database queries and subsequent calculations. When MAVERICK installed the initial SPC application, the responsible department was delighted, as 90 percent of the results they needed were available in seconds rather than hours.

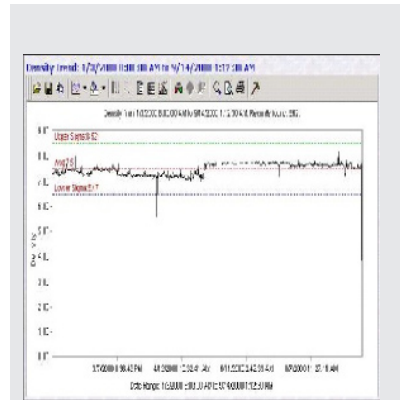
Wonderware and InSQL

One final aspect of the Web-based solution is the display of data from Wonderware. As mentioned previously, data archival has been occurring both from Open Batch to SQL Server and Wonderware to InSQL Server. The Open Batch data contain the bulk of the information required, but not all of it. For example, Wonderware can show how full a tank is and what its temperature is, whereas Open Batch does not track this information. MAVERICK has implemented numerous ASP displays of Wonderware data, including pages showing only Wonderware information, Wonderware data interspersed with Open Batch data and historical trends (using Chart FX). Essentially, the pages of the Web-based solution have replaced the InSQL Trend tool, in addition to providing a simple point-and-click method of retrieving data from the InSQL database.

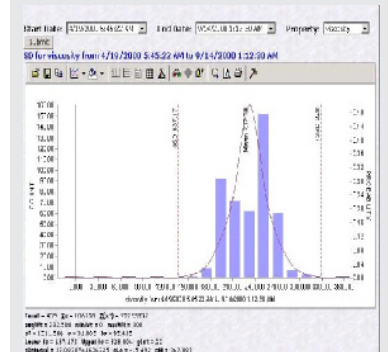
Future Applications

MAVERICK is developing an additional layer to the Web-based solution in the form of Smart ASP applications. The idea of a Smart ASP Application (SAA) is to not merely display and manage data, but to interpret it. MAVERICK began this activity with the recently completed SPC analysis installed on the Web-based solution, where we calculated and graphed standard normal distributions, linear regressions and historical trends. MAVERICK will extend the capabilities of our applications even further by using operations research (OR) mathematical methods to perform analysis of data and make recommendations based upon this analysis. This, in essence, is the definition of an SAA: an ASP application that uses a model of a given activity to perform mathematical analysis of archived data and suggest specific recommendations for future action based upon this mathematical analysis. The five steps of OR and what MAVERICK terms Smart ASP applications are:

- Define a problem
- Construct a model
- Derive a solution
- Evaluate the solution
- Implement the suggested procedure



ActiveX Graphic Solutions



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