UNILEVER CONTROL SYSTEM UPGRADE TEST CASE

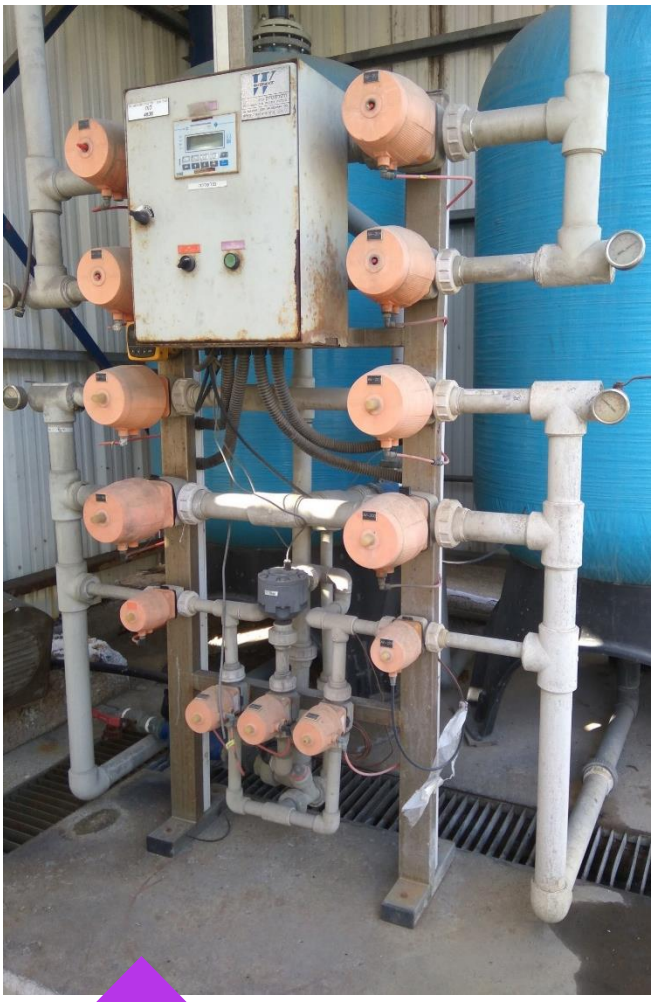
Amir Kaufman, Co-Founder WonderLogics | January 2018

WATER SOFTENER PLC SYSTEM UPGRADE

ABSTRACT

As reliable as automation systems can be, they eventually require replacement. While hardware replacement is relatively straight forward, using old drawings or observing the wiring on site, software upgrade is much more complicated. The original programmer may not be available, the PLC model may be outdated, the program may not be adequately documented and it is difficult to reverse engineer it. In-house personnel know how to operate the system, but in most cases are not familiar with the "bits and bytes" of the control software, which may have been programmed by a third party. Getting new control hardware installed and connected raises some concerns like how long the system will be down. But while the time required to connect the hardware can be planned, re-commissioning the machinery with the new control software is hard to estimate and can cause more delays than initially anticipated.

Unilever Haifa needed to upgrade the control system of a water softener - a critical piece of equipment providing process water to a whole manufacturing site. The existing PLC was obsolete and had no spare parts anymore, so the company planned to approach different control system integrators to design a new PLC system for controlling the existing equipment. However, considering previous experience with undocumented control software, and having heard of our solution for generating fully documented PLC code, Unilever decided to choose WonderLogics for upgrading the control system.



A VIEW OF THE SYSTEM – THE OLD CONTROL PANEL, 13 PNEUMATIC VALVES AND THE TWO SOFTENING COLUMNS AT THE BACKGROUND.

THE SOLUTION

The first step was to observe and record the system, and understand how it works. Additional information was retrieved from some old drawings that existed and from literature regarding the recommended operation of industrial water softeners.

The result was the following top-level process description and flow:

- There are two softening columns.
- While one is softening water, the second column is being refreshed or in stand-by.
- The cycling between softening and refresh is automatic and based on time of operation and quantity of water processed.
- Refreshing can be initiated manually as well.
- The Refresh sequence includes the following stages: backwash, filling brine, soaking, and washing the column with soft water to remove all of the brine. The sequence is completed when the desired conductivity level is reached, indicating low salt content.
- An additional requirement was to ensure that in the event that the system is stopped before completing the Refresh cycle, the column being refreshed will not provide water to the factory until completing a full Refresh cycle.

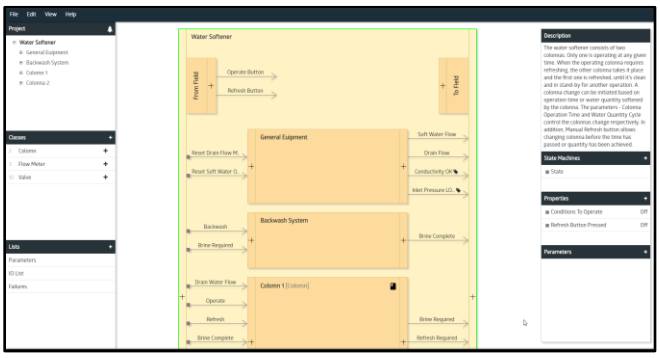
WonderLogics Studio, is based on object oriented design principles. It guides the user in defining Components – some of which are physical and others represent logical functions. In Addition, common Components can be grouped in Classes, providing the capability of propagating any change done in one of them to all others.

We gathered all the common equipment modules – valves, flow meters and columns – and grouped them in Classes. We also defined various logical components, such as wash system and brine system.

These components do not represent physical systems. Instead, they are a collection of components that when combined, perform a specific function. So, at the high level, the Unilever components are:

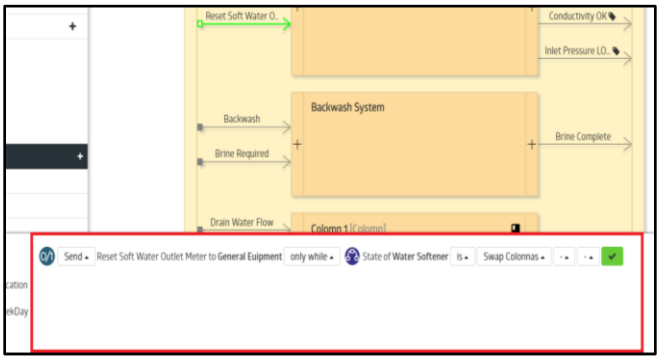
- Column 1 – Contains its valves, parameters and a state machine. This column belongs to the Column Class
- Column 2 - Identical to column 1 since it also belongs to the Column Class
- Wash System - Contains a wash valve and a Brine System.
- Brine System – Contains a brine valve, an air pump and a flow meter.
- General Equipment – All other pieces of equipment that are not part of other components, such as an inlet pressure switch.

The defined components work together to form the Softener System component, which is the root of the project in WonderLogics Studio.



THE WATER SOFTENER MODEL IN WONDERLOGICS STUDIO

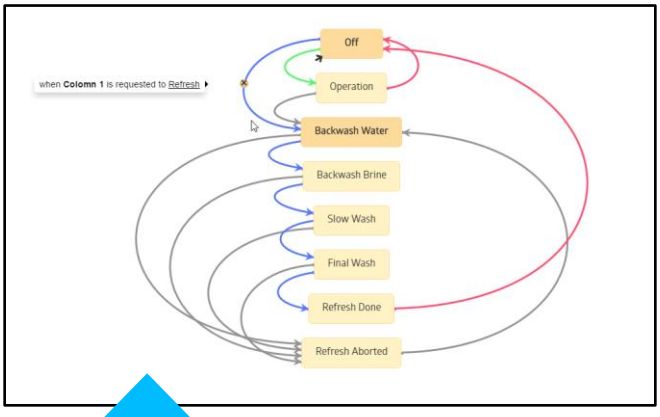
With the top-level structure in place, inputs and outputs are defined. The next step is to establish the logical relationship between the components. This is done using Natural Language logic sentences. Right-clicking on an input provides the option to open the Logic Editor at the bottom of the screen. This is the heart of WonderLogics Studio's patented innovation.



USING NATURAL LANGUAGE TO ESTABLISH LOGICAL CONNECTIONS

The Logical connection is built by choosing attributes and parameters to define an action and when it is triggered. No need to guess how to write a logical sentence – the Logic Editor guides you in defining clear and accurate instructions.

Another important feature used in this project is the ability to easily create **State Machines** for controlling any component. We used this feature to set up the sequence of states, by which each column preforms its refreshing process.



**THE COLUMNS' STATE MACHINE.
THE CONDITIONS FOR TRANSITIONS
BETWEEN THE STATES ARE DISPLAYED
WHEN HOVERING OVER THE ARROWS**

After the designer is satisfied that the project accurately defines the desired control action, he can take advantage of WonderLogics unique tool: Verify Model Logic. This feature runs an integrity check on the whole model, including the State Machine. The integrity check searches for missing logic, invalid references and other mistakes such as latch without unlatch. Errors are displayed graphically, allowing the designer to make corrections and view the error clearing. By verifying the logic before installation, delays in the actual rollout and implementation are avoided and commissioning time is minimized.

After the model's logic is verified, the WonderLogics model, from which the PLC program is derived, is exported to a functional spec document for customer review and approval. Once approved, WonderLogics generates a complete Studio 5000 project with the click of a button. The project contains the PLC program in a hierarchical structure equivalent to the one defined in the model, and ready to run. The approved document stays with the customer for reference and future use.

Following Unilever's approval, the automatically generated code was downloaded to the new PLC. The new control system was installed and brought on-line within 2 hours only and without making any changes to the automatically generated code. Attached is Unilever's approval of the control system's successful installation.

Using its intuitive graphic interface, natural language logic editor and built in logic verification, WonderLogics Studio ensured seamless upgrade of this critical control system.

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Unilever

Re: WonderLogix Project at Unilever Haifa

Unilever Haifa is a complex of Food & HPC factories, employing 350 employees and manufacturing international and local brands in the food and personal and home care categories. Among them – Hellmann's, Mazola, Knorr, Dove, Rexona, Vaseline and Cif.

All the factories in the complex are supplied with water from a central water softening facility. The project in question was an upgrade of the water softener's existing control system.

I hereby confirm that the control system upgrade was successfully completed on May 26th 2017 by WonderLogix Ltd.

The control system was modeled using WonderLogix Studio, and an automatically generated functional spec was presented to us for approval.

Following our approval, PLC code was automatically generated and implemented in a CompactLogix 1769-L16ER PLC by Rockwell Automation, which was especially purchased for the project.

Commissioning the system was completed successfully within two hours only and without making any change to the automatically generated code.

I would like to mention the quality and clarity of the design, made in a graphical environment and using English sentences.

Unlike the previous system, the automatic documentation supplied with the code is detailed and complete and will certainly serve us for years.

I was impressed by the innovative approach to setting up control systems.

Regards,

Unilever

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