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Automation IT working with BMA to Optimise their UDD Dragline Operations

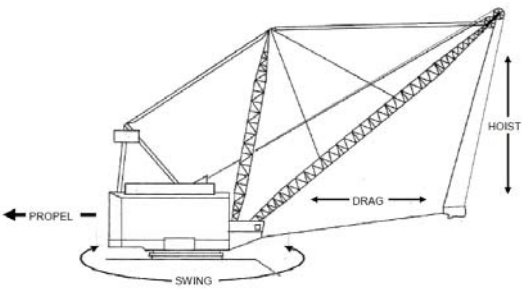
THE BACKGROUND

BMA was formed in 2001 as a partnership between BHP Billiton and Mitsubishi Development Pty Ltd which owns and operates seven Bowen Basin coal mines Blackwater, Broadmeadow, Goonyella Riverside, Peak Downs, Saraji, Norwich Park and Gregory Crinum. The mines have a combined production capacity of more than 58 million tonnes per year.

Currently BMA uses 15 draglines across their mine sites, five of which are Universal Dig Dump (UDD) machines. A UDD machine is a dragline which uses a more precise hoisting system than a standard dragline and so is able to better control the bucket angle by varying the lengths of the two hoist ropes.

The main function of a dragline is to move the overburden (topsoil) from above a coal seam to a spoil pile. The dragline is designed with four controlling motions which are to be used to remove the overburden. These are:

- HOIST — This motion controls the bucket's height
- DRAG — This motion controls the bucket's horizontal position
- SWING — This motion enables the dragline to spin within a fixed 360° circle
- PROPEL - This motion allows the dragline to move to its required position for operation



A UDD dragline's functional overview

THE PROBLEM

Draglines are highly sophisticated machines which are managed by control systems that are able to monitor and manipulate all facets of their operation, including the three-dimensional position of the bucket.

The requirements of each dragline vary over time depending on such factors as their location, the type of overburden it is moving and the type of coal underneath. Hence it is impossible to take into account all of these factors when first designing each dragline, and so as time goes by the dragline will be required to be "tuned" to its specific requirements at that time.

However, the machines are expected to remain continuously in operation, so when a problem arises, the objective is to provide a "quick-fix", which is not necessarily the best solution, in order for the dragline to resume operating as soon as possible.

The end result is a system that works, but very inefficiently, that is it takes much longer to complete an operation while causing unnecessary wear on its parts.

THE SOLUTION

In 2007 Automation IT began working with BMA and UDDTek to optimise the control systems on all of BMA's UDD machines currently operating throughout their mine sites. The initial plan was to start by analyzing and modifying one dragline, Dragline 23 (DRE23), then roll out the improvements to the other UDD machines once they had been proven to work.

Dragline 23 was the first UDD Machine to be worked on as part of this project.

PROJECT OVERVIEW

The main objective of this project is to optimise the PLC code. As there are several different reasons for the draglines' inefficiencies there are several different approaches to solving the issues.

Initially, the entire PLC code is examined and all code that has been made redundant due to it being written to control legacy hardware which has since been upgraded or removed, is deleted or modified as required.

The code is then moved over to an object oriented style with reusable functional blocks. Object oriented programming focuses on the data to be manipulated rather than the actions required to manipulate them. This style of programming allows more accurate data analysis, faster development time and is easier to modify when required to debug.

Another approach used to optimise the UDD machines is to remove all unnecessary points of failure in the system. That is, all third party hardware devices are removed from the network and their functionality is written into the PLC code.

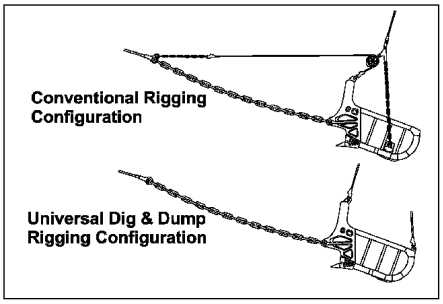
An example of this is the UDD Blackbox, which is a separate unit which controls the angle of the bucket using the two separate hoist ropes. AIT is able to rewrite this unit's functionality using C binary code and then import it into a function block in the PLC code. Allowing the physical module to be removed from the control network.

IMPROVED RIGGING CONFIGRATION

As this project progressed AIT was able to work with BMA and UDDTek to add new functionality to the UDD machines to further improve their performance. The main aim of this is to implement a system to give the operator greater control of the bucket by taking full advantage of the UDDs' dual rope functionality.

The UDD dragline splits the hoist control system into two halves and has a cable attached to both the front and rear of the bucket. This new rigging arrangement allows precise control over the bucket angle by varying the lengths of the two hoist ropes.

For this reason, AIT is able to implement a new function which is able to control the proportion of front and rear rope to be released depending on the different modes of operation of the dragline.



The difference between the rigging of a UDD and conventional bucket.

ROLLOUT OF PROJECT

Once the changes to Dragline 23 were identified and resolved, an implementation plan was created and the changes have been rolled out to the other UDD machines in the BMA Dragline fleet.

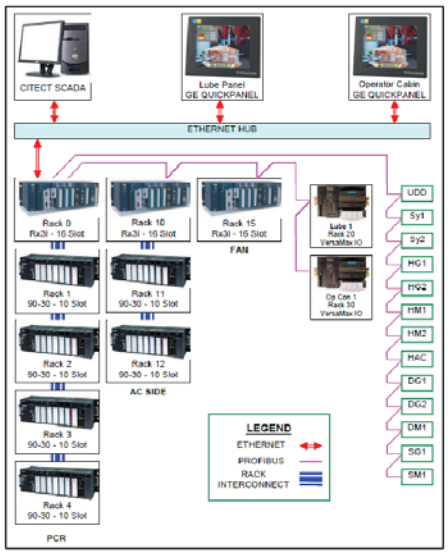
Since the start of the project these optimisation techniques have been implemented on Draglines 22, 23, 26, 39 and 40 over five different mine sites. Furthermore some of these changes have now also started to be rolled out to non-UDD machines, such as Dragline 41.

The optimisation modifications were also rolled out to Dragline 22.

DOCUMENTATION

As with all Automation IT projects a fully documented project solution provides detailed operations and maintenance manuals for the operations team to keep and refer to once the project has been fully completed and questions arise about the PLC or software.

Other documentation associated with the project also includes monthly progress reports throughout, detailed software programming specification, an electrical drawing package and full test documentation.



An example of the complex network configuration for a UDD machine created as part of the documentation requirements.

CONCLUSION

By successfully identifying and resolving certain inefficiencies within the UDD control systems, Automation IT is able to dramatically increase the accuracy and reliability of each of the UDD Machines within the BMA fleet thus reducing their overall downtime as well as increasing the draglines' productivity by up to 21%!

This optimisation of the UDD machines was considered an industry first and this technology is now being considered for other draglines around the world.

Ask Automation IT how they can streamline your processes today!