Automated load-out station

by Jasten Munsami, Systems Automation & Management

The high output demands placed on ore/coal mining operations, coupled with the advancements to rail infrastructure and technologies, necessitate that mines automate their loading stations with the latest control and automation technology.

These improvement initiatives are imperative not only to improve efficiencies such as higher volume output yields and faster turnaround times, but also to comply with the stricter wagon loading policies that are enforced by Spoornet. Failure to load rail wagons to the industry-ompliant parameters can result in non-conformance based financial penalties and this is justified because unbalanced loaded wagons can, and have led to train derailments.

On the load-out stations successfully completed, SAM has partnered with Bateman Engineered Technologies to provide the automation solution for its proprietary design. This solution is not platform-specific programmable logic controller/supervisory control and data acquisition (PLC/SCADA) or distributed control system (DCS) - as long as the platform specified complies with IEC 61131-3 standards, SAM has in-house strategies and software utilities to successfully migrate it to any end client specification. Thus far, this solution has been successfully deployed to Rockwell's Control Logix/ Wonderware InTouch platform, Siemen's Simatic Step 7/WinCC platform and an ABB 800xA platform.

The fundamental function of load-out station is to load material uniformly into a rail wagon and to achieve a loading accuracy of ±2.5% of the full load capacity of the wagon. Furthermore, the total material loaded in the complete train of wagons must be within ±1% of the full load capacity of all the combined wagons. The loaded material in the individual wagons must be profiled in such a way as to achieve a load differential of less than four tons between the front and rear wagon axels, and less than three tons between the right and left sides of the wagon. This must all be achieved while the train moves through the station at a constant speed of anything between 0,3 to 0,6 kph.

The software has to control the station to operate optimally within the above specified parameters and also integrate with the third party rail weighing systems, either via an external SQL database or through a RS232 ASCII serial interface, to the PLC/DCS. The data obtained from these weighing systems is then used to verify that the loading of the wagons are within the permissible tolerances. If they are not within these tolerances then there is an automatic correction algorithm within the software to manipulate the loading to apply corrective actions for the deficiencies. This data is also used to generate production reports and a weigh bill (utilised by the mines, Spoornet and the ports for auditing and billing purposes).

The human machine interface offers the operator complete control over the loading process, with mode selection controls on all the equipment. This affords the operator a high level of intervention capacity, considering that the maximum loading capacity per wagon can vary between sixty and a hundred tons of material. These features combined with stringent safety controls, enables the system to be quite robust and flexible.

The major constraint encountered during the software deployment and commissioning phases was getting the loading responsive to the speed fluctuations of the locomotives and the resultant concertina effect of the trailing wagons. Usually, the triggering of the loading of the wagons is compromised, causing the front to rear loads distribution of the wagons to be thrown out of the tolerance limits. However, with the implementation of more rail level infrared sensors and employing a series of software checks, this problem was resolved.

A fully automated load out station operating at full throttle is truly an awe-inspiring sight, and testament to the fact that with a little imagination and sound engineering practises, anything is possible.

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