Swiss Factory Boosts Rail Bogie Efficiency, Traceability

Swiss manufacturer Stadler Winterthur had developed a hybrid UHF RFID- and QR code-based system that automatically collects data about the materials going into the assembly of each of its railcar bogies (train undercarriages), as well as the individual doing the work, thereby boosting efficiency and traceability. The solution, which was taken live last summer, is expected to provide a return on the company's investment within 1.6 years.

Stadler Winterthur's deployment is a finalist in the 2020 RFID Journal Awards for Best Manufacturing Deployment (see Finalists Unveiled for 14th Annual RFID Journal Awards). Winners will be announced at the RFID Journal LIVE! event, to be held in Orlando, Fla., on Sept. 9-11.

The solution, provided by Switzerland-based RFID technology firm Identech, includes the company's AIMSOC middleware to manage the RFID- and QR code-based data, as well as mobile RFID readers that also scan 1D and 2D barcodes, supplied by FEIG Electronics. In addition, the system includes M-Rook UHF RFID tags from The Tag Factory with built-in Alien Technology Higgs-3 chips, and DistaFerr UHF RFID tags

from Schreiner Protech, which are worn by staff members.

Large-format MultiSync P404 displays, provided by NEC Display Solutions and used in the production area, are programmed by Identech to display the order data, including all tasks that need to be accomplished, as well as the QR code required to begin accessing and collecting data in the welding cabinets, on the assembly site floor.

Stadler Winterthur serves as the competence center for bogies within train maker Stadler Rail. The bogie frames typically consist of two longitudinal beams, connected by a cross tube or cross beam to make a frame in the shape of an "H." Main components are then built into the bogie, such as engine brakes, wheelsets, primary suspensions, bogie bolsters and automatic train control devices, in order to ensure passenger comfort.

The plant, located near Zurich, has been growing its capacity in recent years. Initially providing approximately 900 bogies to Stadler and other companies each year, it is now able to make approximately 2,000 annually. The company initiated a combination of lean building practices and automation to make this possible, according to Sebastian Kohl, Stadler Winterthur's process engineer.

In 2017, the company was seeking a technology-based solution to more easily track and document the raw materials being built into its bogies, as well as to manage work-in-progress as the products are built. The company's goal, Kohl says, was to improve the overall quality of each product and to optimize efficiency and general workflow.

The Zurich-area plant builds the bogies at a series of stations on three main production lines. After being welded, the frame goes through machining, followed by measurement, washing, sand blasting and painting. Then, when the frame is painted, it undergoes quality control before going through the

assembly, where the remaining components are added to the frame to form the final bogie.

Traditionally, goods were tracked via a mostly manual process. A printed paper label was glued to each new bogie, and the parts' serial numbers were manually stamped onto them and were then visually read by workers. As each bogie was built, individuals at welding stations referenced paper-based instructions on the shop-floor to assemble and weld the parts according to each product's parts list. Additionally, each worker had to enter his or her ID into the company's enterprise resource planning (ERP) system to create a record of who was doing the work.

With the RFID solution, the company sought a way to automatically collect data from welding stations related to the work being done and the staff members providing each task. The company's management also wanted to make assembly simpler by providing easily accessed instructions using pictures. However, there were several challenges related to deploying a purely RFID-based solution.

For one thing, applying RFID tags to each component attached to the bogie and then tracking those tag reads would be too costly and create the potential for stray reads. A secondary challenge concerned the viewing of data on the assembly floor. While the company wanted to collect and display relevant data, making it available to workers would not be easy due to the personal protective gear they wore. Any touch screens or small buttons would be unrealistic for those wearing heavy gloves.

To resolve the issues, Stadler Winterthur and Identech created a system that allows the worker to interact with a display device without taking off the protective gear. explains Manuel Geeler, Identech’s technical lead. The combined ECCO+ scanner acts as a remote control for the display session, he says, as well as a scanning device to identify the product by reading its RFID tag. The AIMSOC middleware then displays the QR code on the display. Workers scan the QR code on that screen with the same device that could already read an RFID tag on the product.

Each subassembly of a bogie frame—consisting of longitudinal beam, cross beams and tubes—is uniquely identified via a UHF RFID label. Later in the assembly process, the subassemblies, along with the forged and cast components, are welded together to form the bogie frame. The master transponder is attached on the frame’s left side. By scanning the transponder in a workstation, a worker can view the relevant order and product data on the display. When the employee scans his or her UHF user badge and the QR code on the screen, the FEIG ECCO+ RFID reader forwards that data to Identech’s AutoID AIMSOC middleware via a Wi-Fi connection.

That information is integrated on a central server using a Microsoft SQL database. Stadler’s ERP system creates a bill of lading and integrates with the AIMSOC middleware to link the data to the RFID tag, and the bogie then begins to move through the assembly process beginning with welding. The handheld ECCO readers are in use at the welding cabinets, which are equipped with the large-format displays.

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To launch each session and start a new work procedure, an employee uses the handheld device to scan a QR code displayed on the screen, then reads his or her own UHF RFID badge to link that person’s ID with the product and the task being done. The worker next uses the handheld to read the master RFID tag on the product to get into the details of the production order. If the final assembly process is being carried out, the same system is deployed with the worker reading the tag on what is the final assembly—a completed bogie frame.

The software displays the product instruction on the screen and guides each worker through the procedure based on the protocol for that specific product. This spares the employee the time he or she would have previously spent reading through written instructions after looking them up manually. As components are added, the worker scans the RFID tags of the subassemblies, and the GS1 DataMtarix codes are recorded for documentation purposes. That data is linked to the master transponder and the bogie details, as well as being displayed on the screen for verification. If any component is not authorized to be used on that bogie, an alert is displayed on the screen.

Once the welding task is completed, an inspector must verify the product’s quality by using the ECCO scanner to read his or her own RFID badge, along with the bogie’s UHF RFID tag. The data provides value for management as well. When a bogie completes assembly and inspection, the full set of data can be viewed in the software to provide real-time and historical data. “One of the main goals of implementing the system,” Kohl says, “was to reduce the required steps to get the product

documentation.” The company is required to collect documentation related not only to the assembly’s quality, but also the materials used in that bogie.

The system enables the company to know how long each product took to be fully assembled, as well as who provided the tasks, which robot was used in certain tasks, which components were employed, when a delay is taking place and where this occurs. “The process of filling out the product protocols [assembly steps] is now fully automated,” Kohl states. “There’s no need to write down the protocol and then type the protocol in the PC.” That means reduced labor time, as well as the potential for errors. “With one click, we are now able to generate the protocols.”

Since the tag remains on the bogie throughout the frame’s lifetime, it can also be used by the rail company. “Some of our customers make use of the transponder to manage their maintenance process,” Kohl says. Stadler Winterthur and Identech had to overcome several unique challenges to ensure the RFID technology would work properly in the factory environment. First and foremost, Geeler recalls, finding the proper location for the tag to ensure its readability without exposing it to damage required some creativity.

Each product already comes with an existing frame plate that includes printed serial numbers for rail companies to reference. Therefore, the team opted to build the RFID tag into the frame plate. To make that possible, the company had to find the appropriate tag to fit the plate’s dimensions, then built a plastic part to protect the tag during the welding and treatment processes. The high volume of metal in the environment posed another challenge. The tags need to be read in close proximity to welding and grinding equipment, with many moving metal parts, overhead cranes and welding robots.

Identech's Manuel Geeler

"We embedded the chip in the already existing frame plate and covered it with a plastic cover to protect it from sandblasting and washing," Kohl says. The chip is durable enough to sustain high temperatures, he notes, adding, "When we went to some manufacturers of the tags at exhibitions, they were laughing because they were not believing we could make this possible" [having the chip integrated in a welding environment and reading it throughout the process].

According to Kohl, the system has been working well since it was launched about six months ago. He sees three key benefits. First, he says, "We have traceability and can ensure we are building in the correct parts" into each product. Second, it provides feedback related to production time and efficiency. A third benefit relates to further automation into which the company is transitioning. With the technology, he says, the data could enable robots to detect the bogie and components, and to automate part of the production process.

In the meantime, Geeler reports, historic data provides traceability in the event of a recall or maintenance issue. In case of an accident, for instance, "You can trace back the entire production and material built into it," he says, "all enabled with this RFID chip."