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Application Brief

Enhance Inventory Management With RFID

Daimler Trucks North America is enhancing inventory visibility and cutting costs by using a closed-loop RFID (radio frequency identification) solution to track parts in its manufacturing plant.

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If you're like most manufacturers, you face relentless pressure to improve the efficiency and accuracy of your resource handling in order to better control manufacturing costs. In fact, you've probably spent countless hours refining your business processes and implementing best practices to achieve this goal. If your current processes are sound, but you're finding it difficult to squeeze more efficiency out of them through simple fine-tuning, maybe it's time you investigated how some new technologies can help take your existing processes to the next level. Daimler Trucks North America recently discovered the benefits of a new technology investment when it leveraged RFID to enhance its inventory tracking and management processes.

KANBAN CARDS OFFER LOW INVENTORY VISIBILITY

Daimler Trucks North America is the leading heavy-duty truck manufacturer in North America. The company is headquartered in Portland, OR, which is also the location of the company's Western Star Truck Manufacturing Plant. In fact, the Portland plant is where many custom trucks are manufactured for Daimler customers.

"It takes approximately 10,000 parts to build a truck," says Robert Clark, senior program analyst for Daimler Trucks North America. "In other facilities, the same types of trucks are made over and over again, which allows for a cookie-cutter approach to assembly because the same parts are routinely used. Since we build custom trucks, the parts required for assembly are always changing. This required us to put a system in place to get the right parts to our manufacturing line in a just-in-time [JIT] fashion."

Daimler Trucks initially adopted a kanban system to provide this JIT environment. Initially devised by Toyota, kanban is a Japanese term used to refer to a system in which cards or other items are used to signal the need for a part on the manufacturing line. Daimler Trucks' kanban system consisted of a series of parts bins, bin racks, and laminated part cards. For example, all parts for finished cab assembly (e.g. fuses, window cranks, fire extinguishers, etc.) are stored in Daimler Trucks' warehouse. These parts were packed into bins of different sizes according to part number, and a laminated card designating the relevant part number was slid into a plastic card holder on the front of each bin.

Match Your RFID Equipment To Your Environment

To combat Daimler Trucks North America's parts tracking problems, solutions providers POSDATA Group, Inc. and System Concepts recommended a closed-loop RFID solution that uses two Motorola XR440 fixed RFID readers and four Motorola AN200 RFID antennas. The XR440 was selected because its open architecture facilitated integration with System Concepts TraxWare asset tracking software as well as Daimler Trucks' existing SQL server environment. The reader is also designed to deliver RFID data capture and communication in dense RF environments, which is ideal for Daimler Trucks, given the amount of metal and metal parts in the manufacturing plant and the fact that the company already leverages an internal wireless network for other applications. The XR440 also provides a variety of data collection features, including filtering, reconciliation, user-defined association, and selective visibility, that Daimler Trucks found compelling for its parts tracking initiative as well as future RFID projects.

The Motorola AN200 antennas were chosen because they would work reliably in the harsh environment of the Daimler Trucks manufacturing plant. The antennas are designed to work both indoors and outdoors and withstand a range of environmental conditions — from extreme heat and cold to moisture and vibration. The AN200 antennas can also be used in standard RFID applications at power levels of up to 1 watt and in customized applications at power levels up to 20 watts.

Each laminated card also contained a specific address code that designated exactly where on the line the product bin was needed. The parts bins were delivered (via parts cart, trolley, or tugger) to the appropriate racks on the assembly line. When all the parts in the bin had been used for assembly, shop floor personnel would place the empty bin on top of the rack as a signal to a warehouse parts picker that the bin needed to be refilled. At the same time, the parts cards were collected from the empty bins, placed into stacks, and returned to the warehouse pickers, so they could begin pulling the needed products all over again.

Elements of Daimler Trucks' kanban system were extremely beneficial to the company. For instance, using bins and racks to transport products from the warehouse to the line and empty bins to signal the need for certain products all met Daimler Trucks' JIT requirements. However, the system also had several weaknesses. For example, the laminated cards used to identify part numbers and locations on the line constantly needed to be replaced. Many of these cards would get lost or misplaced in transit between the shop floor and the warehouse. Furthermore, in an effort to optimize assembly, shop floor supervisors and team leaders would continuously change the location on the line where certain parts would be installed. This required new cards to be printed that would associate a part number with its new address location on the line.

"Sometimes, we changed the location of more than 200 bins at once, and we'd have to create new cards for all of them," says Ross Langlois, industrial engineering supervisor for Daimler Trucks. "Recreating cards and tracking down lost cards hindered our productivity."

Not only was the kanban card system labor-intensive and inefficient, but it also provided Daimler Trucks with little to no visibility into its current inventory levels. "With the card system, all we knew was how many of each product could fit into a bin," says Clark. "We had no idea how many total bins we had or what products and how many of each were on the shop floor as opposed to in the warehouse. Getting insight into our total inventory with this system would have constantly required a physical inventory count, which would be an enormous task considering the number of parts in our warehouse. Without constant, accurate inventory information, we would sometimes over-order products from suppliers to ensure we had enough to meet demand."

RFID PROVIDES INVENTORY INSIGHT WITHOUT ADDED LABOR

Daimler Trucks initially turned to bar code technology in February 2007 as a way to improve on its kanban system. The company placed bar code labels containing product information on each bin, rack, and warehouse shelf, and scanned each at different phases in the process. For example, when products were pulled from the warehouse and placed into a bin, the picker scanned the appropriate warehouse shelf label as well as the corresponding bin label. This act recorded the number of products leaving the warehouse for the shop floor. Pickers also scanned the racks and empty bins when they picked them up from the shop floor. This technology provided Daimler Trucks with the inventory database it desired, but making multiple bar code scans throughout the day to record this information was time-consuming.

"With bar code technology, we finally had real-time insight into our total inventory, as well as when and where products were moving," says Clark. "However, we lacked the efficiency and speed of just grabbing the parts and moving them to the shop floor. Our process was impeded because we needed to make two bar code scans at every step. Plus, we needed to make sure we had enough bar code scanners and replacement batteries to cover two shifts, which was difficult to manage."

Just three months into using the bar code system, Daimler Trucks began investigating alternative solutions. It contacted its wireless solutions provider, POSDATA, and RFID systems integrator System Concepts for guidance. The two companies worked together to conduct a thorough survey of Daimler Trucks' existing business processes and environment. Following the survey, POSDATA and System Concepts determined that a closed-loop RFID system would be an ideal way to solve Daimler Trucks' parts tracking problems. 'Closed-loop' is a term used to refer to an RFID control system in which the tracked objects never leave the company or organization.

For Daimler Trucks' system, passive, 4-by-6-inch KSW Microtec RFID smart labels are applied to each parts bin. These labels are printed on a Zebra R110Xi Thermal Transfer Printer and are encoded with the EPC Tag Data Standard's Global Returnable Asset Identifier (GRAI) format, are reusable, and each is associated with the part number of the product the bin contains. One Motorola XR400 series RFID reader equipped with two Motorola AN200 series antennas (see sidebar on page 12) is placed at each of two 'choke point' or 'portal' locations identified by the survey. These choke points are natural entrances and exits that the bins would pass through from the warehouse to the shop floor. One choke point is designated as the 'in-portal' and the other as the 'out-portal.'

ANALYZE AND TEST TO OPTIMIZE RFID TAG READ RATES

While this closed-loop RFID system seemed promising, questions arose regarding the read-rate accuracy of the tags during the design and testing phases of the project. “Given that our building is a metal structure and we’re dealing with metal parts, our partners didn’t guarantee us 100% read accuracy on the tags because metal often interferes with the RFID signal,” says Clark. “Well, we couldn’t run the risk of having a percentage of our parts, no matter how insignificant, going unaccounted for. Therefore, we began to analyze tag placement and realized that placing two tags on each bin at 90 degrees from one another would give us 99.999% read rates. The readability of this two-tag orientation is much higher because a tag directly faces an antenna at all times as bins pass through each portal. It made much more sense for us to spend additional money on tags than it did to spend countless hours trying to recover lost inventory.”

Given the harsh environment of the manufacturing plant, the durability of the RFID readers and antennas being used was also a concern. Therefore, Daimler Trucks built a metal safety cage or ‘guardrail’ that protects each reader from potential damage due to forklift collision, while not obstructing the RFID signal.

Once these modifications were made to the system, Daimler Trucks was ready to implement the solution in its finished cab assembly area in November 2007. “Since we focused the RFID system on one specific area of our business, established preassigned choke points, and dealt with a select number of parts, we were able to get the system up and running over a single weekend and began using it the following Monday,” says Langlois

PARTS TRACKING VIA RFID PROVIDES REAL-TIME IMPACT

With Daimler Trucks’ new RFID solution, parts in the warehouse are repacked into bins labeled with two passive RFID smart labels. Each RFID label is associated or ‘joined’ to the specific part contained in the bin through a bar code scan of the part number label and the RFID tag. When the bin is required on the shop floor, it is loaded onto a parts cart and passed through the out-portal where the Motorola RFID readers identify the bin and the product it contains. Each read is then registered by TraxWare asset management software by System Concepts, and the identified products are automatically deducted from the warehouse and added to the shop floor inventory database. While at the out-portal, the warehouse picker receives an address list that specifies where on the line the bin needs to be delivered.

Once delivered, parts from the bin are used in assembly. The empty bins are then placed on top of the rack as a signal to the parts picker to take it back to the warehouse for refilling. The empty bins are placed on a parts cart and passed through the in-portal. When the tags are read at this choke point, the TraxWare software automatically ‘disjoins’ the RFID tags on the bin from the part formerly associated with it. This frees up the bin to be associated with new and different parts given the custom assembly needs of the plant.

Daimler Trucks’ RFID solution provides the company with several benefits. For example, since warehouse pickers and shop floor employees no longer have to worry about printing paper cards or scanning multiple bar codes throughout the day, productivity has greatly improved. In fact, Daimler Trucks estimates that its RFID solution is saving the company $28,000 in labor costs annually for each of its two shifts.

However, the most important benefit of the solution is the real-time inventory level information it provides. This insight enables the company to execute its JIT parts fulfillment with the utmost efficiency. “Our RFID solution gives us a comprehensive view of our existing inventory,” says Clark. “We not only know how much inventory of each product we have, but we also know exactly where the parts are in our facility. This knowledge enables us to reduce our inventory levels. When you reduce your inventory levels in a manufacturing facility, you free up cash. In other words, you’re not paying more money than you have to by storing excess inventory.”

Finally, Daimler Trucks’ RFID solution has exposed the plant (and the company) to the real business benefits of RFID. The company is currently investigating ways it can leverage RFID in its production line to track the progress of truck assembly progression and help the organization balance its line more effectively.

While its kanban system provided Daimler Trucks with the foundation for success, it was the infusion of RFID technology that helped the company realize new levels of efficiency. What existing processes could you perfect with a similar technology solution?

POSDATA is a leading full service integrator of wireless and mobile computing and network solutions, POSDATA will design, integrate and support an end-to-end wireless solution - from the backbone to the mobile worker. The company's unique blend of best-of-breed hardware and professional services provides solutions for a full range of demanding mobile environments.

Mobility Service and Support: Because today's competitive environment requires companies to rely significantly upon their information-based systems, POSDATA Group provides the Mobility Services to design, develop, implement and support these mission-critical systems. POSDATA Group Mobility Services assure that the correct hardware, software and support plan are put in place to maintain a cost effective and productive system.

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Entigral Systems develops software products that enable reliable Asset Tracking utilizing data collection technology. With a special emphasis based on RFID (Radio Frequency Identification), Entigral Systems applications create value between enterprise systems and the customer's network edge tracking these Assets. Founded in 1984, Entigral Systems provides industry-leading data collection software products and solutions for the manufacturing and process control, asset tracking and EPC/DoD compliance markets.

TraxWare® solves the challenges of RFID systems optimizing RFID interactions and managing the enormous amounts of information these systems generate. TraxWare's data collection methodologies, input techniques and filter algorithms monitor and manage RFID data between corporate IT systems and the edge of enterprise networks. TraxWare also monitors RFID readers and tags and includes implementation tools that ensure successful installation, operation and return on invested capital.

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