RFID Enabled Bin Tracking Solution in High Metallic Environment

Picture your day without cluttered aisles, excess inventory, lost or damaged products, inaccurate records, endless searching, climbing, bending and frustration. Imagine a highly profitable operation that adds value and decreases expense. That's the promise of RFID enabled bin tracking solution from KeyTone. Learn how Bharat Heavy Electricals Limited (BHEL) minimized errors and improved efficiency in bin put away and retrieval by deploying KeyTone's RFID solution on the Automated Storage and Retrieval System (ASRS)

Summary

BHEL (NSE: BHEL) is the largest engineering and manufacturing enterprise in the energy-related/infrastructure sector with revenues of US $4.7 billion. BHEL manufactures over 180 products categorized under 30 major groups, catering to the basic infrastructure verticals like power generation and transmission, transportation, renewable energy and telecommunication. BHEL provides complete turnkey solutions to core infrastructure sectors like power generation and mass transportation and caters to the requirements of both, large private sector customers as well as governments of various countries.

Business Requirement

Owing to the huge demand for power plants, BHEL factories work round the clock to manufacture various power plant assemblies like turbines, engines etc. One such plant manufactures blades that go into making the turbines of a power plant.

At the new blade shop of this plant – raw material (in form of stainless steel bars) and semi-finished blades are fed to sophisticated CNC (Computer Numerically Controlled) machines which cut, grind and polish them into the finished blades for the turbines. These raw material stainless steel bars, semi-finished blades and blade assemblies are stored in an Automated Storage and Retrieval System (ASRS). The ASRS makes efficient use of the available storage space by accommodating large quantities of various materials in vertically stored metallic bins. Their ASRS comprised of:

- 540 bins
- 34 columns with 8 rows in each column
- Total Area 12430 cubic feet

Figure 3: Crane with operator cabin at the background

Figure 4: ASRS with crane and bins stored in racks

The ASRS control software keeps a record of the bin location and the contents of each bin which is manually fed into the system. The process is error prone and leads to inaccurate data over time. A mis placed bin translates into:

- Unproductive labor required to search the misplaced bins
- Manufacturing machine downtime do to the systems inability to feed raw materials on time
- Delays in project completion leading to penalties

BHEL needed a solution that could help them keep track of the bin location, the material information that was stored in the bin and be able to verify if the correct bin was being retrieved when asked for. The objective was to:

- **Verify** if the correct bin was picked by the ASRS crane even before the bin was brought to the base station giving an opportunity to the operator to take corrective action ahead of time, preventing loss of time due to incorrect bin retrieval thus improving operation efficiency of the ASRS
- **Gain visibility** on the bin content (material SKU) and quantity

Solution Overview

KeyTone Team was quick to understand the problem statement – which appeared more complicated than the goals set by BHEL with the major challenge been to make RFID work accurately in a high metallic environment

Challenges related to the Tag

- The entire ASRS structure, including the bins and the material stored inside the bins were metallic making it difficult to get accurate reads

- The harsh industrial environment of the new blade shop required the tags to be strong enough to sustain impact upon possible collision between two bins, as well as the vibrations triggered due to crane movement

Challenges related to the Reader

- The solution needed the reader and antenna to be mounted on the ASRS crane, which moved at a maximum linear and vertical speed of 96 mts/min and 21 mts/min respectively. The reader and the antenna mounting required to sustain the vibrations caused due to this movement
- The communication channel between the reader and the base server had to be such that the cables should not be an impediment for smooth movement of the crane

Challenges related to Integration

- The ASRS was designed to perform the bin retrieval and put-away functions automatically by virtue of the complex control mechanism installed on it which consisted of PLC, sensors and motors

  The schematic below describes the automated Bin put-away and retrieval process

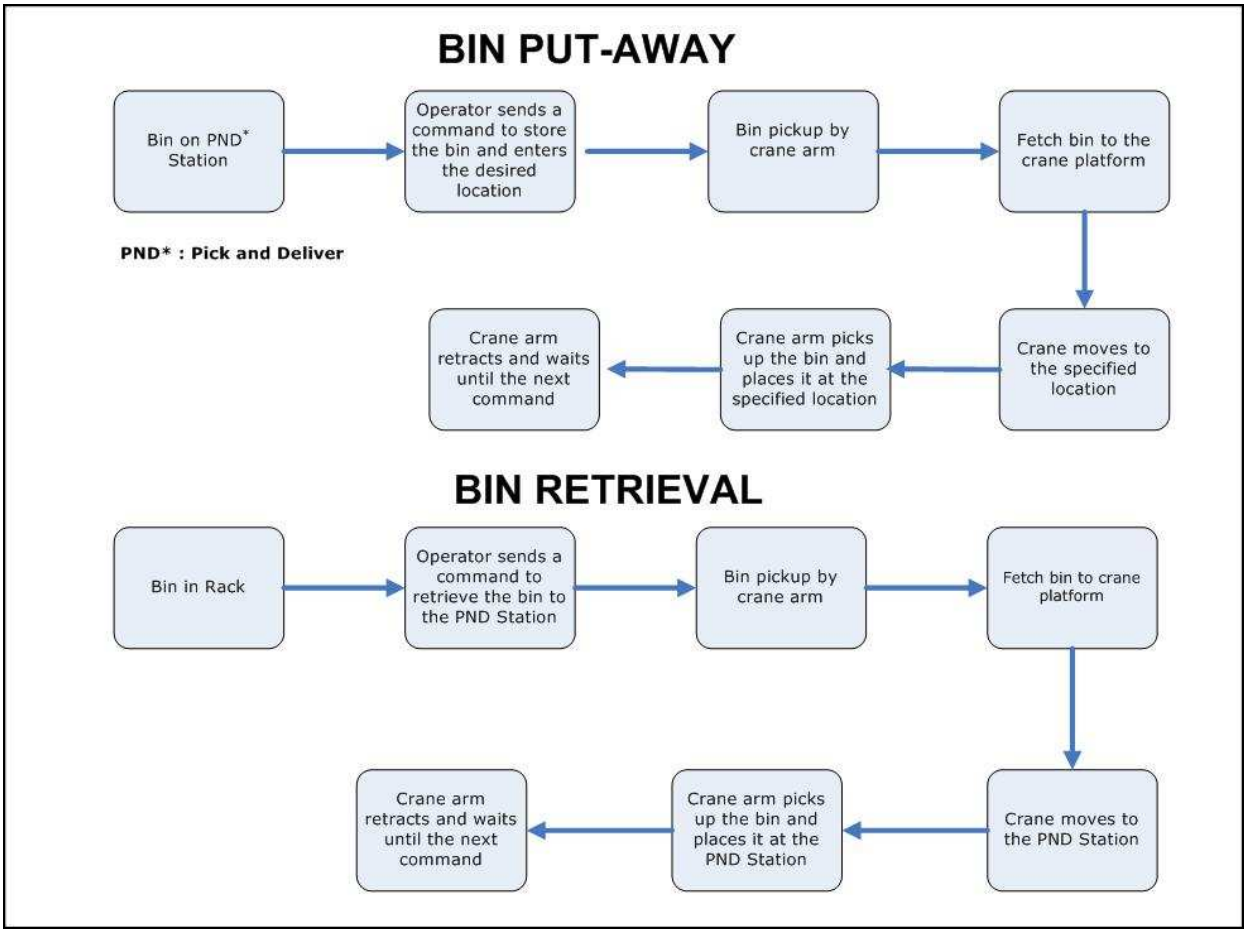

Figure 1: Automated bin putaway & retrieval process

- The RFID based bin verification was to be introduced within the automated process described above
- Owing to the heavy metallic environment writing and reading from the tag memory was a challenge and needed a work around

Tag Solution

- Through R&D, KeyTone researched the effects of mounting the tag on metallic bin and the ideal separation (between the bin surface and the tag) that will decrease the effect that metals exerts on RFID tags

  Industrial grade ISO18000-6B tags were used which were found suitable for the environment. It was also recommended to use polymer bushings as isolators between the metal surface and the tags mounted on the bin to reduce the effects of signal attenuation.
- The bushings proved of dual use, since they provided a cushioning effect against movement, vibration and impact

Figure 2: Metallic bin with RFID tag

Reader Solution

- An industrial grade reader confirming to the IP66 standard was suggested. A special casing was fabricated to enclose the reader which was mounted on top of the operators cabin provided for manual operation of the crane
- A Bakelite back plate was used to mount the antenna. This plate shielded the antennae from the surrounding metal
- The reader and the base server communicated via wi-fi access points – thus facilitating movement of the crane

Integration Solution

- KeyTone's bin tracking application was integrated with the VB based ASRS control software. The schematic below describes the new, RFID based bin put-away and retrieval process

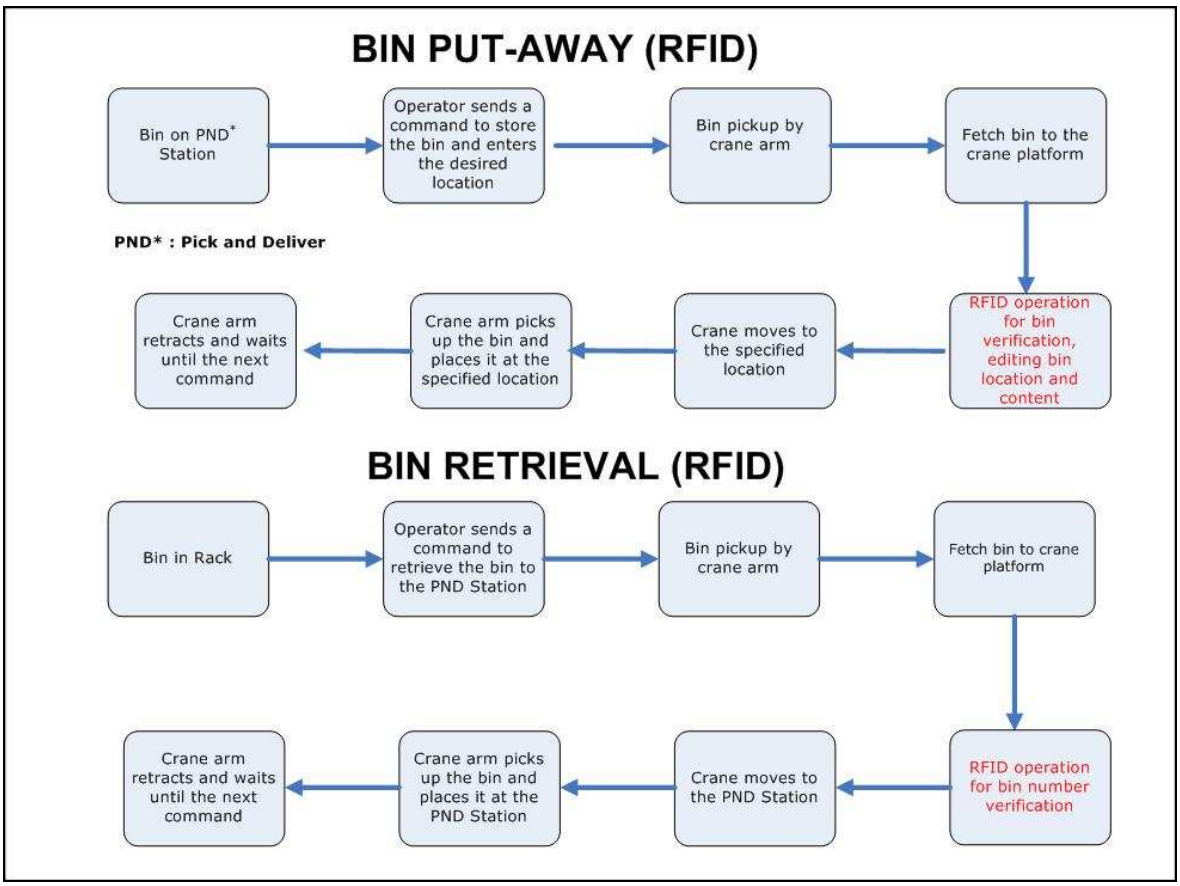

Figure 3: Post RFID bin putaway and retrieval process

- The system architecture was designed to query the tag (mounted on the bin) for its serial number and referencing a backend database for the other bin related information. This approach avoided the RF heavy writing operation directly into the tag memory, which proved to be an impediment for the smooth functioning of the RFID system

RFID Infrastructure on the ASRS

Figure 4: RFID infrastructure mounted on the ASRS

Benefits

With RFID deployment on the ASRS, the operators of the ASRS were being able to verify if the correct bin was being retrieved from the system, even before the system brought the bin to the base station. They were also being able to update the database with the material SKU information as well as the quantity that the bin holds. The benefits accrued by introducing RFID based bin verification were as follows:

- Instances of incorrect bin retrieval were reduced from a daily average of seven to nil
- Quantity of SKU held in the bin was updated in real time whenever any material was removed from the bin, this resulted in 100% accuracy in SKU inventory count

This improved the bin put-away and retrieval efficiency of the ASRS, thus ensuring the high cost CNC machines were fed with the correct material and that BHEL was able to meet the dead lines set by its customers for erecting the power plants.