Do we see RFID helping ports improve their efficiency?
Introduction

Around 90% of the global trade is carried out by maritime transportation. Thus, improving operational efficiency remains a key focus for the ports. With globalization kicking in, there is an upsurge in cargo volumes. In order to scale up and meet the demand, ports need to transform and be built efficiently, to manage large volumes of cargo.

**Radio Frequency Identification (RFID)** is one of the Internet of Things (IoT) technology that would help ports and terminals to improve efficiency, safety, security and improved asset utilization in ports. The overall RFID market in ports is nearly $100m with wide usage in port gate automation and yard processes like track container location, Asset Track & trace, Monitoring Reefer container, Fuel consumption and personal tracking to name a few.
Container Tracking and Gate Entry: Current scenario

Any vehicle that carries the container for export, on arrival need to furnish their details like the export documents, vehicle details, container and shipment details etc., and the seal on the container would need to be verified. After successful verification, these details along with photos of the driver, driving license and truck registration number, would be available to the terminal and would be stored at the Terminal Operating System (TOS).

Verification is a time consuming process and on an average takes about 10 to 15 minutes per vehicle. Hence, to avoid any congestion at the port gates, these verifications is done at the pre-gate survey.

After the pre-gate survey, the vehicles proceed towards the gate of the port. To authenticate the vehicles, the ports could use Optical Character Reader (OCR) or RFID technology. OCR would need a proper “line in sight” to read the truck number, whereas an RFID scanner can read the RFID tag as soon as the truck come near of the gate, in the proximity of the scanner. Details captured during the pre-gate survey and the container live feed from the gate cameras, would be displayed on the monitor screen of the security officer for his visual inspection and once approved by him, Equipment Interchange Receipt (EIR) gets printed. The driver collects the receipts, and the boom barrier makes way for the vehicle to enter inside the port.

By having such an automated gate-in process using RFID, the average verification time per vehicle would now be reduced to less than half a minute, from the earlier 10 to 15 minutes.
Container Location Tracking

Currently, the location details of the container, where it is stacked in the yard, is manually fed on the handheld device by the individual working on the container handling equipment’s like QC / RTG / RMG / Reach Stackers etc. These location details are stored in the TOS / the Freight Station system. Since the location is manually entered, there are chances of error which would cause delay in locating the container later.

RFID is used by container terminal or a container freight station, to track the exact container location. Whenever a container comes in, the below steps are followed in order.

1. Create RFID tag for the Container
2. Attach RFID tag
3. Allow Container to Enter
4. Upload transaction with a time-stamp
5. Unload container from trailer using container handling equipment
6. Antenna on spreader arm, starts reading the container RFID tag
7. RFID tag details with location co-ordinates, are uploaded over GPRS interface with the time-stamp
8. Container movement tracked real-time

When container leaves the terminal/yard,

- Remove container RFID tag
- Disassociate container RFID tag
- Allow container to Exit
- Upload transaction with the time-stamp

Using RFID and GPRS interface, the exact location gets auto-recorded in the TOS / Container Freight station application without any manual intervention, for it to be located easily thereafter.
Port is usually a very large area and getting real time visibility of various assets is a challenge.

**RFID Reader Mounted on Boom**

- RFID Antenna to read Container tag while handling
- RFID Tag placed on Container using magnet

Using RFID and GRPS interface the exact Geo location of cargo handling equipment, vehicles, cranes and other tools/devices would be available to ports operations and maintenance team.

**Asset Track and Trace**

Port is usually a very large area and getting real time visibility of various assets is a challenge.

**RFID TECHNOLOGY IN A CONTAINER PORT: AN ACTIVITY-BASED MODEL TO ASSESS COSTS AND BENEFITS**

Source: [https://pdfs.semanticscholar.org/775c/6e74e3d9b99702f6153b0e24e84fdec34.pdf](https://pdfs.semanticscholar.org/775c/6e74e3d9b99702f6153b0e24e84fdec34.pdf)
RFID for Fuel Consumption

The fuel tanker that goes for the movers and equipment like crane / RTG / RMG / Tugs / pilot etc., launches to dispense the fuel. Flow meter on the hose indicates quantity of fuel being dispensed by each equipment. Accurate disbursement of fuel is essential to prevent loss and theft. RFID is used to identify authorized equipment before fueling starts. Fuel filling is controlled and one can issue quantity of fuel that can be pre-fixed as per allocated quota; and/or automatically stop when tank is full. Using RFID, fuel would be dispensed only to authorized equipment’s and have the complete data in record in terms of the fuel consumption. Hence help in preventing theft/loss of fuel, which ultimately results in the reduction in fuel expenses for the port.

Wireless Reefer Monitoring

RFID application is also seen in the areas of reefer condition monitoring, and involves wireless temperature sensors to control and monitor the temperature inside the container. This helps in collecting critical real-time information, in terms of the condition, the location by enabling GPS, and also used to send engine diagnostics.

The main advantage is that this helps reduce the spoilage due to faulty temperature.

Vehicle Emission Control

RFID has great potential to monitor and track the number of vehicles in the port premises and based on that data in hand Apply standard emissions, and later assess the total emission levels inside the port premises.
RFID access cards which are issued at the ports by their staff, can be used to track personnel across a terminal, or anywhere across the yard. This information would also be useful in case of any incident or emergency, and help in better evacuation.

**RFID Container E-Seal**

The E-Seal is an ISO 17712:2013(E) compliant high security bolt seal, designed for ISO container cargo shipments. The E-Seal is a radio frequency enabled device that transmits container information as it passes a RFID reader and stops working if the E-Seal has been tampered or damaged. The E-Seal combines physical as well as RFID security that analyses and reports any seal tampering to ensure the integrity of container shipped across the globe.

**Port of Singapore.** has installed RFID transponders into its container yard to create a multi-dimensional tracking grid. All of this helps them to track, manage the placement and location of their containers.

**The Port of Rotterdam,** is one of the largest operators of container handling systems in Holland. Buried RFID transponders guide automated guided vehicles (AGVs). All container transfers are controlled by automated guided vehicles, and unmanned bridge cranes carry out stacking operations.

Most of the Ports have implemented RFID based gate automation solution. Every export container in India is fitted with RFID e-Seal at the factory premises at the time of stuffing. This mandate is from central board of indirect tax and customs, government of India.
Benefits of using RFID

- Improved container identification efficiency, tracking and storage management through real-time updates
- Process Automation
- Reduced manual inspection
- Reduced chances of error
- Ensures safety and security
- Improved supply chain management
- Speeds up the shipping process
- Reduce cost

References

https://pdfs.semanticscholar.org/775c/6e74e03d9b99702d6153b0e24e84d84fddc34.pdf
https://pdfs.semanticscholar.org/b269/27fced20792756f38555e320ebc167d1e6d34.pdf
file:///C:/Users/VB00627004/AppData/Local/Microsoft/Windows/InetCache/Content.Outlook/GU5KDOV/ShiTaoVoss2011RFID.pdf
https://www.researchgate.net/publication/220143886_RFID_Technology_and_its_Application_to_Port-Based_Container_Logistics
https://wlius.com/blog/active-rfid-temperature-sensor/
Shailesh Rathod  
Head of Maritime Practice Tech Mahindra Ltd.  
Shailesh.Rathod@TechMahindra.com

Having experience in project delivery in conceptualization, visualization, development & deployment of comprehensive ICT solutions for Maritime industries. Created unique solution offering for Smart Ports / Shipping using connected technologies like RFID, IOT, RPA, Blockchain, Drones and 5G. Ability to visualize end to end solution, thorough understanding of the Ports business processes & IT systems.

Vani Bansal  
Management Trainee (Maritime)  
VB00627004@TechMahindra.com

PGDM from IMT, Hyderabad. She’s been working with the maritime practice. She was involved with an As-Is study at the Port. She has been working on doing a research on various technologies used by various Ports.

INTEGRATED ENGINEERING SOLUTIONS (IES)
Is a Connected Engineering Solutions business unit of Tech Mahindra. At Integrated Engineering Solutions, customers are at the core of every innovation. We align Technology, Businesses and Customers through innovative frameworks. We deliver future-ready digital convergence solutions across Aerospace and Defense, Automotive, Industrial Equipment, Transportation, Consumer Products, Energy and Utilities, Healthcare and Hi-Tech products. Our ‘Connected’ solutions are designed to be platform agnostic, scalable, flexible, modular and leverage emerging technologies like Networking, Mobility, Analytics, Cloud, Security, Social and Sensors, that enable launching of smart products and deliver unique connected consumer experiences, weaving a connected world. Coupled with this, our strong capabilities in Electronics, Mechatronics and Mechanical Engineering along with domain understanding and product knowledge, bring excellence to the entire lifecycle of these connected ecosystems.

CONTACT US AT  
connect@techmahindra.com  
www.techmahindra.com

SOCIAL MEDIA  
www.youtube.com/user/techmahindra09  
www.facebook.com/techmahindra  
www.twitter.com/tech_mahindra  
www.linkedin.com/company/tech-mahindra