



# RTLS TECHNOLOGIES IN TERMINALS



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Container terminals employ a variety of real-time locating services (RTLS) that range from DGPS/INS to RFID technology. Terminal equipment positioning systems, extended real-time monitoring systems, and auto hand off systems are all currently applied in container terminals that are operating today. Below are some of the existing RTLS technologies and their pros and cons, as well as an insight into how they are used in various types of terminals.

## GPS

GPS is a viable option for any container operator that wants to visualise terminal processes with minimum investment. The GPS visualiser can track terminal trucks and gather basic information such as movement history, speed and status of trucks that are loading containers. However, there are limits to the accuracy of pinpointing locations. Weak satellite signals lead to low accuracy levels, and signal interferences are high due to thick layers of containers and heavy equipment such as cranes and reach stackers.

Therefore we can state the positives and negatives as below:

- Pros: Inexpensive, easy installation and implementation, as well as less space required by small devices
- Cons: Relatively low accuracy, vulnerable to satellite interferences and this often leads to lost targets

## DGPS AUGMENTED BY INS

DGPS (Differential GPS) decreases the margin for error to less than 1 metre by using the fixed position of reference stations in the terminal yard. However, DGPS is also vulnerable to signal interferences; therefore it requires additional sensors to enhance stability and accuracy. Inertial Navigation System (INS) is a method that uses computers, motion sensors (accelerometers) and rotation sensors (gyroscopes) to continuously calculate the position, orientation, and velocity (direction and speed of movement) of a moving object without external references[1] even in dead reckoning areas. The images below

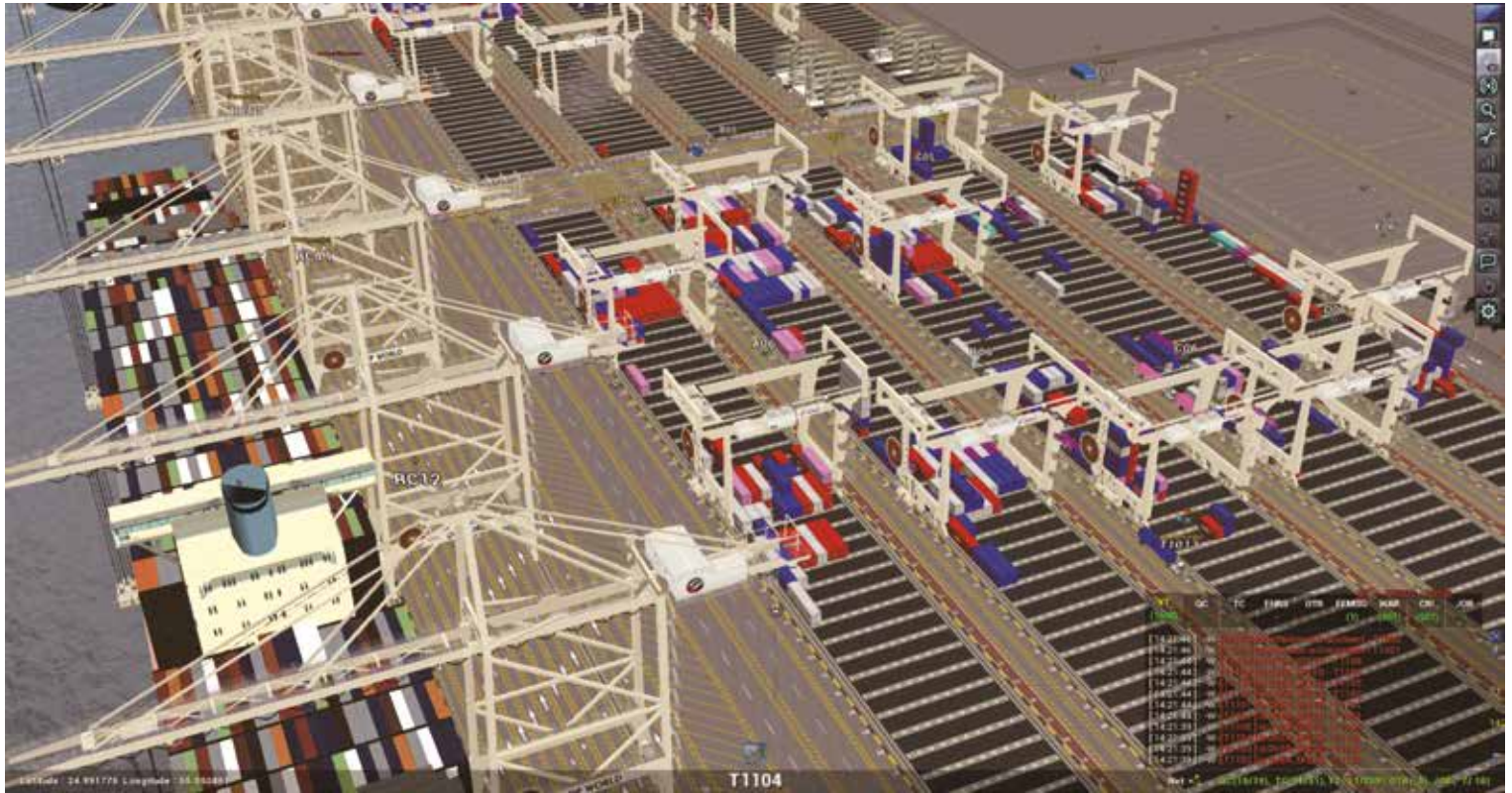
display vehicle tracking using DGPS only (red line) and DGPS augmented by INS (blue line). Integrating INS and DGPS can achieve precise and real-time truck tracking, automated container inventory and automated container hand-off. We can highlight the positives and negatives:

- Pros: High accuracy, stable in harsh environments with frequent satellite signal interference, able to track location even when GPS signal is lost
- Cons: More expensive than a normal GPS system

## RFID

RFID technology is commonly used in terminal operations. It is used for generally three purposes:

1. Pre-advice data validation at terminal gates: RFID tag inside trucks are read by RFID readers at terminal gates
2. General truck position tracking within terminals by RFID readers at various yard blocks and cranes
3. Positioning for coupling trucks and cranes



The positives and negatives can be outlined as:

- Pros: RFID tags are very inexpensive and batteries are not required (passive)
- Cons: RFID readers required at multiple points to read tags (additional installation required inside terminals), RFID also has low accuracy

### UWB

Ultra-wideband (also known as UWB, ultra-wide band or ultraband) is a radio technology that uses low energy for short-range, high-bandwidth communications over a large portion of the radio spectrum.[2] UWB has been adopted in car manufacturing and heavy machinery industries in order to analyse production status and gather various forms of data during work processing.

High accuracy and wide network bandwidth are advantages of UWB technology in terminal operations environments such as Ro-Ro terminals. One of the main concerns of Ro-Ro terminals is vehicle inventory management. Unlike container cargo, vehicles cannot be fitted with RTLS equipment for safety issues. Thus, the essence of a Ro-Ro terminal monitoring system lies in positioning, and tracking of individual drivers and UWB RTLS technology can be a good solution.

However, UWB holds limits of its own as well. Standard UWB systems find it difficult to measure distances between access points (AP) that are more than 100 metres

apart. Therefore, it is necessary to install multiple APs in the terminal as this leads to increased costs. However, there have been different attempts recently to overcome the constraints by extending UWB range to an additional 100 metres. The positives and negatives are listed below:

- Pros: Very high accuracy, strong in indoor location tracking, able to send and receive high-volume data using ultra wideband network
- Cons: More expensive than GPS/RFID RTLS, requires UWB locator (reader) in every 60 to 100 metre space

### CONCLUSION

RTLS technologies can be implemented in a different range of prices. Each technology has different specifications and requirements such as:

- Accuracy
- Detection range
- Network and data bandwidth
- Power consumption
- Frequency
- Civil work requirements
- Safety issues
- Ease of implementation and integration
- Ease of maintenance and repair
- Ruggedness of device

More and more customers are adopting RTLS based process automation solutions. Because of this it is necessary to understand the different characteristics of technologies and choose an optimal solution for terminal operations.

### References

1. "Basic Principles of Inertial Navigation Seminar on inertial navigation systems." (PDF). AeroStudents.com. Tampere University of Technology, page 5. Retrieved 22 January 2015.
2. USC Viterbi School of Engineering. Archived from the original 2012-03-21.

### ABOUT THE AUTHOR

Jake Jung Taek Kim currently serves as a sales representative in CyberLogitec Terminal Business Unit. Previously, he has served as a system engineer and also served as a project manager in various TOS projects. He is now deeply involved in strategic alliance, proposal, and terminal solution sales and marketing.

### ABOUT THE ORGANISATION

CyberLogitec has ample experience in implementing different terminal automation solutions for global terminal operators. We provide highly experienced professional teams and cutting-edge technology solutions to ensure customer satisfaction.

### ENQUIRIES

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