CAMCO TECHNOLOGIES

Safety Through Automation





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Navis

-Automation Support Engineer



Long Beach Container Terminal

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- -Operations Manager



Ports America

- -IT Manager
- -Operations Superintendent

Camco Technologies



Privately owned Global presence 24 years in terminal automation Passion for technology Industry innovator



Camco US One World Trade Center Long Beach



CAMCO TECHNOLOGIES AUSTRALIA PTY LTD



Camco Middle East FZE JAFZA ONE Tower - Building A



Camco China Shanghai



Vision & Location Technology Based Solutions





Most global supplier in our market niche





"We automate the container hand-over process"





Camco = Product(ion) factory





Camco = Software company





Camco = Project company







Camco = Service company









Reasons to Automate

Safety

- •Efficiency
- •Cost Savings
- •Freeing up human capital
- •Minimize human error
- Greater customer satisfaction
- •Many others...





Some Examples of Safety Automation



Automated Guided Vehicles (AGVs)

- Self-driving vehicles that can transport containers within a terminal without the need for human drivers
- AGVs can operate around the clock, reducing the need for manual labor and minimizing the risk of accidents caused by human error
- Automated areas use safety gates that will halt all automated vehicles if gate is opened



Autonomous Cranes

- Can be programmed to move containers automatically, reducing the need for human intervention and minimizing the risk of accidents caused by human error
 - These cranes can also operate more quickly and efficiently than human operators, which can help reduce delays and increase productivity





Drones

- Drones can be used to perform safety inspections of the terminal, including checking for potential safety hazards such as damaged containers, infrastructure, or equipment
- They can also be used to monitor traffic and cargo movements within the terminal, which can help prevent accidents caused by congestion or poor traffic management











Collision Avoidance Systems

- These systems use sensors and software to monitor the movement of equipment and containers within the terminal
- helping to prevent collisions and other accidents caused by human error

Radio Frequency Identification (RFID) Technology

- Help track containers throughout the terminal
- Reduce the likelihood of loss or damage
- RFID readers can be installed throughout the terminal to monitor movements











Optical Character Recognition Cameras

- Can be used to automatically obtain data and transfer it to the terminal operating system
- No need for a person walking around in a dangerous environment







Line-scan camera images truck & container





Container : Area-scan camera images and OCR angle correction







Rail OCR











Yard Crane OCR







Predictive Maintenance Systems

- Use data analytics and machine learning algorithms to identify potential equipment failures before they occur
- By predicting equipment failures in advance, these systems can help prevent accidents caused by equipment malfunctions.





Wearables

- Items such as smart glasses or smart helmets can provide workers with real-time information on safety hazards and provide alerts or warnings when necessary.
- They can also be used to monitor worker health and fatigue, helping to prevent accidents caused by physical exhaustion or other health issues.



Augmented Reality (AR)

- AR can be used to provide real-time information to operators and workers within the terminal, helping them to identify potential safety hazards and take appropriate action.
- For example, RTLS can be used to provide workers with visual cues or instructions for safe container handling.





Machine Learning and Artificial Intelligence

- Advanced analytics and machine learning algorithms can be used to identify patterns and predict potential safety hazards in the terminal.
- For example, these technologies can help predict when equipment is likely to fail or identify areas of the terminal that are at higher risk for accidents.





Argus Automated Damage Inspection- ADI

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Visibility









Visibility with Camco

Camco vision for 2023 - 2028



Regarding terminal automation, we move from "application solution provider" to "global solution provider"

This move is supported by 2 software platforms:



Camco's BRIDGE software is a web browser based UI. It's a multi terminal, multi application front end of all Camco visual and location based products covering setup, configuration, user configuration, exception workstation, maintenance console, dashboard, reporting and analysis. From Q4/2023 3th party systems will be supported

TWINBRIDGE Management by Digital Twin

It's Camco solution for Digital Twin, a virtual copy of the physical terminal. Main focus is real time 3D visualisation of the operations of the terminal. Camco feeds the Digital Twin model with real time data from our own 2 sources, OCR data on all handover locations and location data across the full terminal of all moving equipment. Our third source is the TOS, giving stack & vessel information. Later we will add replay and simulation functions.



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How did we prepare the visual based part?



First we developed a new product:





The Bridge

Welcome screen











The Bridge

Exception Selection Job on one page (truck, rail, crane, PDS)

							Jobs	Landside monitorir	ng Camco monitori
Jo	ob ov	erview							Create job
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•	₩ 9	OCR Job	14/12/20 - 20:35	Location one	Sidney Fischer	bx-543	BN 123-123-123	1-XVM-143	BP12-12-476
8	<u>.</u>	Mismatch	14/12/20 - 18:22	Location two	Herbert Jordan	bx-543	BN 123-123-123	-	BP12-12-476
•	ဓ	Linking Job	14/12/20 - 16:33	Location four	Irma Hamilton	bx-543	BN 123-123-123	1-XVM-143	BP12-12-476
•	<u>ü</u> θ	OCR Job	14/12/20 - 11:18	Location two	Kurt Olson	bx-543	BN 123-123-123	1-XVM-143	BP12-12-476
a	Щp	Linking Job	13/12/20 - 22:03	Location three	Edith Hicks	bx-543	BN 123-123-123	1-XVM-143	BP12-12-476
â	員	Mismatch	13/12/20 - 19:56	Location three	Felicia Fischer	bx-543	BN 123-123-123	1-XVM-143	BP12-12-476
•		Mismatch	13/12/20 - 17:13	Location four	Dwayne Allen	bx-543	BN 123-123-123		BP12-12-476
•	t	OCR Job	13/12/20 - 16:56	Location six	Tracey Hunt	bx-543	BN 123-123-123		BP12-12-476
•	999 199	Linking Job	13/12/20 - 14:38	Location one	Ella Walker	bx-543	BN 123-123-123	1-XVM-143	BP12-12-476
â	眞	OCR Job	13/12/20 - 09:16	Location five	Cassandra Shaw	bx-543	BN 123-123-123	1-XVM-143	BP12-12-476
•	Щ9	Mismatch	12/12/20 - 17:57	Location one	Sara Wolf	bx-543	BN 123-123-123	1-XVM-143	BP12-12-476
•	ភា	OCR Job	12/12/20 - 14:06	Location two	Michelle Sims	bx-543	BN 123-123-123	-	BP12-12-476
â	Щ9	Linking Job	12/12/20 - 09:36	Location two	Beth Hawkins	bx-543	BN 123-123-123	1-XVM-143	BP12-12-476
•	<u>۾</u>	OCR Job	12/12/20 - 04:55	Location six	Thomas Brown	bx-543	BN 123-123-123	1-XVM-143	BP12-12-476
•	∰9	OCR Job	12/12/20 - 01:33	Location one	Violet Nichols	bx-543	BN 123-123-123	1-XVM-143	BP12-12-476
a	<u>.</u>	Mismatch	11/12/20 - 23:47	Location two	Corey Hamilton	bx-543	BN 123-123-123	-	BP12-12-476
•	ē.	Linking Job	11/12/20 - 16:38	Location four	Dolores Bell	bx-543	BN 123-123-123	1-XVM-143	BP12-12-476
•	₩9	Data Job	11/12/20 - 14:09	Location two	William Hill	bx-543	BN 123-123-123	1-XVM-143	BP12-12-476
	ΞŤ	Mismatch	11/12/20 - 12:14	Location four	Erika Craig	bx-543	BN 123-123-123	-	BP12-12-476



The Bridge Truck Gate exception

CREATION 12/12/20 - 01:33	sullueor Truck visit	Location Location one	CONTAINER bx-543	BADGE NUMBER BN 123-123-123	LICENSE PLATE 1-xvm-143	VISIT ID BP12-12-476		Car	ncel Stage don	e V
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The Bridge Gate Lane equipment

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What's a Real Time Digital Twin?



The key differences between digital twins and real-time digital twins can be summarized as follows:

Characteristic DT)	Digital Twin	Real-Time Digital Twin (RT-
Concept	 3D presentation of a terminal's assets Equipment behavior replicates the real world Action based on emulation and simulation 	 3D presentation of a terminal's assets Equipment behavior has no constrains Action based on real data
Driven by	 Pre-programmed Equipment and TOS actions 	 Real time incoming data from OCR, RTLS, TOS and IOT equipment
Use cases	 Performance analysis Development green field terminals Upgrade brown field terminals 	 WYSIWYO (Operate) Real time viewer of live systems for situational awareness. Interactive terminal Analysis by seeing
Implementation	Software only but complex	Based on hardware & software



The challenge is getting and processing the real time data

What are the sources?

Real time data sources



Systems	Source	Data
OCR Systems	 Truck & Rail OCR portals STS/RTG/RMG OCR cameras 	 Time stamps, log files Container (ID, ISO, Seal,), truck id, wagon nmbr Container nictures + damage status
Yard IOT equipment	Sale & yard Kiusks • Barriers, RFID readers • Scales	 Time stamps, log files, VoIP logging Driver name, truck id, RFID numberss Kiosk processes
Location technology	 TT's/Straddle/Shuttle STS, RTG, RMG, EH, RCH 	 Exact location on the terminal Job promotion (via VMT) Tvus lock totus, unment data
Telematic data	 TT's/Straddle/Shuttle STS, RTG, RMG, EH, RCH 	 Tire pressure, engine hours Oil/engine temperature Max speed, battery level, fuel level
TOS	TOSVBS	 Stacks (yard), Bapli (vessel), Rail manifest (wagon/container), Truck chassis Booking number





OCR technology = Identify object 🔿 Location technology = Track of the object



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How do we implement the location technology?



Camco's RTLS is build on 3 location technologies:



- Global Navigation Satellite System
- Based on recent GNSS chips
- Multi constellation
- Multi receiver, allows orientation



- Based on RF-pulse technology
- Measures distance between antennas
- Very high accuracy (2cm)
- Very fast (collision avoidance)



•

technology

can be reproduced without permission No content RFID is a location *awareness* Confidential, all rights Presence in a radius of 8m







Problems

• GNSS quality drops under STS cranes



Normal GNSS quality



Disturbed GNSS under STS



Disturbed GNSS under STS



Location technology: UWB

MLT/UWB Intelligent antennas

- 8 UWB antennas on the STS crane
- 2 UWB antennas on the TT or Straddle carrier
- Uses triangulation between antennas
- Includes PLC connection (CAN bus)
- Multi lane alignment of TT or straddle carrier











Hardware on CHE's



The Bridge

Yard cameras





Real Time Digital Twin: gates





Capturing Images from Above

Based:

- Front/back license plate
- RFID (door, windshield, license plate)
- SpreaderCam: Roof number





Real Time Digital Twin: TT



Real Time Digital Twin: Stack





"You can replace containers and machines but you can't replace you or me" -Wayno, Ship Boss



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