TOC EUROPE

June 11-13, 2024

Application of camera and artificial intelligence in identification of vessels in ports

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AECOM overview

110 year track record in servicing infrastructure

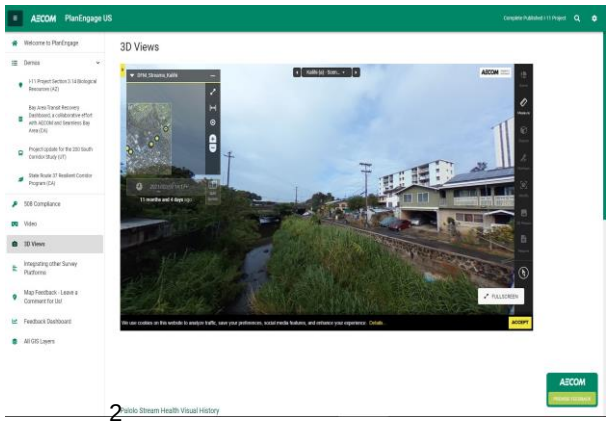
50,000 dedicated professionals – Leader in port design and development for over 80 years

7 continents, 400 offices in 130 countries

#1 design firm in Transportation, Facilities, Green Environmental Engineering and Water

Digital Consulting

Digital Delivery



Data science & analytics

Analytics, machine learning, AI and reporting technologies in the built environment.

- Data science
- Analytics
- Simulation

Software development

Custom software development and engineering.

- Web/Cloud software
- Mobile apps
- Ui/UX design
- Custom reports and dashboards

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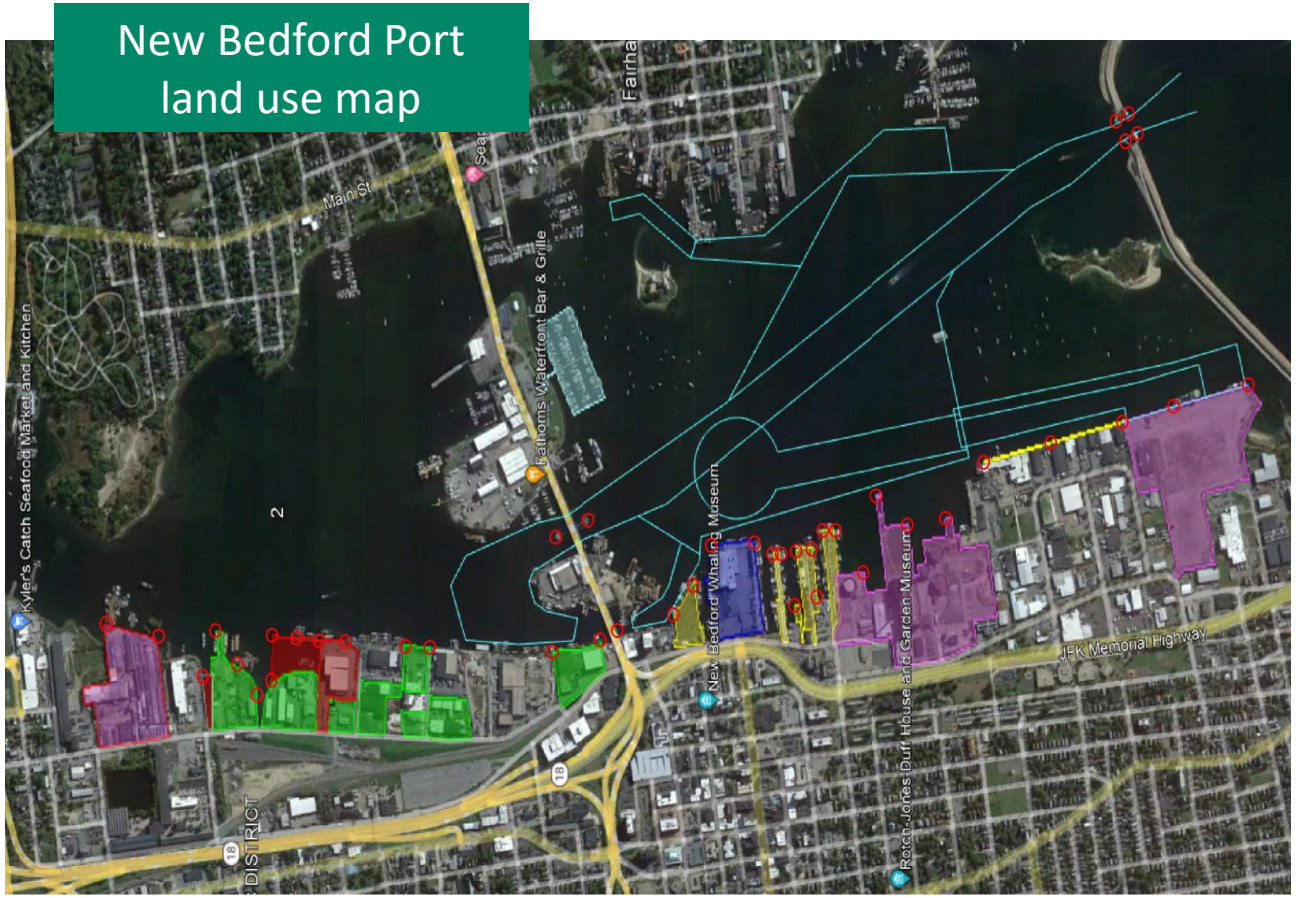
New Bedford Port Authority – the largest fishing port in USA

- Leading commercial fishing port in United States with over $500m of annual catch
- Generated more than $11b in economic output and 7,000 direct and 40,000 total jobs
- Over 5.5 kilometers of vessel berthing infrastructure catering to vessels up to 150 meters in length
- Unique hurricane barrier at the port entrance with a 50-meter opening at the entrance
- Increased vessel calls / demand at the port due to transient vessels related to fish processing industry and offshore wind energy development



Camera locations denoted ○

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Challenges related to port use - optimization study

- Increased threat to port security and safety in relation to additional traffic e.g. offshore wind development
- Challenge of real time visibility of smaller fishing & recreational vessels
- Lost revenue assessment and prevention
- Vessels are docking up to 5 deep at some locations
- Ports track vessels within the port harbor environment using AIS tags
- AIS tags are not mandatory on smaller vessels

Current practice – manual

- Port authority collects data for vessels docked at their piers by performing manual inventory every weekday morning
- Captures the vessels docked on their piers only at the point in time of the inventory
- Potentially missing other vessels that dock at other times of the day or weekends
- Some vessels turn off their AIS transponder to circumvent tracking while AIS is not mandatory for smaller vessels

Current industry for large vessel detection tools

- Radar – Automatic Radar Plotting Aid (ARPA)
- Automatic Identification System (AIS)
- Electronic Chart Display and Information system (ECDIS)
- Magnetic Anomaly Detection System (MAD)

AIS Monitor

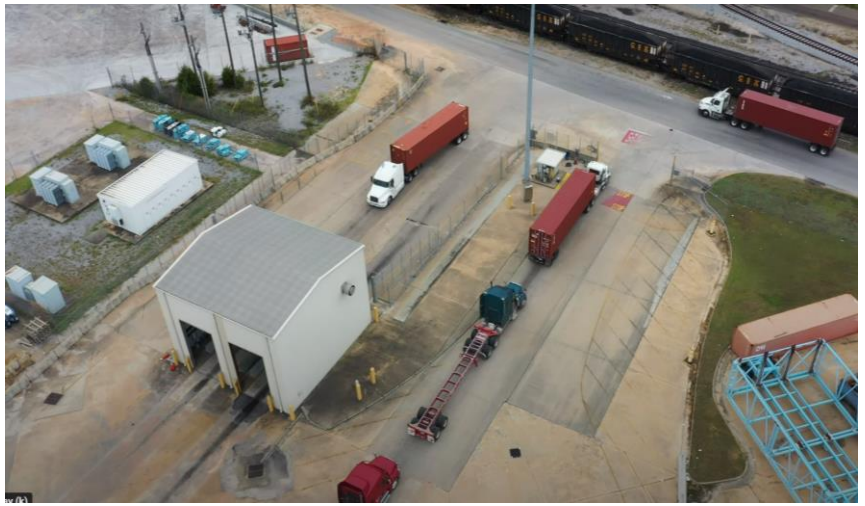

MAD Bird


ARPA System

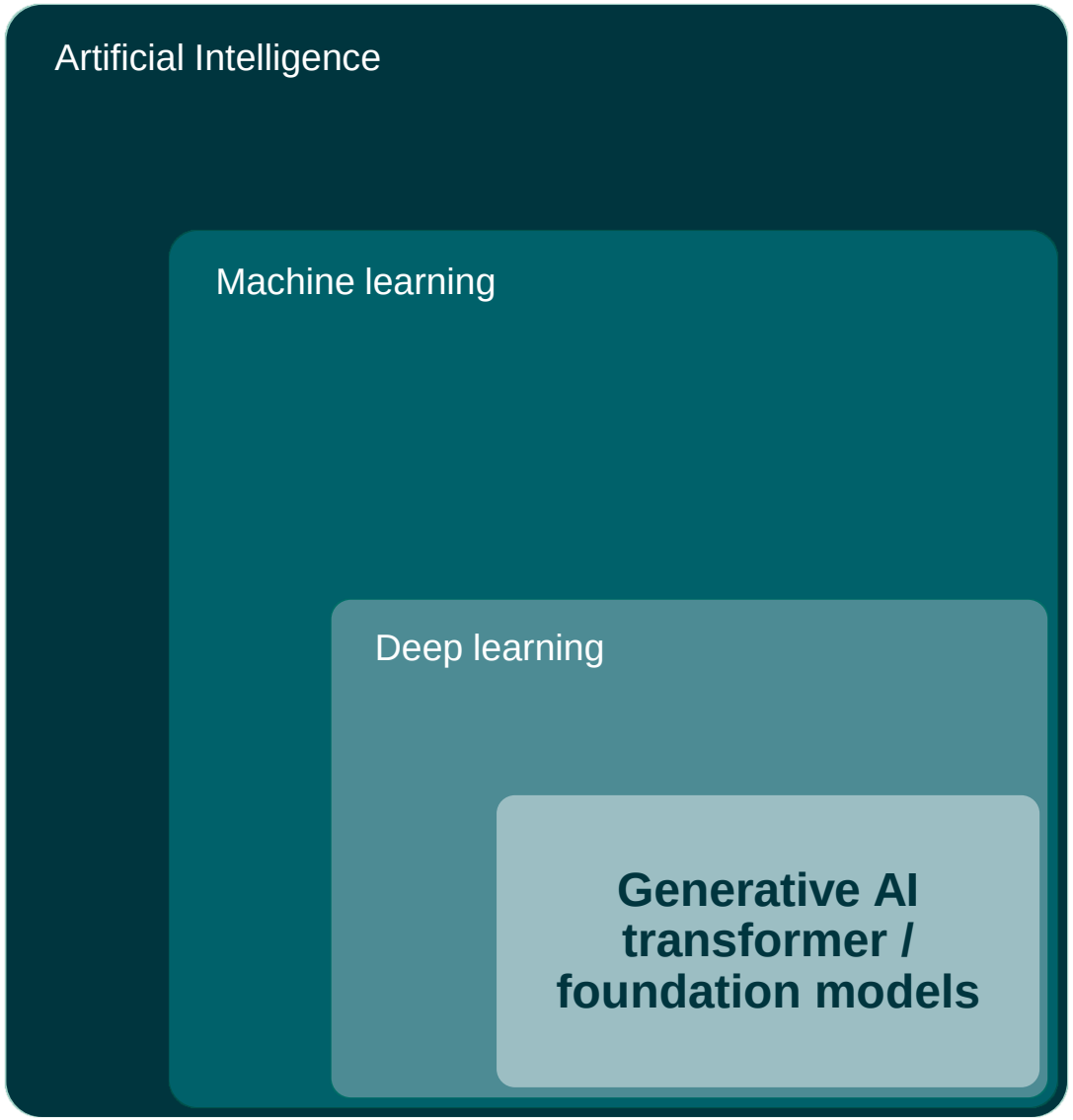

Magnetic Silencing

Conventional optical character recognition (OCR)

- Cameras and software automatically read and auto populate information into terminal's database
- Typically used for container numbers and license plate
- Often placed inside sheds for better environmental control
- Information collected while trucks are in motion
- Very accurate but some manual intervention required for damaged containers or irregular information
- Introduced in early 2000s and now used at ~ 100% of container ports



Brief history of AI



1956

Artificial intelligence

The field of computer science that seeks to create intelligent machines that can replicate or exceed human intelligence

1997

Machine learning

Subset of AI that enables machines to learn from existing data and improve upon that data to make decisions or predictions

2017

Deep learning

A machine learning technique in which layers of neural networks are used to process data and make decisions

2021

Generative AI

Create new written, visual, and auditory content given prompts or existing data

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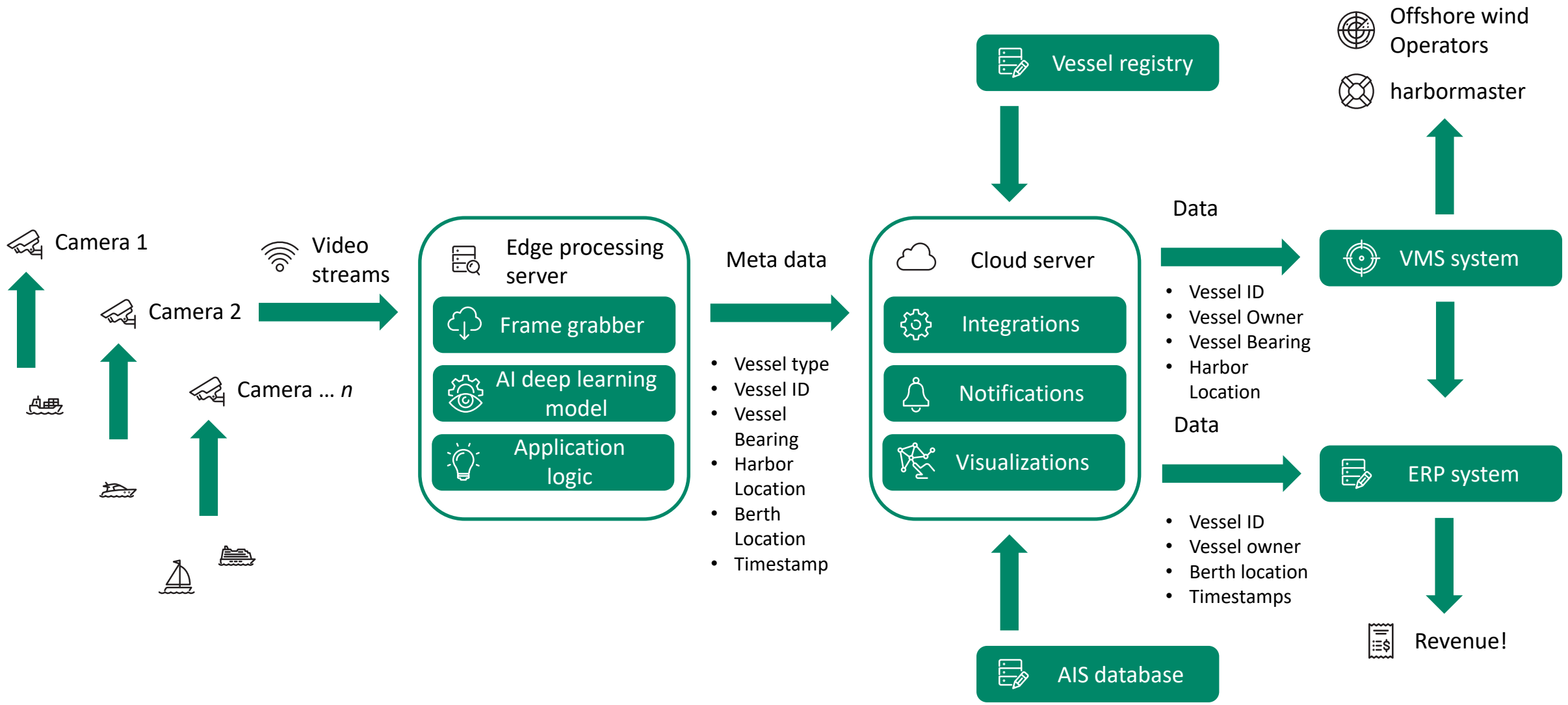
AI process flow and system landscape



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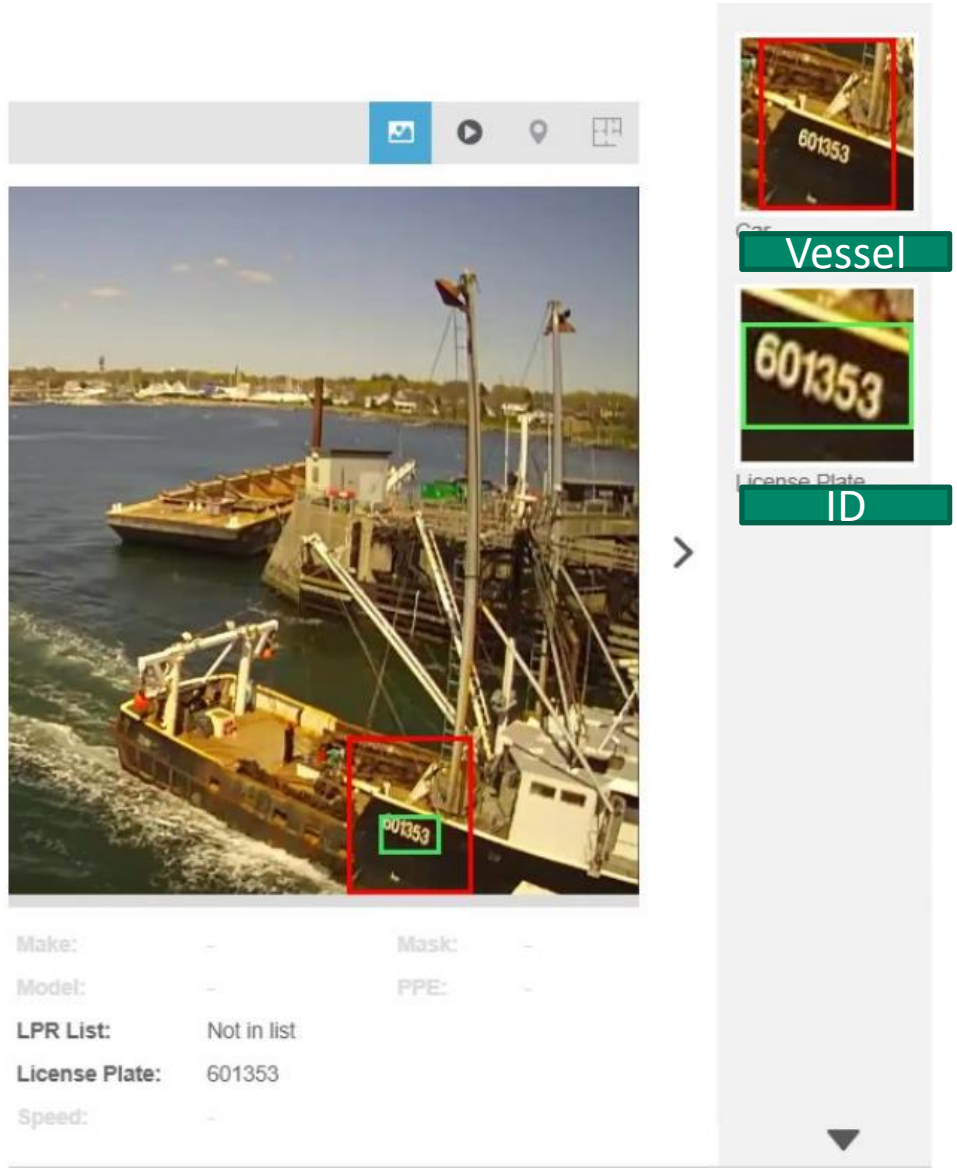
AECOM's proof of concept (POC) solution

DETECT, CLASSIFY and ***IDENTIFY*** vessels going in and out of the harbor using **Artificial Intelligence (AI)** technology :

- **Motion detection** is prone to false positives, applying AI allowed for more accurate detection
- Applying AI technology's **machine learning** (ML) capabilities five types / categories of vessels, namely, Fishing, Ferries, Recreational, Bulk Carriers and Offshore Wind **were classified,**
- Vessels Official Numbers (VON) assigned by IMO or USGS was used to identify vessel's **particular information and ownership**
- In a 20-day trial (3) existing **cameras as sensors were used** to capture information



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Results of the solution

We **Collected** and **Analyzed** real-time data and **Integrated** captured info with existing data, the results indicated:

- POC Allows for identification of most vessels entering and exiting the harbor
- Identifies vessel type and provides count and movement data
- Enables better understand safety concerns
- Provides for the ability to geofence areas where certain vessels should not enter
- Increases data quality regarding harbor usage and revenue collection

A HIGH VALUE SOLUTION INTEGRATING NEW TECHNOLOGIES

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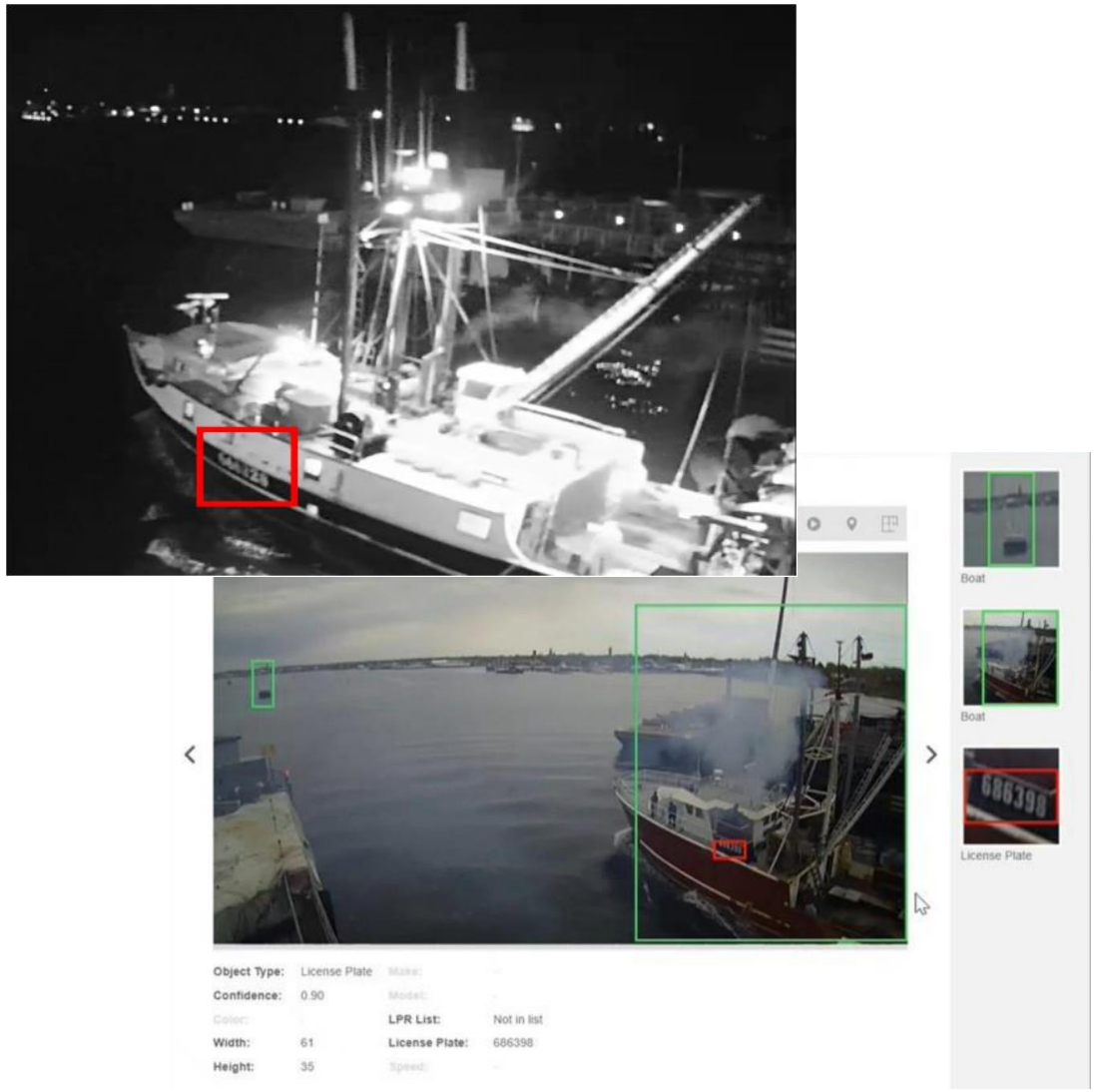
Lessons learned to consider for future implementation

- Camera locations – selection of choke point
- Camera Field of View (FOV) – appropriate angle, 90 degree
- Image resolution – 80 pixel-per-inch recommended
- Image quality – proper lighting on target
- Wide Dynamic Range (WDR) – ability to compensate lighting contrast, 120 dB WDR recommended
- Corrupted frames – adequate bandwidth and low latency



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Q&A