



Virtual Workshops (Focus Groups)  
on user requirements

## Autonomous Tugboats



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# Autonomous Tugboats – Success Indicators



Reduction of human error-related accidents for manoeuvring and docking

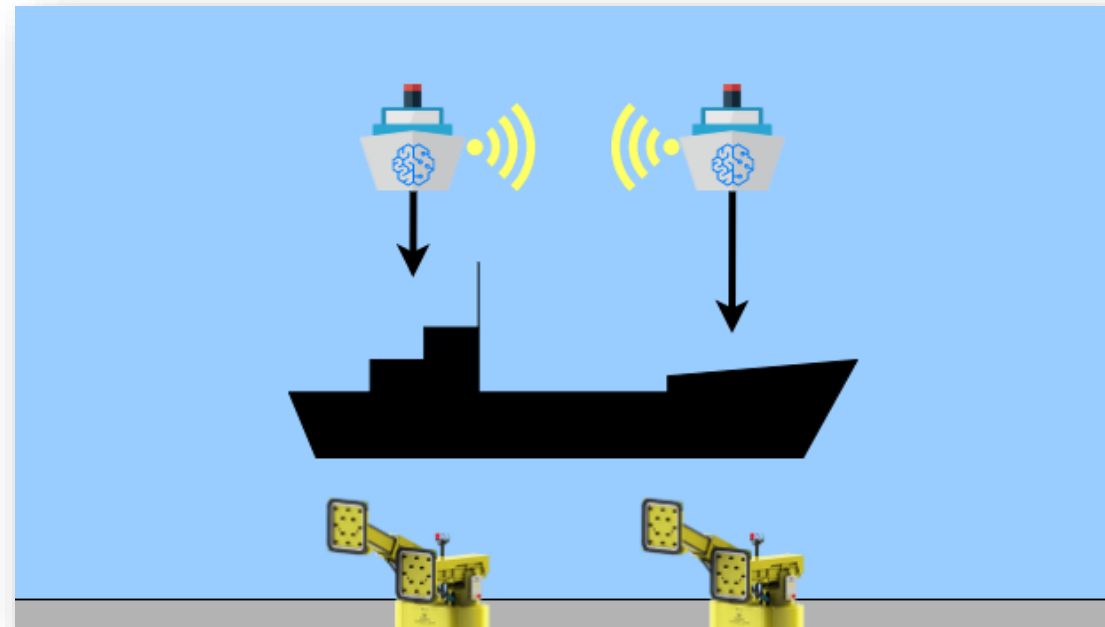
Reduction of air pollutants in port areas

Reduction of manoeuvring and docking time by at least **20%** compared to current norm (pilots and human operated tugboats)

Increase of port services availability up to **100%**

# Automated System for Reducing Manoeuvring and Docking Time for DSS ports

Swarm of autonomous tugboats

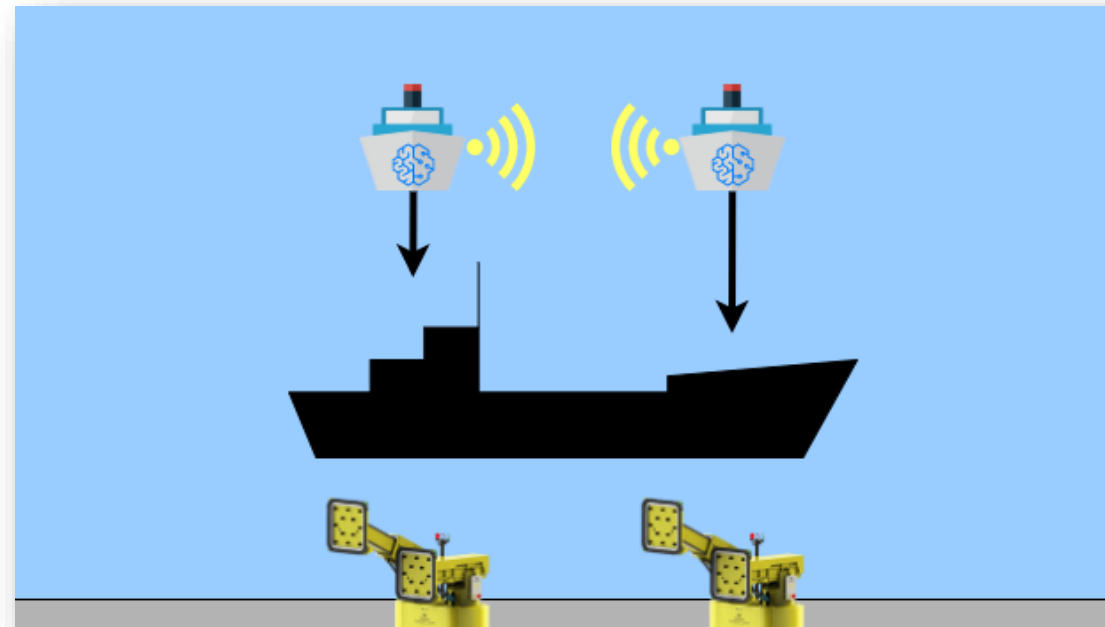


# Automated System for Reducing Manoeuvring and Docking Time for DSS ports

Swarm of autonomous tugboats

Cooperate with **Trelleborg's AutoMoor** system

Automatically & safely manoeuvre and dock large containerships



# Autonomous Tugboats



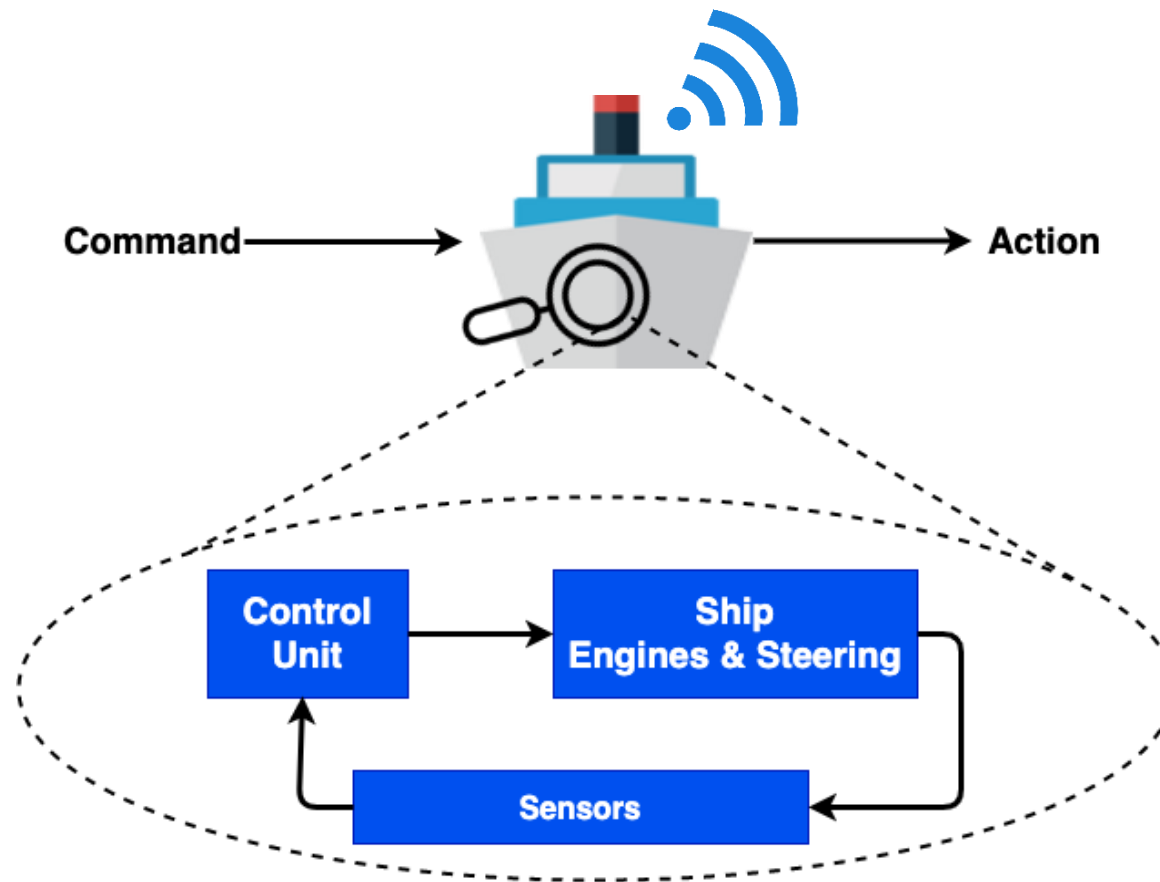
## Guiding Question #1

Is it necessary for a human to be present at all times in the autonomous tugboats (switch from automatic to manual mode)? If so, why?



# Automated System for Reducing Manoeuvring and Docking Time for DSS ports

Sensors and hardware modules will be used to transform deployed tugboats into autonomous tugboats.



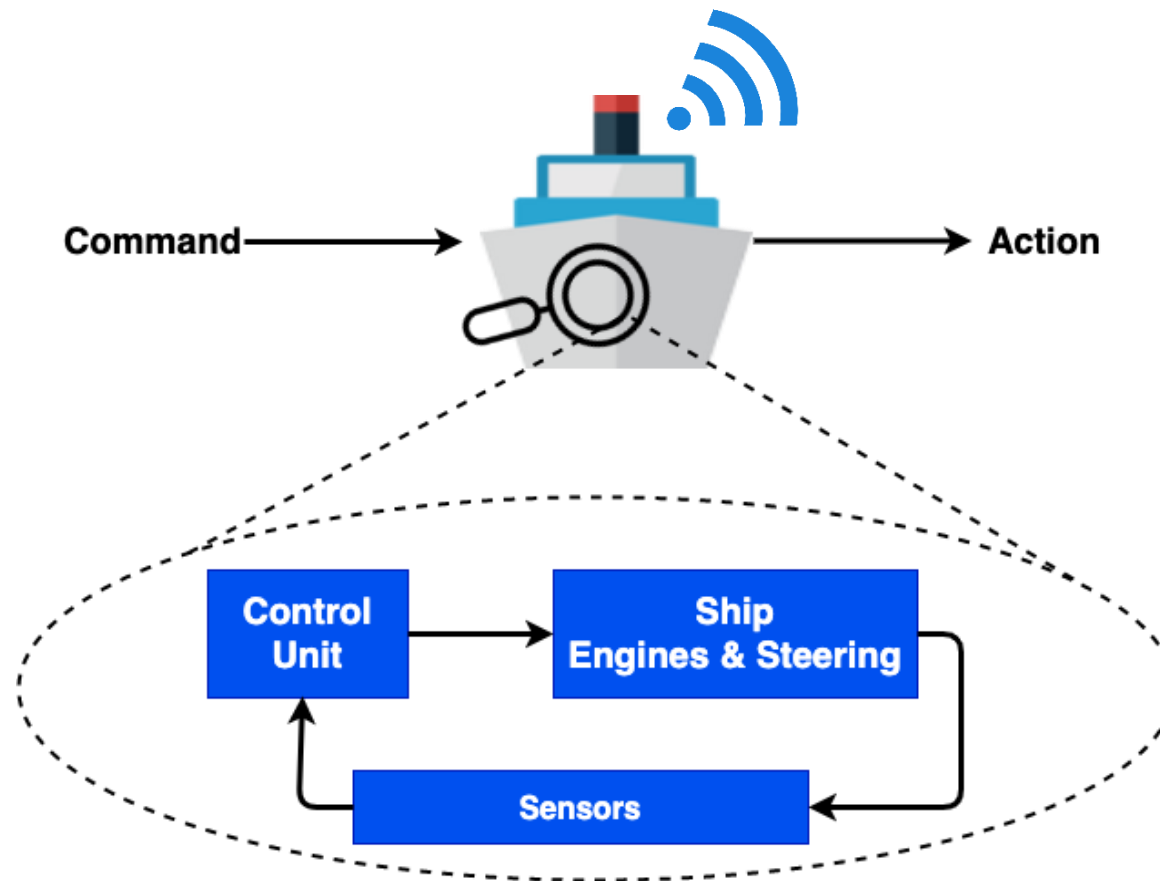
# Automated System for Reducing Manoeuvring and Docking Time for DSS ports

Sensors and hardware modules will be used to transform deployed tugboats into autonomous tugboats.

Detection module

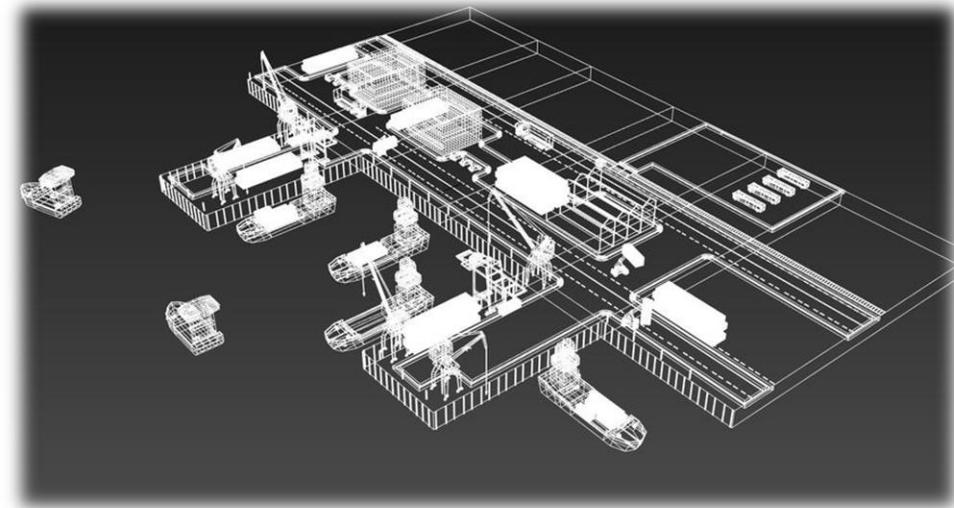
Path planning module

Control module



# Automated System for Reducing Manoeuvring and Docking Time for DSS ports

AI algorithms for swarm intelligence



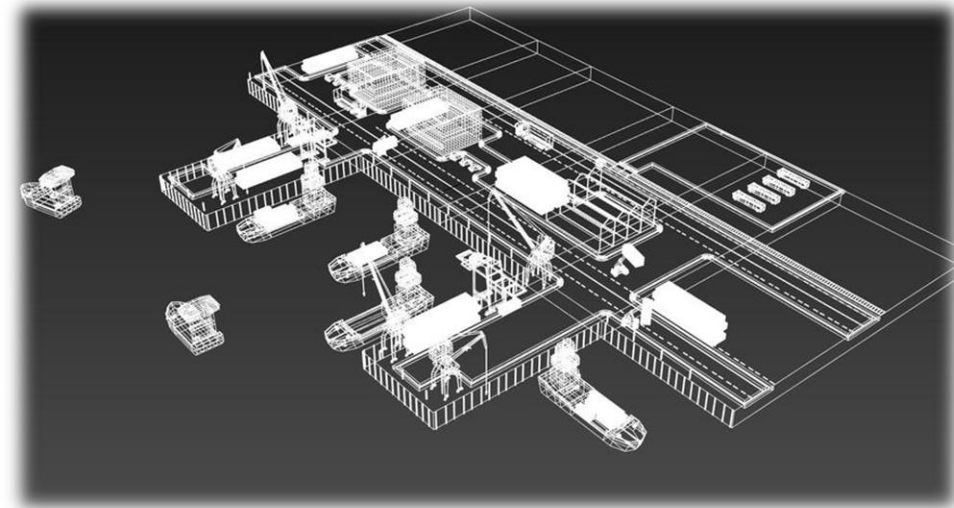


# Automated System for Reducing Manoeuvring and Docking Time for DSS ports

AI algorithms for swarm intelligence

The algorithms will be trained in a virtual environment based on real scenarios

Simulation of the kinematics and stresses applied to the ships

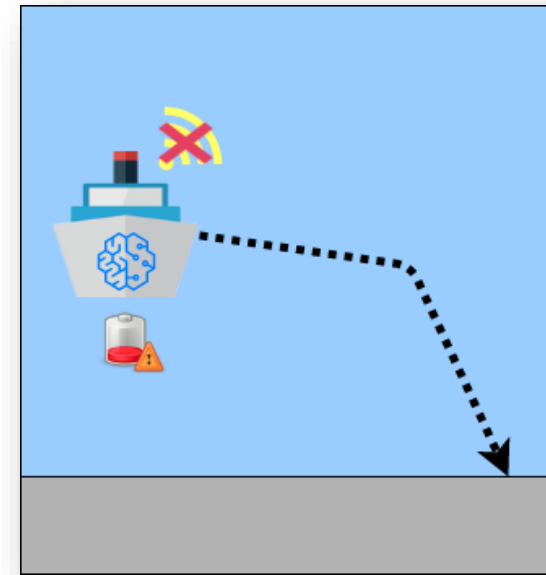


# Automated System for Reducing Manoeuvring and Docking Time for DSS ports

Battery optimization functionality for energy efficiency

For a single tugboat

For the entire fleet



# Automated System for Reducing Manoeuvring and Docking Time for DSS ports

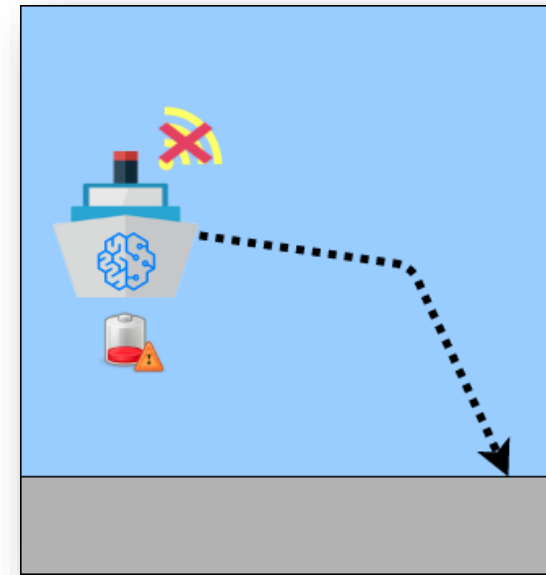
Battery optimization functionality for energy efficiency

- For a single tugboat

- For the entire fleet

‘Fail-safe operation’ mode

- Tugboat returns automatically to a designated spot upon connectivity loss or raise of an alarm.



# Autonomous Tugboats

## Guiding Question #2

What kind of troubles could an autonomous tugboat face inside a harbour?



# Automated System for Reducing Manoeuvring and Docking Time for DSS ports

Creation of Central Control Platform

Support decision-making of the Port Control Authority.

# Automated System for Reducing Manoeuvring and Docking Time for DSS ports

Creation of Central Control Platform

Support decision-making of the Port Control Authority.

Facilitate ship movement within the port

Providing real-time access to information

Port operations

Available tugboats.

# Automated System for Reducing Manoeuvring and Docking Time for DSS ports

## Creation of Central Control Platform

Support decision-making of the Port Control Authority.

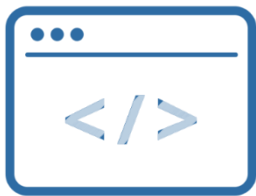
## Facilitate ship movement within the port

Providing real-time access to information

Port operations

Available tugboats.

Manage autonomous docking of large vessels via a user-friendly interface which includes:



Web app



Interactive dashboard



Logging component



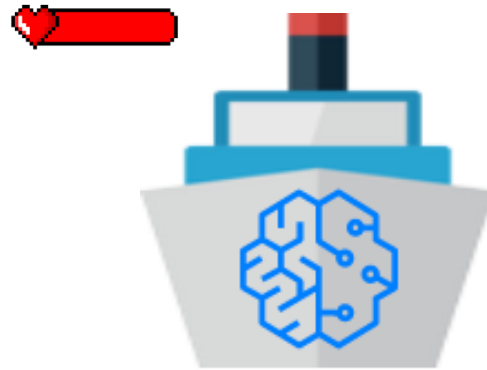
Scheduling component

# Autonomous Tugboats



## Guiding Question #3

How important is it to have a real-time system which monitors the condition of the tugboat to possibly identify crucial damage to the tugboat?

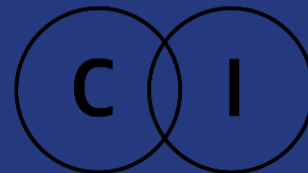






# MOSES

## Thank you for your attention!



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 MOSES project2020

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