VIRTUAL AND MIXED REALITY TOOLS FOR MARITIME TRAINING: THE CASE OF THE ROMANIAN NAVAL ACADEMY

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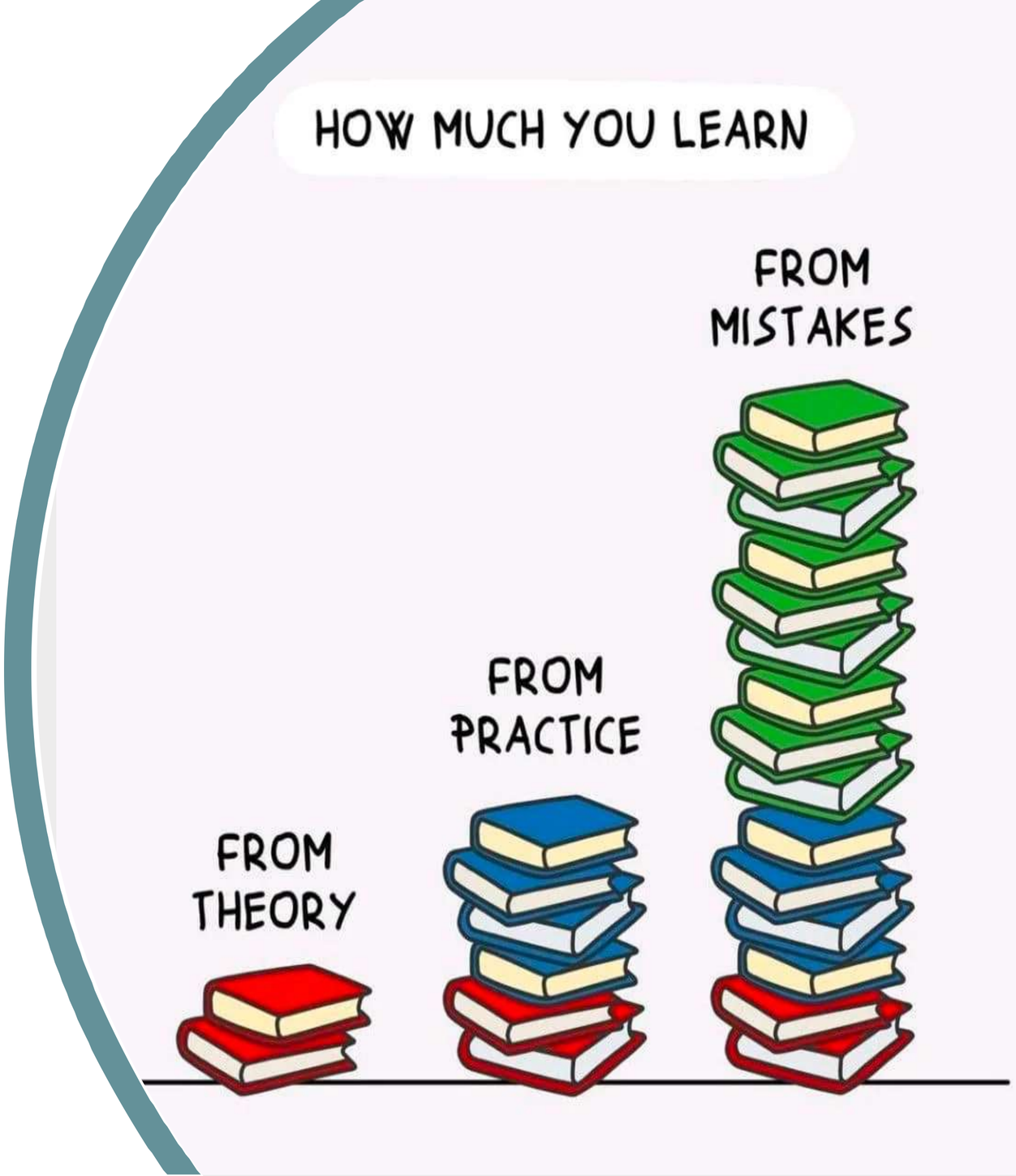
Introduction

“Learn to practice - practice to learn”



Virtual Reality (VR)

fully digital environment,
blocking out the real world

Augmented Reality (AR)

overlays digital information
on the real world

Mixed Reality (MR)

allows digital and physical
elements to coexist and
interact in real time

Virtual Reality and Augmented Reality in Higher Education

VR allows large groups of users to interact with each other within the same three-dimensional environment.

AR applications can complement a standard curriculum by adding graphics, videos, text, or audio files to a student’s study material in real time

VR and AR can be implemented in higher education through:

- Virtual Laboratories
- Virtual Field Trips
- Real-World Scenario Simulations
- Interactive Training
- Collaborative Learning
- Visualization of Complex Data and Models
- Personalized Learning Experiences
- Health and Safety Training

VR environment entirely created by a computer

headset and controllers

vs.

AR addition of virtual components to the real world

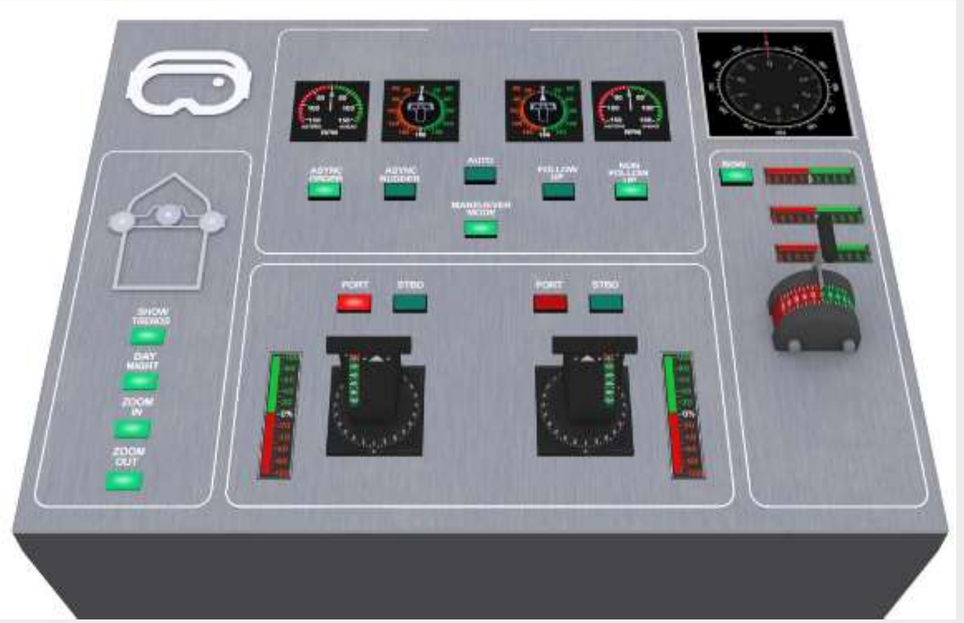
mobile devices (laptops, smartphones, tablets), specialized devices (like Google Glass and HoloLens)

Feature	Virtual Reality (VR)	Augmented Reality (AR)	Mixed Reality (MR)
Perceived Environment	Fully digital, replacing the real world	Real world with digital overlays	Real and digital coexist and interact
Devices Used	VR headsets, controllers, motion sensors	Smartphones, tablets, AR glasses (e.g. HoloLens)	HoloLens, MR headsets, spatial recognition cameras
Immersion Level	Very high	Low to moderate	Moderate to high
User Interaction	Entirely virtual	Limited to overlays and basic interactions	Advanced interaction between real and virtual
Educational Use	Full simulations, safe and repeatable training	Visual guidance, technical info overlays	Complex simulations combining real and digital

Planned VR and MR Configurations at the Romanian Naval Academy

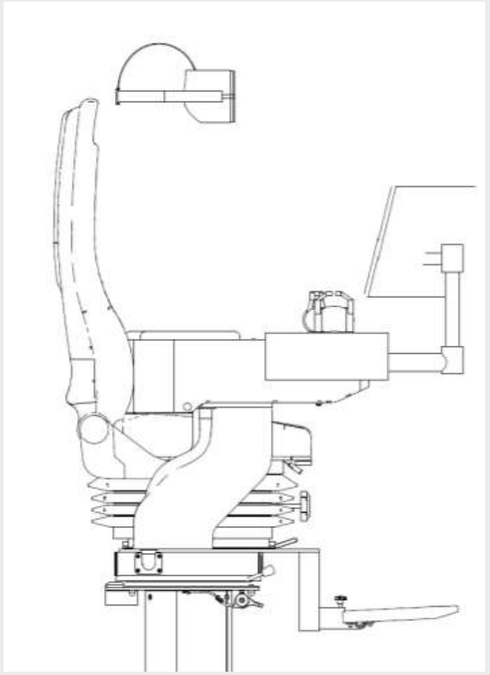
1. **VR Ship Handling Simulator** – provides realistic training environments where trainees can practice ship maneuvering and navigation in various conditions and weather scenarios;
2. **VR Tug Maneuvering Simulator** – offers realistic training environments for tugboat captains and marine pilots operating vessels in and out of port areas;
3. **MR Fast Boat Simulator** – includes a mini navigation simulator on a motion platform designed for two persons with marine seats:,
4. **VR Engine Room Simulator** – a virtual space replicating the engine room, enabling simulation of equipment operation and interaction, including with the high-voltage switchboard (HVB), in a VR environment.

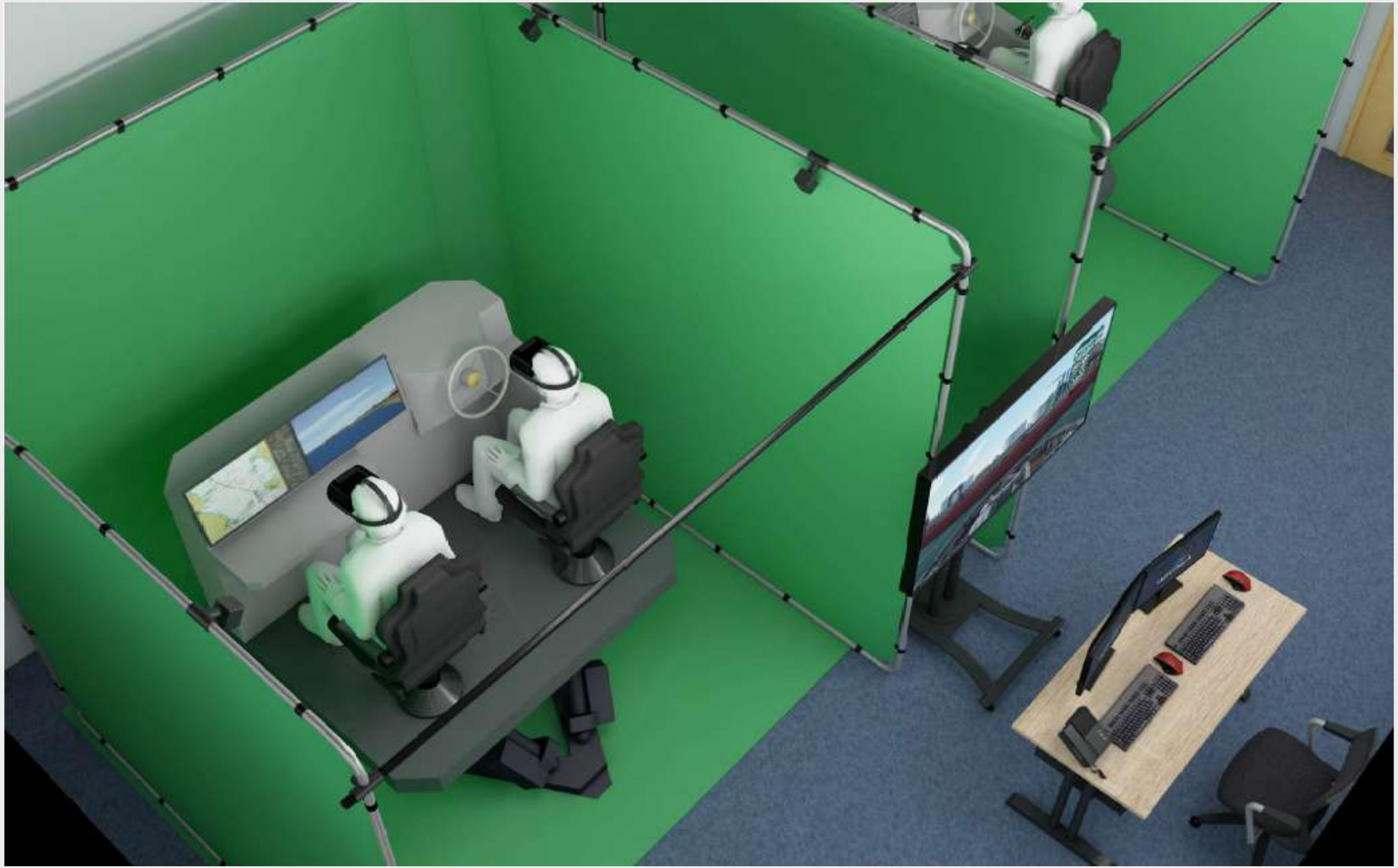
Configuration of VR Ship Handling



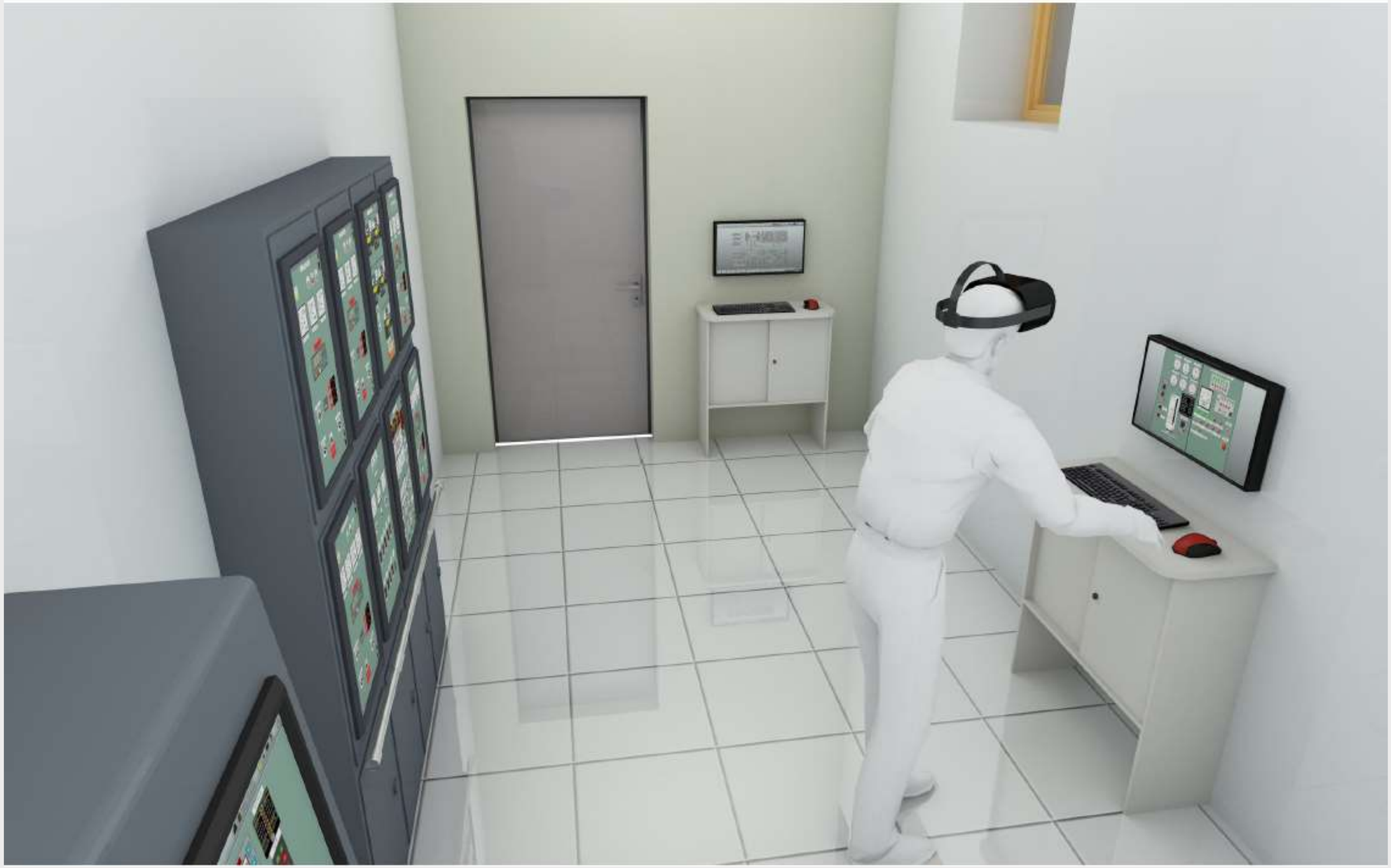
Virtual Reality (VR) Deck Configuration for Tugboat Maneuvering

Configuration of Mixed Reality (MR) Bridges for Fast Boats





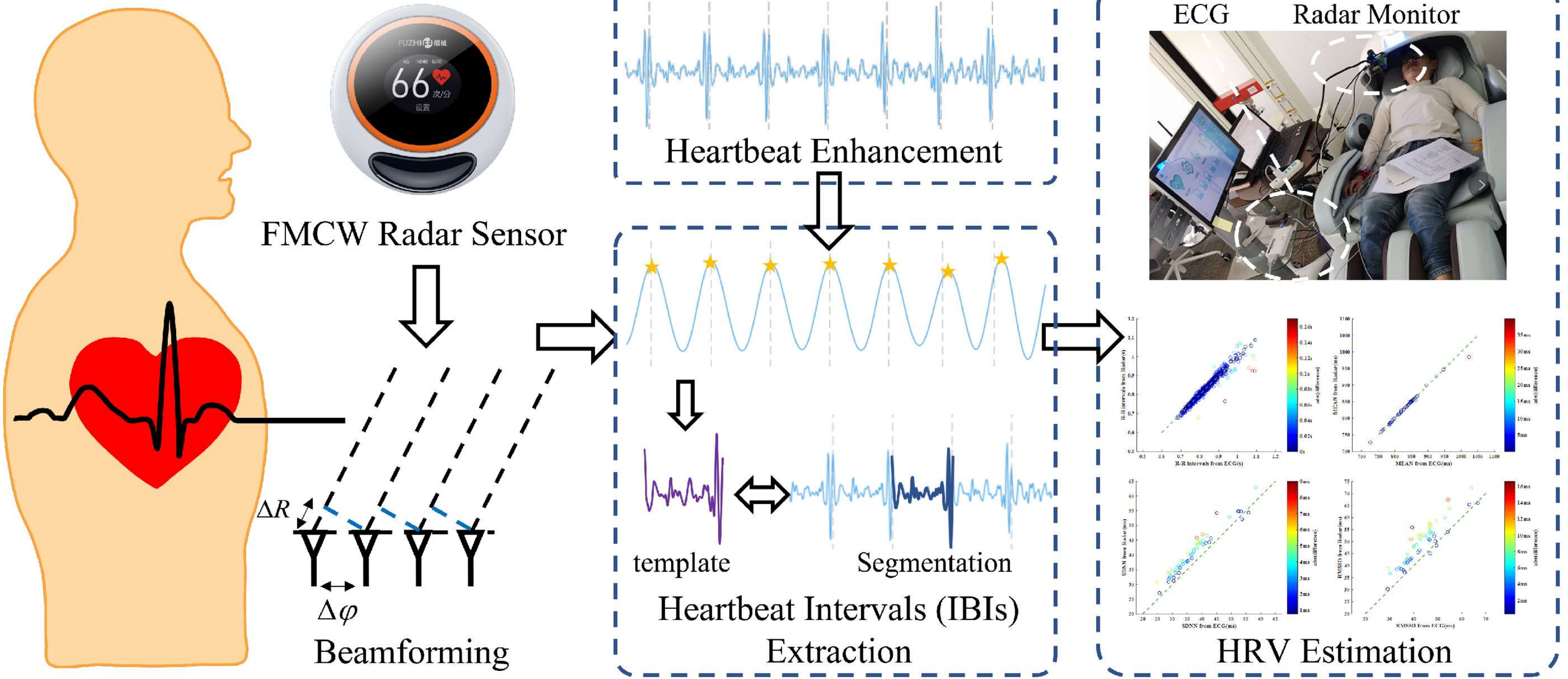
Configuration of Virtual Reality (VR) Stations for the Engine Room



Applications in Scientific Research

biometric devices (sensors for heart rate monitoring, electrodermal analysis wristbands – EDA, facial expression tracking cameras, eye movement sensors

INDIVIDUAL PERFORMANCE PROFILE



The simulators for ship handling and engine room operations at the Naval Academy include:

- VR ship maneuvering simulator (two bridges);
- VR tug maneuvering simulator (two bridges);
- MR fast boat simulator (two bridges);
- VR engine room simulator (1 station).

THANK YOU FOR YOUR ATTENTION