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MAN-OVERBOARD EXPOSURE SYSTEM AND ADVANCED SAFETY (AI) TOPOGRAPHIES ENDURANCE ON ON-BOARD VESSEL

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ABSTRACT

The Man Overboard (MOB) sensing system is a critical safety feature for maritime operations, designed to enhance the safety of crew and passengers on ships. This paper presents a novel AI-driven MOB detection system that leverages advanced sensor technologies and machine learning rule to automatically detect and respond to overboard incidents in real time. The system integrates multiple data sources, including high-resolution cameras, thermal imaging, and wearable devices, to monitor and analyze human activity on the ship's deck. By employing computer vision and anomaly detection techniques, the AI system can accurately identify and differentiate between normal activities and potential MOB events. Upon detecting an overboard incident, the system triggers immediate alerts, providing the crew with the exact location of the event and initiating automated emergency responses, such as adjusting the ship's course and deploying rescue equipment. This AI-based approach significantly reduces response time, improves the chances of a successful rescue, and minimizes the risk of human error. The paper also discusses the challenges of implementing such a system, including environmental variability, false positives, and privacy concerns, and proposes solutions to address these issues. The proposed MOB detection system represents a significant advancement in maritime safety.

KEY WORDS: MOB, Detection, Tracking, ATM, SAS.

1. INTRODUCTION

Man overboard (MOB) incidents are one of the most critical emergencies that can occur on a ship, often leading to life-threatening situations. Traditional MOB detection relies heavily on the vigilance of crew members or passengers to notice and report the incident, a process that is highly susceptible to human error, especially in low visibility or high-stress conditions. Delays in detection and response can drastically reduce the chances of a successful rescue, making it essential to explore more reliable and efficient methods.

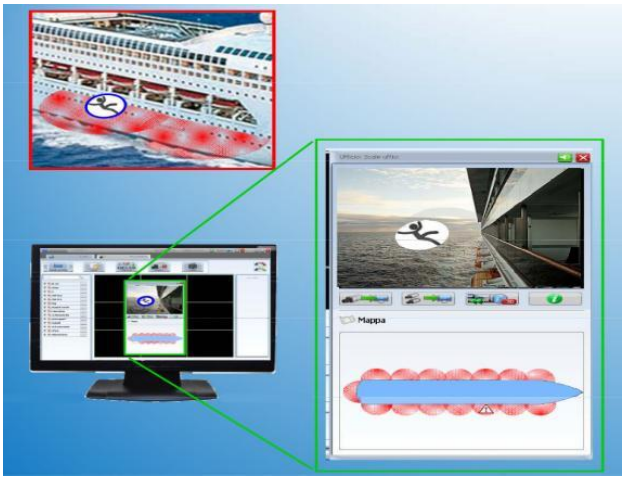


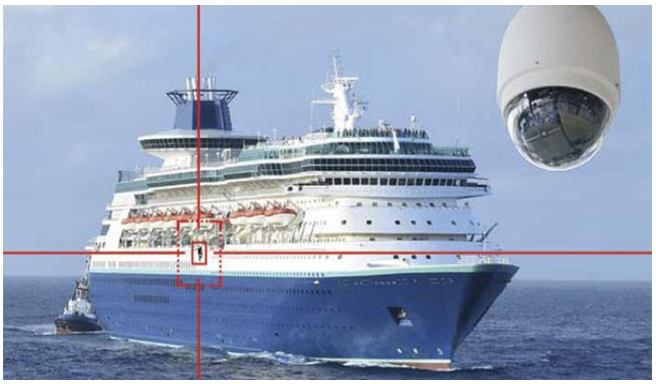
Fig :1

2. AI-BASED SAFETY SYSTEM

Advancements in artificial intelligence (AI) and sensor technologies offer new possibilities for enhancing maritime safety. AI-driven systems can process large volumes of data from various sensors in real time, enabling the automatic detection of MOB incidents without the need for constant human monitoring. This paper presents an AI-based MOB detection system designed to improve the accuracy and speed of incident detection and response on ships.

The proposed system integrates multiple data sources, including video feeds from high-resolution and infrared cameras, wearable devices, and radar or LiDAR sensors. By applying machine learning techniques, the system can recognize and analyze patterns of human activity on the ship's deck, distinguishing between normal movements and those indicative of a potential overboard incident. In the event of detecting a MOB situation, the system triggers immediate alarms, alerts the crew with precise information about the location of the incident, and can even initiate automated rescue operations.

2.1.1 Infrared Cameras (IRC)



FigL:2 Monitoring through IRC

- Thermal Imaging IR cameras detect the heat emitted by objects, including human bodies. They are particularly effective in low-light or nighttime conditions, where traditional cameras may struggle.
- These cameras can be positioned around the ship to provide comprehensive coverage of key areas, such as the deck, railings, and overboard zones.

2.1.2 Optical Cameras (OC)

- High-Resolution Imaging Optical cameras capture detailed video footage of the ship's deck and surroundings. They operate effectively in daylight and well-lit conditions.
- Many modern cameras come with zoom, pan, and tilt features, allowing them to focus on specific areas or track movement dynamically.

2.1.3. THERMAL CAMERA (TC)

- The automatic lifebuoy deployment mechanism is a groundbreaking safety innovation that revolutionizes maritime emergency response. By rapidly and accurately deploying lifebuoys in man-overboard situations, it minimizes risk to individuals and enhances overall vessel safety.
- With its reliable and precise operation, this system reduces human error and ensures consistent performance, meeting or exceeding regulatory requirements and industry standards.
- Its ease of use, simple maintenance, and seamless integration with existing safety systems make it an invaluable asset for the maritime industry. Ultimately, this technology has the potential to save countless lives, making it a crucial investment for any vessel prioritizing safety and security at sea.

2.1.4. Computer Vision and AI Processing Unit

- The video feeds from IR and optical cameras are processed by an onboard computer vision system, which uses AI algorithms to detect and analyze human movement.
- The AI is trained to recognize normal movement patterns and identify anomalies, such as a person climbing over a railing or falling into the water.
- The system can distinguish between typical activities and unusual behavior that may indicate an overboard incident.

2.1.5. Alarm and Notification System

- When the system detects a potential MOB event, it triggers an immediate alarm, alerting the crew with visual and audible signals.
- The system can tag the location where the overboard event occurred, helping the crew respond more effectively.
- The detected incident and its location are displayed on the ship's monitoring systems, such as bridge displays or security terminals.

2.2 Functionality and Operation

- 1.Continuous Monitoring: The system continuously monitors the deck and surrounding areas using a combination of infrared and optical cameras. This ensures that any unusual activity, regardless of the time of day or weather conditions, can be detected.
- Day and Night Operation: During the day, optical cameras provide clear images, enabling the system to detect movements and potential MOB incidents. At night or in poor visibility conditions, IR cameras take over, detecting heat signatures of individuals on the deck or in the water.
- Real-Time Detection and Alerts: The AI processes video data in real time, allowing for instant detection of a person falling overboard. Upon detection, the system automatically triggers alarms, reducing the time taken to initiate rescue operations.
- Minimizing False Positives: The AI is trained to differentiate between normal and risky activities, such as someone leaning over a railing versus

someone falling. This helps minimize false alarms, which can otherwise desensitize the crew to real emergencies.

3. Automatic Life Buoy throwing System:

- Automated Launchers, the Life buoys are stored in automated launchers positioned at key points around the ship, typically near the deck's edges.
- Motorized or Spring-Loaded Systems These launchers can use motors or spring mechanisms to propel the life buoys into the water as soon as an MOB event is detected.
- Directional Control The system can be designed to aim the life buoy launcher towards the detected MOB location, ensuring the buoy lands as close as possible to the person in the water.

Fig-3 Automatic Throwing Mechanism (ATM)

3.1 Principle of Automatic Lifebuoy Throwing Mechanism

- Detection: Sensors detect a person falling overboard and send a signal to the control system.
- Signal Processing: The control system processes the signal and verifies the detection to prevent false alarms.
- Activation: Upon confirmation, the control system activates the deployment mechanism.
- Release: A holding pin or latch is released, allowing the lifebuoy to deploy.
- Deployment: The lifebuoy is propelled or falls into the water, guided by a rail or chute to ensure accurate placement.
- Location Tracking: The lifebuoy's location is tracked using GPS or wireless signals, enabling the ship's crew to locate and retrieve the person in distress.
- Reset: After deployment, the system resets, ready for another activation if needed.

3.2 The mechanism relies on (SAS)

- Sensors and signal processing for accurate detection.
- Control system software for verification and activation.
- Mechanical components for deployment and release.
- GPS or wireless tracking for location monitoring.

4. CONCLUSIONS

The automatic lifebuoy deployment mechanism is a groundbreaking safety innovation that revolutionizes maritime emergency response. By rapidly and accurately deploying lifebuoys in man-overboard situations, it minimizes risk to individuals and enhances overall vessel safety. With its reliable and precise operation, this system reduces human error and ensures consistent performance, meeting or exceeding regulatory requirements and industry standards. Its ease of use, simple maintenance, and seamless integration with existing safety systems make it an invaluable asset for the maritime industry. Ultimately, this technology has the potential to save countless lives, making it a crucial investment for any vessel prioritizing safety and security at sea.

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