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INNOVATION IN ACTION: TURNING IDEAS INTO REALITY

Chapter 40
TradeLens-XR

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ABSTRACT
TradeLens-XR is the cutting-edge AR-driven solution introduced here, which has the potential to revolutionize air cargo logistics to address critical issues such as cargo damage, communication barriers, safety risks, and handling inefficiencies due to manual processes. The solution combines AR with artificial intelligence (AI), thermal sensing, and contextual translation with AI to provide real-time tracking of cargo, damage detection, situational awareness, and language-based translation. These capabilities are integrated into a glasses-like, hands-free unit that enables air cargo crews to operate more efficiently and safely in dynamic, high-pressure environments. TradeLens-XR brings great benefits to the logistics industry and society as a whole with enhanced safety, reduced human error, improved traceability, and enabling of sustainable and efficient global trade operations. Business opportunities of the innovation across sectors like aircraft maintenance, security screening, emergency response, and infrastructure monitoring, thereby making it a common product for modern air cargo management.

Key Words: TradeLens-XR, logistics, air cargo, augmented reality (AR), artificial intelligence (AI), thermal imaging, scanner, translation

1. INTRODUCTION

Logistics is a critical component of international trade, facilitating the efficient movement of products across borders. Broadly defined, logistics encompasses supply chain and transportation management to ensure the timely and secure delivery of products. The expansion of the international trade industry has further amplified the importance of logistics as a foundational element of international trade. Traditionally, logistics is divided into two key categories: materials management and physical distribution. Materials management involves sourcing and purchasing raw materials, components, and finished goods (Jenkins, 2024), while physical distribution encompasses the handling, storage, and transportation of products. Critical logistics functions such as packaging, inventory control, warehousing and transportation are integral to physical distribution, ensuring products are efficiently managed

and delivered in optimal condition. Among the various transportation modes, air transport stands out for its ability to support fast and reliable delivery, particularly for high-value and time-sensitive products. However, despite its advantages, air cargo operations often face challenges related to real-time visibility, handling accuracy, and operational efficiency. In response to these challenges, there is an urgent need for innovation, not only to improve existing systems but also to transform the way logistics is managed and executed. Thus, TradeLens XR emerges as a forward-thinking application designed to meet these demands. Using cutting-edge AR technology, TradeLens XR aims to revolutionise cargo management by ensuring safer, faster, and smarter logistical operations in an increasingly interconnected world.

2. PROBLEM STATEMENT

In air cargo operations, efficiency, accuracy, and safety are non-negotiable factors in logistics management of international trade. Minor errors in the process can have serious consequences, including significant financial losses, shipment delays, or damaged high-value cargo. Human error or lack of visibility during loading and unloading activities are the main issues that contribute to cargo damage (iContainer, 2016). These issues are further exacerbated by inadequate monitoring systems that fail to provide real-time oversight, especially for temperature-sensitive goods such as pharmaceuticals, perishables, and fragile items (Gould et al., 2017). In the global air cargo environment, multilingual communication is an essential component. However, current machine translation tools often struggle with contextual accuracy, particularly in technical fields like logistics. According to Shahnazaryan et al. (2025), machine translations frequently misinterpret industry-specific terminology, leading to misunderstandings, incorrect instructions, operational delays, and even safety hazards. These challenges underscore the urgent need for an innovative, technology-driven solution that enhances visibility, minimises human error, and supports accurate cross-border communication. Therefore TradeLens-XR addresses this need by integrating augmented reality (AR) and context-aware communication tools into air cargo operations.

3. OBJECTIVES

The primary objective of TradeLens-XR is to enhance the safety, efficiency, and accuracy of air cargo operations by addressing the critical operational and procedural challenges faced by cargo crews and ground handling teams. These include issues such as cargo damage, language barriers, security threats and airport hazards (Gould et al., 2017). To achieve this, TradeLens-XR is designed with the following specific objectives.

3.1 To Improve Safety and Efficiency in Cargo Handling

TradeLens-XR enhances real-time cargo condition monitoring, damage prevention, and operational safety through augmented reality (AR) overlays and hands-free functionality, allowing crews to work more efficiently in high-risk environments.

3.2 To Enhance Communication and Decision-Making

By providing real-time, context-aware translation and AI-driven insights, the system reduces language-related misunderstandings and supports faster, more accurate decisions in international air cargo operations.

3.3 To Strengthen Cargo Visibility and Incident Response

TradeLens-XR enables cargo scanning and automated reporting, improving traceability, reducing delays, and accelerating responses to cargo-related incidents or irregularities.

4. NOVELTY

TradeLens-XR stands out with three key innovative features that directly support safer, smarter and more efficient air cargo handling.

4.1 AI Damage Detection

This feature uses artificial intelligence to detect cargo damage, both visible and hidden. It scans cargo surfaces in real-time and alerts users to any issues to help prevent losses and ensure better cargo care.

4.2 Thermal Imaging and AI Contextual Translation

TradeLens-XR includes built-in thermal imaging to detect heat levels in cargo. This helps identify temperature issues, which can warn users of fire risks or equipment malfunctions before they become serious problems. The translation tool allows users to instantly translate written text into their preferred language, directly through AR display. TradeLens-XR helps overcome language barriers during operations, reducing errors and improving communications among cargo management teams.

5. BENEFITS TO COMMUNITY

The TradeLens-XR innovation in air cargo logistics brings meaningful benefits to society by improving safety, efficiency, communication, and sustainability in cargo handling.

5.1 Improved safety and working conditions

TradeLens-XR enhances crew safety with hands-free AR technology, reducing risks in hazardous or tight spaces and helping prevent cargo damage and accidents.

5.2 Better communication and global collaboration

With real-time translation, the device breaks down language barriers in international teams, leading to fewer misunderstandings and smoother operations.

5.3 Greater efficiency and sustainability

By reducing manual errors, improving cargo tracking and supporting better decision-making. TradeLens-XR minimises waste, boosts productivity, and supports sustainable and efficient global trade.

6. COMMERCIALIZATION POTENTIAL

The commercialization potential of TradeLens XR in air cargo is significant, as it can benefit a wide range of stakeholders within the supply chain and logistics industry. TradeLens XR is a blockchain-based digital platform that enhances visibility, transparency, and efficiency across cargo movements. In the context of air cargo, it can be used by freight forwarders, airlines, customs authorities, ground handlers, and logistics companies to track shipments in real time, streamline documentation, and reduce delays caused by manual processes. With enhanced data sharing and secure, tamper-proof records, users can make faster decisions, improve coordination, and increase trust across partners. Furthermore, airports and cargo terminal operators can use the system to manage cargo flow more efficiently, reducing bottlenecks and improving service delivery. Overall, TradeLens XR's commercialization potential lies in its ability to connect all parties in the air cargo ecosystem through a single, reliable digital platform.

7. PRODUCT DESCRIPTIONS

7.1 Before innovation

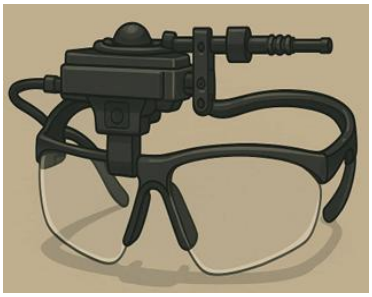

Figure 1.0: Conventional head mounted display (HMD)

Figure 1.0 illustrates a conventional head-mounted display (HMD) equipped with core augmented reality (AR) features. These include a display or projection system, sensors, a microphone, and a camera. This standard AR device provides users with an interactive and immersive experience by overlaying virtual information onto real-world environments. It allows users to view the physical world while receiving computer-generated visuals and data in real time, from virtually any location.

7.2 After innovation

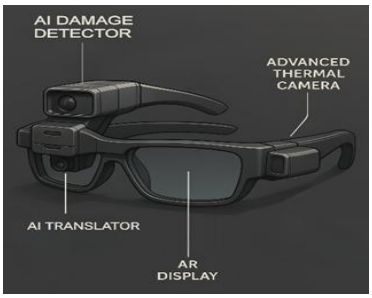

Figure 1.1: Innovation of TradeLens-XR

Figure 1.1 presents the TradeLens-XR, an enhanced AR wearable developed specifically for air cargo operations. The TradeLens-XR retains the basic features of the original HMD, including a display, sensors, microphone, and camera.
This innovative version introduces three significant upgrades which are advanced thermal imaging for detecting heat signatures in cargo, AI-powered damage detection to identify both visible and hidden cargo issues, and AI contextual translation to support real-time, accurate communication across languages.

8. CONCLUSION

TradeLens-XR is a smart and practical innovation in air cargo logistics. By combining AR, AI, thermal imaging, and real-time translation, it helps solve key challenges in cargo handling. The product improves safety, speeds up operations, and supports better communication and decision-making. It also promotes global teamwork and more accurate cargo tracking. Overall, TradeLens-XR sets the stage for a safer, faster, and more sustainable future in air cargo management.

REFERENCES

ACW. (2024, September 2). Preventing cargo damage and loss. *Air Cargo Week*. https://aircargoweek.com/preventing-cargo-damage-and-loss/

Gould, R., Hind, S., & Sorensen, K., Jacquet, F. (2017, November). *Detecting Hidden Fires On Aircraft Using Thermal Imaging Cameras*. https://www.fire.tc.faa.gov/2019Conference/files/Battery_I/HindHiddenFires/HindHiddenFiresPaperWeb.pdf

IATA. (2021, September 10). Augmented Reality – the Future of Air Cargo Operations. IATA. https://www.iata.org/en/about/worldwide/europe/blog/augmented-reality-the-future-of-air-cargo-operations/

IATA. (n.d). Cargo Technology Trends Survey Shape the future of operations. IATA. https://www.iata.org/contentassets/ea370e43f1e84cf6835650c2bec61885/iata-cargo-technology-trends---survey-materials.pdf

iContainers. (2016). *11 common problems shippers face at destination | iContainers*. IContainers; iContainers. https://www.icontainers.com/us/2016/11/08/11-common-problems-shippers-face-at-destination/

Jenkins, A. (2024, December 3). *What is materials management?*. Oracle NetSuite. https://www.netsuite.com/portal/resource/articles/inventory-management/materials-management.shtml

TechnoLynx. (2024, September 12). TechnoLynx. Augmented Reality in Cargo Management. https://www.technolynx.com/post/augmented-reality-in-cargo-management