Augmented Reality in Engineering Education:
An Industrial Production Line Case Study
(Poster)

Naomi Unkelos-Shpigel
Braude College of Engineering
naomius@braude.ac.il

Shahar Berenson
Braude College of Engineering
Shaher.berenson@e.braude.ac.il

Shlomi Fridman
Braude College of Engineering
Shlomi.Fridman@e.braude.ac.il

Elad Denenberg
Braude College of
Engineering, Karmiel
eladd@braude.ac.il

Dan Cuperman
Braude College of
Engineering, Karmiel
danc@braude.ac.il

מציאות רבודה בחינוך הנדסי: מקרה בוחן של פס ייצור תעשייתי
(פוסטר)

שחר ברנסון
המכללה האקדמית להנדסה בראודה בכרמיאל
Shaher.berenson@braude.ac.il

נעמי אונקלוס-שפיגל
המכללה האקדמית להנדסה בראודה בכרמיאל
naomius@braude.ac.il

דן קופרמן
המכללה האקדמית
להנדסה בראודה בכרמיאל
danc@braude.ac.il

אלעד דננברג
המכללה האקדמית להנדסה
בראודה בכרמיאל
eladd@braude.ac.il

שלומי פרידמן
המכללה האקדמית להנדסה
בראודה בכרמיאל
Shlomi.fridman@e.braude.ac.il

Abstract

In the era of Industry 4.0, Augmented Reality (AR) is becoming a central tool in engineering education, enabling improved learning and training processes (Al-Ansi et al., 2023). Production lines constitute a core educational component integrating various engineering disciplines, yet learning about them traditionally requires field observations or expensive laboratory facilities. AR provides an accessible, safe, and cost-effective alternative for operating and learning industrial production systems while offering different levels of visualization and interaction capabilities for various stakeholders (Pavanatto et al., 2021).

This research presents the development of an AR-based learning environment for a production line at the CIM laboratory at Braude College of Engineering, focusing on adapting needs of different stakeholders. The research questions are: (1) Which stakeholders in engineering and engineering education can find value in an AR-based learning environment? (2) What are the required characteristics of an AR-based learning environment from each stakeholder's perspective? (3) How

do learners who use this environment perceive its contribution to understanding the engineering subject being learned?

Methodology: We performed a literature review, which focused on identifying AR technologies in education, stakeholder requirements, and success metrics in educational and industrial systems (Prananta et al., 2024). Next, an AR prototype was developed in collaboration with the CIM laboratory through iterative cycles with feedback from potential users.The AR application for the Android platform using QR and IMU sensors for real-time tracking of carts on a simulated production line. The system features 3D visualization, station interaction, velocity tracking, arrival time calculations, and delay alerts, while integrating digital twin technologies (Yin et al., 2023; Magaña et al., 2025).

Key findings: We focused on providing intuitive interaction and clear educational content to Mechanical engineering students. The system provides clear visualization with 3D models, touch-based interactions, and interactive stations with quizzes. Educators/instructors need teaching and assessment tools. The system enables real-time guidance, built-in quiz functionality, and support for multiple concurrent users. Industrial operators require reliable monitoring and real-time feedback (Peter et al., 2023). The system provides visualization of locations and velocities, arrival time calculations with ±0.5 second accuracy, and delay alerts.

Conclusions: The research proposes a framework for designing educational-industrial AR systems addressing diverse stakeholder needs (Syed et al., 2022), presenting a holistic approach integrating educational accessibility, technical complexity, and industrial reliability. Future research will include interviews, surveys, and quantitative evaluation of learning effectiveness.

Keywords: Augmented reality, engineering education, production line, Industry 4.0.

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