

# UX-driven methodology to design usable Augmented Reality applications for maintenance

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**Abstract.** In recent decades industrial development has led to increasingly sophisticated machinery and systems, which require complex maintenance routines. Consequently, maintenance operators may not have the sufficient skills to perform recovery procedures properly and quickly, so that the need of assistance from the manufacturer’s after-sales service or companies specialized in maintenance services. Such actions usually lead to very long recovery times, high maintenance costs, and a temporary drop in production. In this scenario, we should consider that Industry 4.0 is making available innovative technologies, such as Augmented Reality (AR), suitable for improving the skills and competencies of operators without burdening their cognitive load, and consequently wellbeing. However, technologies must be selected, designed, and used according to the users’ needs to be effective and useful. The paper presents a user experience (UX)-driven methodology for designing user-centric AR applications for complex maintenance procedures. The methodology was applied to a real industrial case concerning the management of CNC machines in a plant producing tractors components, where a smartphone-based AR application was designed and tested with users. The satisfactory results highlighted the potential benefits of AR in industry and specifically in maintenance.

**Keywords.** Augmented Reality, Industry 4.0, Operator 4.0, User experience design, Maintenance

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