5G-Enabled Mobile AR System for Location-aware Assistance in Buildings – System Overview and Preliminary Evaluation

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Key words: Low cost technology; Photogrammetry; Positioning; 5G; Real-Time Streaming; Augmented Reality (AR); Technical Building Equipment (TBE); Digital Transformation

SUMMARY

The increasing complexity of technical building equipment (TBE) requires advanced digital solutions to support technicians in tasks such as planning, installation, maintenance, and inspection inside buildings. The N5GEH-LocI4AR project addresses this demand by integrating the 5G communication standard, Internet of Things (IoT), and Augmented Reality (AR) technologies into an intelligent location-aware mobile assistance system designed to provide real-time support during complex technical operations. This system is specifically intended to help technicians navigate large installations, identify components, access relevant technical data, and monitor sensor readings in real time.

The core components of the system include coarse indoor positioning, fine-grained localization and pose tracking, and AR streaming and visualization, which collectively enable context-aware and real-time support for technicians. Coarse positioning relies on sensor fusion, combining data from inertial measurement units (IMUs), Wi-Fi, Bluetooth, and 5G fingerprinting to establish an initial location estimate independent of GNSS. This estimate is then refined through fine pose tracking, which ensures the precise spatial alignment of AR content—such as BIM models of the TBE—with the technician's physical surrounding. The AR streaming and visualization component utilizes 5G to offload computationally intensive tasks to a server or cloud, enabling the real-time delivery of high-resolution 3D content to mobile devices while maintaining minimal latency and optimized device performance.

In this paper, we present the design, development, and preliminary evaluation of the N5GEH-LocI4AR system, focusing on its core components for providing context-aware AR overlays in real-world environments. Initial results demonstrate the capability of the system to deliver stable performance across devices, with high frame rates and reliable indoor positioning

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accuracy. Future work will aim to further optimize the fine localization process, enhance AR content stability, and conduct comprehensive evaluations of workflow latency to ensure robust deployment in practical applications.