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An Infinite Procedural Ocean for Mobile Augmented Reality Marine Biology Education

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Abstract

Marine biology education can be difficult because students rarely get the opportunity to explore real marine ecosystems. This project presents an augmented reality system that allows students to ex- plore a virtual underwater environment directly in their classroom. The seabed is placed on the classroom floor, and students can phys- ically walk around to explore the environment. Instead of using fixed, pre-designed underwater scenes, the sys- tem generates the seabed, marine life, and surrounding water di- rectly on the device. Different marine environments can therefore be created using a small set of environment settings without rebuild- ing the entire application. Marine animals and plants are placed us- ing rules based on real marine ecosystems, making the environment more realistic and educational. Teachers can create environments by selecting simple options, while built-in rules ensure that the generated environment remains consistent and functional. The system also provides information about the environment in simple, speakable descriptions, which can be used for narration, teaching, assessment, and interactive learn- ing. The system is available as both an Android application and a browser-based application that does not require installation.

Keywords: Augmented Reality; Authoring Tools; Marine Biology Education; Mobile Learning; Procedural Content Generation; STEM Education