3D-Visualization of Utility Lines in the Browser using Augmented Reality on Tablets

Graduate

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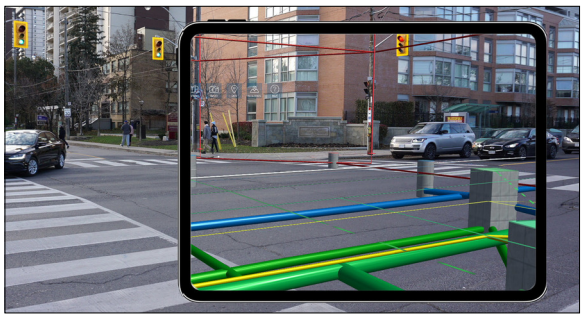
Introduction: Locating underground utility lines, such as water pipes, is challenging because they are typically hidden and only illustrated on 2D plans. This project aims to further develop the existing application from the preceding term thesis. The existing solution provides basic 3D visualization of utility lines in the real world environment using augmented reality (AR). Alternative solutions for this purpose are native applications and require specialized, expensive hardware. In contrast, this project's application is web-based, works with off-the-shelf tablets and a low-cost, high-accuracy GNSS (GPS) device such as ArduSimple's RTK Handheld Surveyor Kit. These utility lines are defined using Industry Foundation Classes (IFC) data, a standard for Building Information Modeling (BIM).

Approach: Key requirements derived from the term thesis include user authentication, IFC data upload, and various enhancements in the AR viewer. Keycloak was used for user authentication. Authenticated users can upload their IFC files. To handle the IFC data, the backend was adjusted to convert IFC files to a web-optimized 3D format (glTF) using the BlenderBIM add-on. Furthermore, the backend extracts relevant information from IFC files, such as type and reference coordinate. The frontend was extended by correction controls for the models' placement and convenience features. Main technologies used for the project are shown in the figure at the bottom.

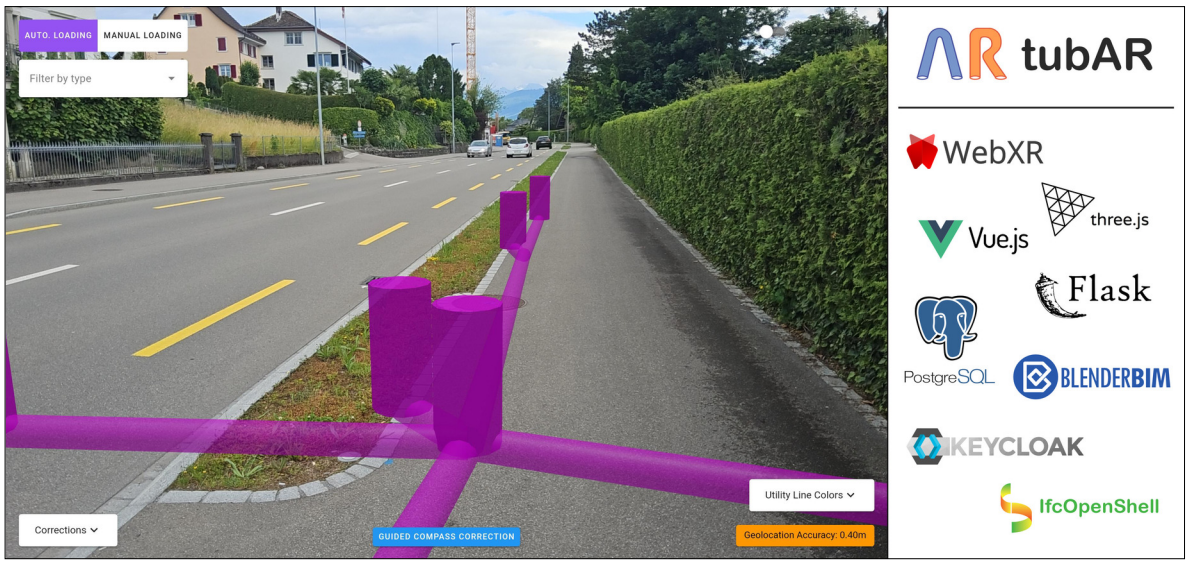
Result: The resulting application tubAR allows users to log in with Google or GitHub accounts and upload IFC files. After a successful upload, the utility lines are saved in the database and can be visualized in the AR viewer. Utility line models can be loaded manually or dynamically based on the user's position, with the option to filter by type. Models are colorized based on their type. Users can click on models for details and manually adjust the position and rotation of the model to increase accuracy. In addition, a guided compass correction feature helps with alignment. The screenshot from the outdoor test in Stäfa demonstrates the utility lines correctly aligned and colorized by type.

Example screenshot showcasing another augmented reality solution by vGIS using a native app
https://www.vgis.io/



Stäfa Seestrasse without virtual utility lines visualized in the AR space
Own presentment

Stäfa Seestrasse virtual utility lines visualized with control overlay. Utilized key technologies on the right
Own presentment



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