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Using AR visual positioning system to visualise an extinct village Zhůří

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Abstract:

With the technological development, it is possible to create more immersive and accurate large-scale visualisations using augmented reality (AR). This contribution focuses on the possibilities of the use of a visual positioning system to visualise an extinct village Zhůří in AR.

The extinct village Zhůří, located in the southwest of the Czech Republic near the German borders (Fig. 1), was once part of the Bohemian borderlands inhabited by Germans. The first larger settlements in this area were built during the 17th century. In the 19th century, Zhůří was inhabited by a few hundred people, who mostly worked in mills, sawmills or in the glass industry. During the Nazi occupation of Czechoslovakia, the Bohemian Forest was a part of the Sudetenland, because it was inhabited mostly by German-speaking people. After the Second World War, almost all Germans were expelled from Czechoslovakia. In 1952, the Dobrá Voda military proving ground was established by the Communist Party on a large part of the Bohemian Forest, which led to the continuous destruction of several formerly German-speaking villages, including Zhůří.

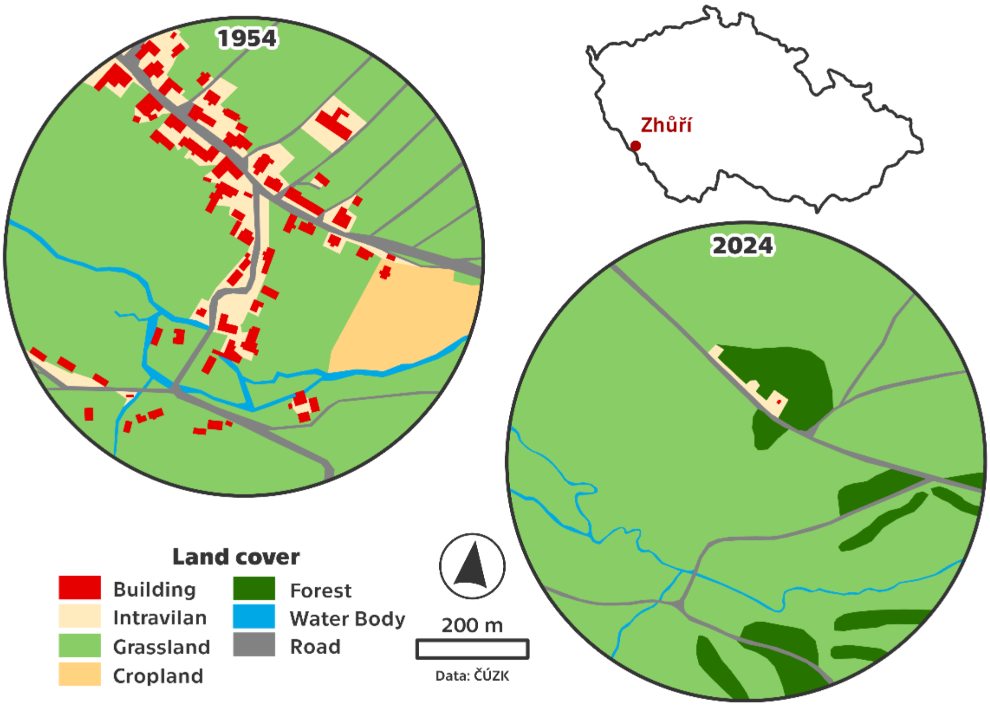

Figure 1. Study area with land cover in years 1954 (left) and 2024 (right).

Augmented reality (AR) visualisation has become an established part of entertainment (e.g. games, advertising, sports), but it is still a minor visualisation technique in cultural heritage preservation (Saggio and Borra, 2011; Boboc et. al, 2022). Most of the applications are based on tabletop or marker AR techniques (e.g. Halik and Wielebski, 2023). Those can be used very effectively even for the presentation of 2D or 3D cartographic models (Schnürer et. al, 2020), but they are still

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limited for certain uses and have to be more deeply studied in the future, especially for geo-located visualisations. Mobile geo-located AR is technologically limited by the accuracy of mobile device sensors, mainly the low accuracy of GPS and compass (Dünser et. al, 2012). Visual positioning systems (VPS) have been developed to solve these issues and make geo-located AR much more accurate, so that it can be used regularly as an AR technique. One of the VPS software libraries is Immersal, which is used in this work. It provides the AR SDK for the Unity game engine and the Mapper mobile scanning application. The study area is scanned with Mapper followed by the creation of the point cloud and its upload to a server. This point cloud is then added to an AR scene in Unity where the position of the 3D model is set (Fig. 2). Thanks to the visual positioning system, the mobile device is able to place the 3D model in AR with much better accuracy.

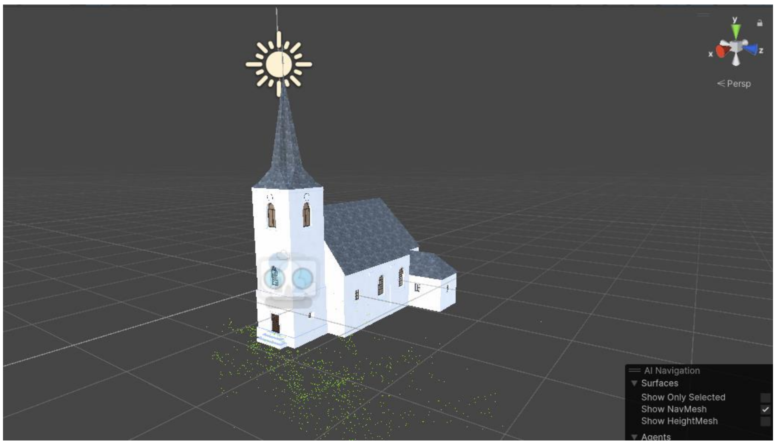

Figure 2. 3D model and scanned point cloud in Unity.

The visualised 3D models are created in CAD software SketchUp based on old plans and photographs, mostly from the 1930s. One of the problems during modelling was finding the building material and its colour due to the lack of colour photographs. This was solved by comparison with other preserved buildings in the Bohemian Forest from that era. The location of the 3D models was taken from a georeferenced State Map 1:5,000 – derived from 1954.

As a result, a mobile application was developed, available for Android. For obvious reasons, the main part of the application could only be viewed at the study area. However, a scaled-down version of the visualisation is also available as tabletop AR in the application and can be viewed anywhere. With the use of VPS, the precision in positioning of the AR model is significantly increased. Nevertheless, additional research must be done in order to enhance the visualisation. Particular attention should be paid to the enhancement of the possibilities of viewing AR models at sites with no distinctive landscape elements (e.g. ruins or buildings) where the more precise positioning can be difficult to achieve due to the lack of recognised points by VPS.

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