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Enhancing a Printed Vltava River Atlas with Augmented Reality

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Abstract:

Augmented reality (AR) is already a fairly common technology for visualizing 3D spatial data, whether in the form of photogrammetric models, reconstructions of historical buildings, or presentations of digital terrain models. However, its use in cartography still appears very rarely, only in isolated cases. This work aims to provide a practical demonstration of the possibilities of augmented reality for cartographic visualization purposes, in conjunction with a printed atlas of the Vltava River. The virtual layers enriching the atlas are displayed using the marker AR method, which is based on their direct connection with the map in the atlas. In this way, the physical paper merges with virtual elements viewed through a mobile phone or tablet. By making use of augmented reality, it is possible to enrich maps with a wide range of interesting layers that could not be viewed in a printed map without significantly reducing its legibility. One example is large-scale development maps of specific locations, to which AR can add a three-dimensional reconstruction of the historical state. Those map can be also interactive, allowing users to learn information not only through the map itself but also via pop-up windows in the mobile application (e.g. information about individual buildings). Further enrichment can include the addition of a third dimension or animations for infographics. An important characteristic of these maps is an emphasis on ensuring that the printed maps themselves provide good informational value and remain interesting to the target user even when not viewed through augmented reality.

Figure 1. Example of a 3D generalization needed for a smooth AR visualization.

One of the main sources of inspiration for this work is the study by Schnürer et al. (2020), in which the authors focus on linking school atlases with augmented reality elements. The result is a set of thematic map layers in AR that extend the printed atlas and provide it with additional context. These virtual layers can also be updated at any time, which represents a significant advantage over printed maps. As the authors note, an important element of the AR experience is accurate and stable tracking of the base printed map above which the virtual layers are displayed on the mobile phone screen. It is therefore important that printed maps are created with a sufficient number of points that are easily distinguishable well machine-readable. These may include point features, toponyms, or transitions between areas of different colours. Another issue that must be resolved when linking an atlas with AR is the curvature of book pages, which can cause distortion of AR visualization. That is why it is necessary to anchor the augmented reality in such a way that it fits well even on the curved pages near the spine of the book.

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The mobile application itself can be launched in two ways: either as a native application downloaded by the user from the Google Play Store or the App Store. The advantage of this option is the ability to create more complex visualizations and the availability of offline access. Second way is a web-based application accessible directly in the web browser, which many users prefer since they are reluctant to download “another” mobile application to their smartphone. However, in the that case, the demands on generalization and the possibilities for data visualization are more limited (see Figure 1), as everything must run smoothly online within a web browser. It is therefore necessary to adapt the application to its intended purpose, while also taking into account the long-term sustainability of the AR application in the years ahead.

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References

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