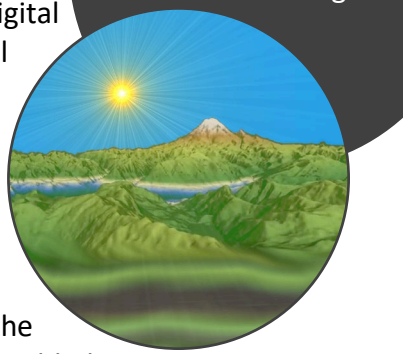
Universität Stuttgart

IWS Department of Hydraulic Engineering and Water Resources Management
Prof. Dr.-Ing. Silke Wieprecht

M.Sc. Topic
Virtual Reality: Digital Twin River Restoration with the Unreal Engine



Background: A digital twin is a virtual representation of a physical object to enable real-time emulation of processes. In the pharmaceutical and automotive industries, digital twins have already become standard elements of product design. Geographic digital twins are also used in civil engineering and urban planning, for instance, to model design scenarios of urban environments (*smart cities*). In contrast, hydraulic engineering still often relies on pure CAD or numerical grid analyses. The interpretation of such engineering datasets requires a high level of technical understanding and special software. Thus, for the planning and presentation of hydraulic engineering interventions, mostly only plan-like data are available, which indicate just by hatching where, for example, water runs off. The rendering of natural processes, such as water runoff or sediment displacement, is up to the imagination of the viewer. Therefore, the potential impact of flood waters or the added ecosystem value of restoration features is left to the engineering or ecological expert's mind. Multidisciplinary planning and decision-making processes should, however, use objective information that are accessible to all, for instance, by means of virtual reality and digital twins of rivers. This Master's Thesis intends to pioneer the development of digital twins of rivers, starting with the transformation of an existing river ecosystem into a virtual world using digital terrain data. To this end, the freely available and powerful *Unreal Engine* from the video gaming industry will be explored and applied.

Thesis Overview

1. Familiarize with data of a comprehensively surveyed real river ecosystem (understand digital terrain models and numerical modeling results).
2. Familiarize with the *Unreal Engine* software for importing and rendering digital terrain models and ecosystem information (e.g., terrain properties with regards to land use or vegetation).
3. Create a digital twin of the real-world river ecosystem (data will be provided).
4. Virtualize a restoration measure (e.g., an anabranch) for comparison with the current state.
5. Animate natural processes (e.g., flowing water).
6. Export media data (e.g., images, videos, or virtual reality scenarios) and produce a technological outlook.

*This Master's Thesis can be written in **English or German**.*

Desired Skills: Good computer skills, interest topics such as Industry 4.0, Building Information Modeling (BIM), or video gaming.

Apply now!

sebastian.schwindt@iws.uni-stuttgart.de

Examiner: Prof.-Dr. Ing. Silke Wieprecht (LWW) | Supervisor: Dr. sc. Sebastian Schwindt