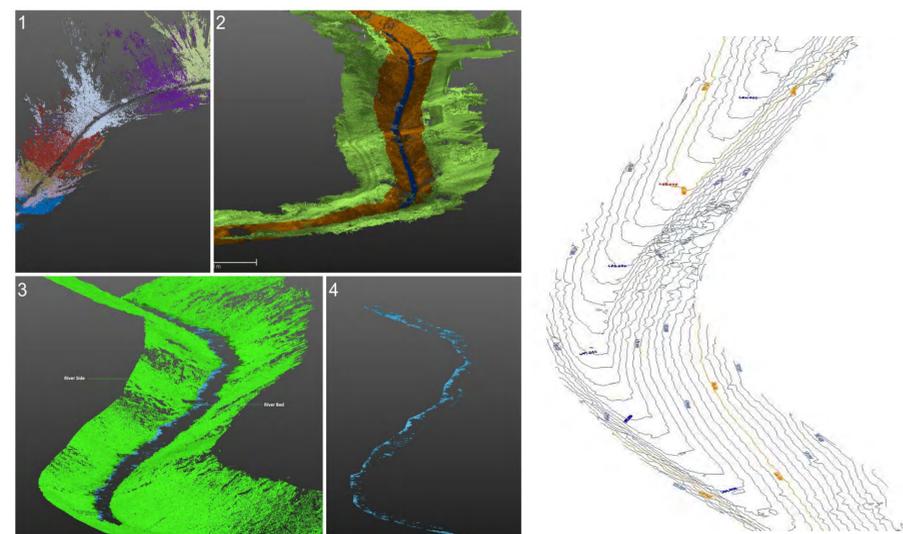


# Effective Measurement and Evaluation Technologies for 3D-Modeling of Riversides with complex Geometry and dense Vegetation

## Introduction

Surveying rivers for spatial geodata and visualize it in 3D model can be a challenging task, especially considering difficult accessibility through dense vegetation or obstruction in urban area. On the other hand a lot of different measurement and data processing technologies like surveying with total station, GNSS, photogrammetry and laser-scanning are available to get the data from such complex environment in efficient way. The goal of this thesis is to utilize various geospatial data collection techniques and merge the outputs to produce topographic map of study area and visualize it in 3D model.



Computed Topographic map of the river from point cloud

## Data acquisition procedure

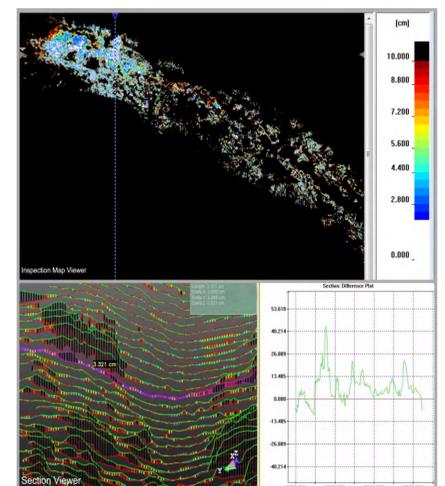
Terrestrial Laser Scanning (TLS) alongside Unmanned Aerial Vehicle (UAV) Photogrammetry methods have been used to collect the data. For the different parts of the river, dense forest to open landscape and residential area the most appropriate method has been employed. In addition; GNSS RTK has been operated for measuring the GCPs in order to geo-reference the datasets as well as controlling the quality of the obtained data.

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## Data processing

To process, edit, classify and evaluate the data out of UAV and TLS, two most powerful and very common applications namely Agisoft PhotoScan and Trimble Realworks have been used in this research. In UAV data processing, it has been proved that the wrong Tie points can affect the accuracy of the model therefore; they need to be eliminated to get an optimal accuracy. Moreover, for TLS point cloud registration using Cloud-to-cloud registration methodology, a new style of registration has been introduced by registering the clouds starting with middle scan. The proposed tactic helps to minimize the error and improve the accuracy.

Furthermore, TLS point cloud has been determined as reference cloud to compare and analyze the point cloud of UAV. The result shows that the points near to GCPs are more accurate than those which are further away from GCPs.



Accuracy assessment analysis result

## 3D Model Visualization

Finally, a 3D interactive web application has been developed using 3DHOP platform allow users to measure the model and view the study area from different perspective virtually in 3D environment.



3D web map application developed to represent study site